University of Alberta

Three Essays on Financial Reporting – Archival Studies

by

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Abstract

This thesis consists of three distinctive archival studies in financial reporting. The introductory chapter briefly describes the background, motivation, research methodology and major findings of each study. Chapter 2 re-assesses the association between pension information and firm value. Consistent with extant academic work, I document that the current service cost of defined benefit plans is positively related to firm value. I check the validity of the results by running various sensitivity tests. Whereas prior studies report this result as anomalous, I provide evidence that the positive sign is consistent with pension plans capturing the unrecorded intangible asset - human capital. In Chapter 3, I examine whether the improvement of financial reporting quality after SOX is associated with the strength of firms' internal and external monitoring. The results from the gap-based analyses suggest that the gap in financial reporting quality between firms with strong internal/external monitoring and firms with weak internal/external monitoring has widened at least in the short-run following SOX. Furthermore, the results from the sufficiency-based analysis of external/internal monitoring indicate that firms with loose monitoring in one of the two dimensions can improve their financial reporting quality by strengthening the other dimension, while firms with already strong internal (or external) monitoring do not seem to be able to achieve better reporting quality by strengthening external (or internal) monitoring. In Chapter 4, I examine discretionary accruals and abnormal R&D spending as alternative tools toward the income objectives. My findings suggest

that discretionary accruals are used symmetrically around positive and negative pre-management earnings, while abnormal R&D is asymmetrically distributed - significantly negative abnormal R&D spending associated with poor performance but good performance not giving rise to positive abnormal R&D spending. I also find that the decision of discretionary accruals influences on the level of abnormal R&D spending but not the reverse, suggesting the former decision preceding the latter. Lastly the analyses regarding the effects of SOX on both earnings management tools do not support that managers switch from accruals management to real earnings management subsequent to SOX.

This dissertation is dedicated to my loving husband, Jun, who has been endlessly patient and unconditionally supportive, and my parents, who have always encouraged me to achieve my goals.

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Chapter 1.

Introduction

In this thesis, I choose to write three essays of distinctive archival studies in a broad area of financial reporting. The first essay focuses on how the market interprets pension information; the second one examines the effects of regulations (the Sarbanes-Oxley Act) on financial reporting with the interaction of the effectiveness of internal/external monitoring; and the last one studies how managers use discretionary accruals and abnormal R&D as alternative earnings management tools to meet or beat the earnings targets. The motivations, relevant literature, and research designs for each study are quite different. I briefly discuss these three studies one by one below.

Chapter 2 is based on the first study where I re-evaluate the historically equivocal evidence on the association between pension information and firm valuation by considering an alternate theoretical construct, human capital, which can be captured by pension information. There is a large body of literature in labour economics and human resources providing conceptual and empirical evidence that pension plans coverage, including both Defined Benefit Pension (DBP) and Defined Contribution Pension (DCP), is related to longer job tenure, lower turnover rates, and higher compensation, which infer higher productivity. I define the employees' ability to work at a high level of competency as human capital – an unrecorded economic asset. While the evidence from labour economics and human resources research suggests higher human capital being associated with pension plans, none of prior accounting studies have considered this unrecorded asset in the valuation questions of pension information. As pure compensation expenses, service costs are expected to be negatively related to firm value. Prior studies that find positive sign for service costs in the valuation regression simply treat it as anomalous. I demonstrate that the reported pension information given in footnotes of the financial statements captures more than the simple compensation expense and pension asset and liability that they are purported to represent. Consistent with the human capital hypothesis, the empirical results from the valuation of pension information reflects that the market recognizes the unrecorded economic asset – human capital embedded in pension information.

Similar to prior works on pension accounting, the fundamental model used in this study is Ohlson (1995) valuation model with modifications. I find that when I use a more complete model, the service costs for DBP firms and the pension costs for DCP firms have consistently positive coefficients that can be attributed to capturing the human capital of the firm in regressions explaining price and the growth in the human capital of the firm in regressions explaining returns. Additional analysis confirms the human capital hypothesis by showing that the coefficient on service costs is correspondingly more or less positive for firms that are likely to have more or less human capital. I also conduct several specification tests to ensure that the results are not driven by any potential econometric problems.

Chapter 3 discusses the second study which is motivated by the furious debate on the wisdom of the Sarbanes-Oxley Act. In response to a string of highly publicized corporate scandals, the US Congress passed the Sarbanes-Oxley Act (SOX) on July 30, 2002, stated by President Bush as "the most far-reaching reforms of American business practices since the time of Franklin D. Roosevelt".[1] Opponents of the SOX, on the other hand, believe that it was hastily enacted as a political reaction to fraudulent conduct by a few bad apples such as Enron and Worldcom, and argue that the SOX imposes significant direct and indirect costs. The purpose of Chapter 3 is to address the question of whether any improvement in reporting accuracy and reliability following the SOX depends on the quality of the reporting entity's internal governance and external auditors.

I conduct univariate and multivariate tests in GAP-based and Sufficiency-based analyses. The GAP analysis contrasts firms with strong internal/external monitoring and those with weak internal/external monitoring, assuming that internal and external monitoring must be both present to ensure high reporting quality. The results from the GAP analysis indicate that the gap between these two groups widened immediately following SOX but reverted back to the level prior to the SOX in a longer horizon. It seems that all firms were forced to improve their financial reporting quality under more stringent rules of the SOX, though firms with stronger internal/external monitoring would

[1] Elisabeth Bumiller: "Bush Signs Bill Aimed at Fraud in Corporations", *The New York Times*, July 31, 2002, page A1

react more quickly and improve reporting quality to a greater degree in the short run. Given a longer time horizon after the key provisions pertaining to internal control (e.g., Section 404) have been implemented, poor reporting entities would catch up to narrow the reporting gap back to the pre-SOX level. This finding of positive reaction from both good and bad reporting entities lends support to more stringent regulations.

In the Sufficiency analysis, I unbundled the two sources of monitoring to examine the separate effects of internal and external monitoring on reporting quality. The results indicate that when one of the monitoring dimensions is strong, firms were unable to achieve higher quality reporting by strengthening the other dimension. However, firms with weak monitoring in one of these two dimensions could substantially improve their financial reporting quality by strengthening monitoring in the second dimension. The finding that an effective auditor may be sufficient to enhance reporting quality even if internal monitoring is weak implies that regulations such as Sections 404 and 301 of the SOX requiring major changes to the financial report-generating process may not be necessary, especially given the high costs of compliance.

Lastly, Chapter 4 studies how managers, facing income objectives, manipulate earnings through accruals and real activities such as cutting R&D spending. While it is generally agreed that accruals and real earnings management are alternative earnings management tools, most extant studies in this literature examines only one aspect at a time which may "obscure the overall effect obtained through a portfolio of choices" (Fields, Lys, and Vincent 2001). My study, instead, investigates the behaviour of both discretionary accruals and abnormal R&D spending for firms in different cases of pre-managed earnings relative to the targets.

The comparisons of discretionary accruals and abnormal R&D across contingent earnings cases reveal that discretionary accruals are used symmetrically. That is, more positive (negative) discretionary accruals are used when pre-managed earnings are below (above) the target. In contrast, abnormal R&D is asymmetrically distributed – R&D spending is reduced when the performance is poor and/or there is a motivation to manipulate through R&D cutting, but good performance does not necessarily give rise to R&D spending.

Consistent with prior studies, results from the two-stage least square (2SLS) regressions suggest that discretionary accruals and abnormal R&D spending are substitutive earnings management tools. However, the finding that the level of abnormal R&D spending does not influence discretionary accruals decision, but the latter always has a substitutive effect on abnormal R&D is contrary to prior studies which conjecture that abnormal R&D decision precedes discretionary accruals. By examining the quarterly pattern of both abnormal R&D spending and discretionary accruals, I provide further evidence on the timing issue of the decision on these two alternates. The results are consistent with the discretionary accrual decisions influencing both contemporaneous and subsequent abnormal R&D spending as a substitute. It appears that the decision of discretionary accruals, rather than abnormal R&D spending, is determined in advance.

To achieve the last objective of Chapter 4, I examine the changes in both discretionary accruals and abnormal R&D spending surrounding SOX. There is a limited support that managers use discretionary accruals less aggressively in the post-SOX era, compared with the pre-SOX period. However, I find no evidence of the increased use of abnormal R&D spending to replace the use of discretionary accruals, which is against the contention that after SOX managers switch from accruals management to real earnings management, at least with respect to abnormal R&D spending.

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Chapter 2.

Human Capital, Pension Information, and Firm Valuation[2]

I Introduction

Reporting on pension information remains one of the most technically challenging and contentious areas of financial reporting. In a recent article former SEC Chairman Arthur Levitt described pension accounting as a "shell game" and called for "immediate action to bring accuracy, transparency and accountability to pension accounting" (Levitt 2005). Sir David Tweedie, Chairman of International Accounting Standards Board (IASB), referred to pensions as "one of the most complex and obscure areas of accounting". The IASB recently amended its standard to allow the option of immediate and full recognition of actuarial gains and losses in the year in which they occur and anticipate working with the Financial Accounting Standards Board (FASB) to achieve a comprehensive global standards convergence project on the measurement and recognition of firms' pension information. Accordingly, the (FASB) staff in November 2005 initiated a project to improve the financial reporting of pensions and other postretirement benefit plans. The first phase will focus on Balance Sheet recognition of the over or under-funded status of the plan. The second, more comprehensive phase will review all aspects of financial reporting for pension and other post retirement obligations. Thus, this is an opportune time to reassess our knowledge of pension reporting and the link to firm valuation.

The current academic literature provides only equivocal evidence on the link between firm valuation and disclosures of both pension assets and liabilities and pension costs. Barth (1991) finds that the pension asset, accumulated benefit obligation (ABO) and the projected benefit obligation (PBO) are reflected in the share price, supporting the conceptual accounting view that pension assets and liabilities are valuation relevant assets and liabilities, and that full disclosure, if not recognition, is necessary. If the reported measures capture only the pension asset and liability, and do so accurately, they should be incorporated in price on a dollar for dollar basis. If this 'asset-liability' view is correct,

[2] Working paper version of this chapter is coauthored with Tom Scott (University of Alberta).

investors can simply look at the net pension assets (the difference between pension asset and pension liability) to assess the price of shares. Yet, Barth, Beaver, and Landsman (1996) used this net pension asset as a control variable in their valuation model in a different sample, and found that the net pension asset was not associated with firm value. Similarly, when Barth, Beaver, & Landsman (1992) test the hypothesis that pension cost components are more permanent and lower risk, and should have absolutely larger coefficients, they obtain equivocal results. In particular, the service cost component, which represents the direct measure of the deferred cost of the labor rendered this period,[3] has a positive rather than negative sign. The authors note this, and the sample specific nature of other results, as unresolved questions.

The hypotheses in prior studies all make the same implicit assumption that the pension asset and pension liability unambiguously represent assets and liabilities and the components of pension cost unambiguously represent costs. The contribution of this study is to advance the proposition that there is an unrecorded human capital asset that underlies these equivocal results. While I concur with standard setters that the primary pension measures *conceptually* capture the pension assets, liabilities, and costs; I argue that any assessment of the reported pension numbers will be clouded because the pension variables are significantly correlated with an important off-Balance Sheet asset, Human Capital. To do this I empirically document the equivocal relationship between pension information and firm value over a twelve year period. In particular I document a significant and consistent positive, rather than negative, association between service cost and firm value. I then cite evidence from economic research and provide my own additional evidence that indicates that pension information is significantly correlated with latent human capital. I provide significant sensitivity analysis to ensure that none of the findings can be attributed to collinearity, scaling, the influence of outliers, or a particular year or industry. The implication of this study is that, absent a reliable empirical proxy(ies) for human capital, mapping pension disclosures into firm value is problematic. Thus, this paper provides an initial step to solving the omitted variable problem that limits the usefulness of academic research on pension reporting to fully and confidently support these standard setting initiatives.

[3] The other elements are either a function of the existing plan asset and liability (expected return on plan assets and interest cost) or amortizations of actuarial gains and losses and past plan adjustments.

The paper proceeds as follows. Section two provides a conceptual development of the main issues. Section three describes the sample and data. Section four develops the specific empirical models to be tested. Section five provides results. Section six concludes the paper.

II Conceptual Development

2.1. Value-Relevance of Pension Information

As discussed in the introduction, most analyses of the value relevance of pension information assume that the pension information captures only the underlying pension cost (expense) or assets / liabilities that it is supposed to capture.[4] A number of capital market researchers have provided evidence of the value-relevance of pension information (e.g. Feldstein & Morck 1983; Daley 1984; Landsman 1986; Barth 1991; Barth, Beaver, & Landsman 1992; Barth, Beaver, and Landsman 1996). Researchers tend to use either asset-liability based models or income (cost) based models. Examples of the former are Landsman (1986) and Barth (1991) who uses a market value model, whereby total assets (TA), total liabilities (TL), pension assets (PA), and the pension liabilities (PL) are hypothesized to explain the market value of common equity (MVE). They argue that the theoretic values for coefficients on PA and PL are one, conditional on the pension assets and liabilities representing 'true' assets and liabilities. Barth, Beaver, and Landsman (1992) employ an income components model to investigate the valuation relevance of pension cost and its components relative to other revenues and expenses based on the conceptual permanence and risk of the pension cost components. They test only the three early years following SFAS 87 and divide the sample into early and late adopters. Their results are equivocal,[5] and in particular, the service cost variable has a positive rather than negative sign which the authors note as an unresolved question.

[4] Pensions give rise to a cost that may or may not be an expense in the period incurred. Labor may have been paid compensation including pension costs to produce capital assets or produce goods that remain in inventory at the end the year. Accordingly, I use cost throughout the paper to capture the pension payment or liability incurred with respect to the labor services obtained by the firm in the period.

[5] Barth et al find support for their hypothesis among the later adopters, but not the early adopters. All of their tests rely on interactive differences between the two groups, with the late adopters having the predicted larger coefficients, but the early adopters have coefficients with the wrong sign or near zero. It is possible that unobserved differences or collinearity or both drive their results. They do not include a main effect for the dummy variable for early versus late adopters as recommended by Aiken and West (1991), so

I use these models as a departure point. In this paper, however, rather than attempting to obtain "the correct" sign on pension variables, I will demonstrate that and explain why one observes a more positive association between pension variables and firm value than the accounting conceptualization would predict. This more positive result could be evidenced by a coefficient greater than one on the net pension assets (plan assets less the PBO), or by a positive rather than negative relationship between pension cost or service cost and firm value. My objective is to map how *all* the information in pension disclosures maps into prices. In addition to the simple accounting interpretation, there are *two* potential additional complementary constructs to understand how pension information *as measured and reported* will be related to firm value. The first which provides the focus of this paper is that pension information is correlated with the unrecorded and unmeasured human capital of the firm. If the pension disclosures are correlated with an omitted economic asset, human capital, one should observe a more positive coefficient than anticipated for all or a subset of the pension variables. The second perspective is that the *economic* pension cost/asset/liability is different than that recorded in the notes; however, evaluating this alternative requires carefully segmenting any sample on the firm's economic circumstances and labour contracts and is reserved for future study.[6]

2.2. Human Capital

Some intangible assets such as R&D and brand names, although unrecorded as assets, have been shown to make up part of the value or investment base of firms (see Lev and

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that differences between the two groups are forced through the interactive terms. Additionally, they present no collinearity diagnostics, although many of the variables are strongly correlated. In 1986 where there are only early adopters, so that these potential statistical problems are avoided, their hypotheses are not supported.

[6] The economic pension asset and pension liability in DBPs are not necessarily the asset and liability reported in the notes. The economic value of the plan assets to the firm may be less because: they are held in a separate trust, the employer is legally limited in withdrawing surplus assets, and there are court rulings in favor of labor's ownership. The economic value of the pension liability can also be either higher or lower than the reported value. Traditionally, firms have made ad hoc increases to retirees' payments that could be perceived to be an equitable obligation, thereby increasing the economic obligation relative to that reported. Conversely, there is significant evidence that firms in adverse circumstances are able to achieve concessions in employee compensation when employees are concerned with protecting their pension plans. Support can be found in Mittelstaedt & Regier's (1993) study on the termination of pension plans and in several recent examples of significant wage concessions in firms with DBPs, such as Delta Airlines, US Air, and Port Alice Specialty Cellulose.

Sougiannis, 1996; Chan, Lakonishak, and Sougiannis, 2001). Similarly, the existence of human capital as an intangible, but unrecorded, economic asset could make the interpretation of the influence of pension assets and liabilities on firm value problematic, and accordingly, the coefficients of these variables in regressions.

Expenditures on education, training, and medical care are examples of investment in human capital. Gary Becker claims that education and on-the-job training are "the most important investments in human capital". Investments in human capital are essential for economic growth, since the diminishing returns from land and physical capital will eventually eliminate further growth. The rapid economic growth of "Asian tigers" in the 80's and early 90's illustrated the importance of relying on a well-trained, educated, productive and cohesive labor force. In particular, large companies in Japan have a system of lifetime employment, which facilitates a heavier investment in the training of employees[7]. It may not be feasible to implement a system of lifetime employment in North America, but pensions establish disincentives for turnover and incentives to promote productivity.

Defined Benefit Pension Plans (hereafter DBP) defer a portion of an employee's wages and impose on employees a significant cost to turnover. If the employment contract is severed for any reason, these deferred wages are lost to the employee, thereby binding the employee and his or her welfare to that of the firm. The most obvious, but less important, binding effect is the vesting of the benefits. Regulation has reduced vesting periods significantly; however, should an employee leave before vesting, the pension benefits earned are lost. The second, more important reason for firms with highest average salary DBPs is that only the employees who spend their whole careers with one firm will get pensions that are based on the maximum salary applied to all years of service. Job changers will have several pension plans; the pension from each is based on the maximum salary from that employer.[8] Actuarial estimates of the discounted value of this loss for an

[7] An example from Gary Becker's article "Education, Labor Force Quality, and the Economy" on Business Economics; Jan. 1992; 27,1.

[8] For example, contrast an employee who worked 26 years for the same employer with one who worked 13 years with firm A and quit on a $50,000 salary, then another 13 years with firm B and retired on a $100,000 salary, her pension would amount to 26% of $50,000 plus 26% of $100,000, which is only $39,000; but if she had stayed with firm A she would have had a pension of 52% of $100,000, which is $52,000.8 But importantly, I do not argue that pensions absolutely bind employees. Rather, I argue for the marginal

employee changing jobs twenty years before retirement range from one half to three quarters of a year's salary (Clark and McDermed, 1990). There is empirical evidence that DBP firms are successful in reducing employee turnover (Ippolito, 1985; Allen, Clark, and McDermed, 1993; Gustman and Steinmeier, 1993; Ippolito, 2002). An additional benefit of DBPs is that while they reward long tenure, they penalize late retirement when no actuarial adjustment is made to the pension of those who stay beyond normal retirement age, and thus further help to renew a productive and cohesive labor force (Dorsey et al. 1998).

By reducing turnover through the deferred wage embedded in DBPs, firms can afford to offer more training to employees and create a more cohesive workforce, thereby providing an economic asset in the form of the human capital of a relatively stable work force (Frazis, Gittleman, and Joyce, 2000). Pesando and Clark (1983) describe three economic models of the labor market: the spot auction/explicit contract (SAEC) model, the spot auction/implicit contract (SAIC) model, and the lifetime/implicit contract (LIC) model. Both of the spot auction models assume that compensation equals the value of services rendered in every period. They conclude, however, that the most appropriate model is the LIC model which assumes that total compensation and the value of the services rendered must be equal only over an entire lifetime. An implicit contract presumes a stronger commitment between the firm and its employees extending beyond the literal contract, suggesting an equitable obligation,[9] based on ethical or moral considerations. The lifetime element suggests an expectation of fair treatment of both the employee and the firm over the employee's working life (and in some cases beyond - consider ad hoc increases to retiree benefits.) Under this model the tradeoffs among levels of compensation, deferral of wages, and training can be rationalized to help explain the existence of DBPs and to justify the appropriateness of the PBO that assumes it is acceptable to project future wages in calculating the pension liability.[10] However, in justifying the PBO, the implicit lifetime contract also justifies the existence of an economic human capital asset.

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binding effect pensions provide. All else equal, a DBP plan imposes an additional economic loss for a job changer and thus reduces the possibility of turnover.

[9] An equitable (or constructive) obligation stems from ethic or moral constrains rather than legal binding contracts. That is a duty to another party to do what one ought to do rather than what one is legally required to do.

[10] See Scott 1992 for a mathematical example of the back end loading of DBPs.

In addition, firms with pension plans, both DBP and Defined Contribution Pension Plans (hereafter DCP), pay more generally. Pension information can act as a proxy for higher levels of compensation (Feuille, Hendricks, and Kahn 1981; Gustman and Steinmeier, 1993; Ippolito, 2002). Allen, Clarke, and McDermid (1993) show that the higher compensation offered by firms with DBPs is a factor in reducing turnover along with the bonding effect induced by DBPs. While Allen et al find that higher compensation is a secondary factor to the bonding effect of deferred wages, Gustman and Steinmeier find that the higher compensation paid by pension plan firms has a more important effect on minimizing turnover. Sorting out whether the bonding or higher level of compensation effect is most dominant is beyond the scope of this paper; however, the association with compensation provides another reason for pension information to be associated with human capital. Although DCPs have minimal deferred wage provisions (they sometimes have a vesting provision), they are also associated with lower turnover. Ippolito (2002) and Gustman and Steinmeier (1993) both report that quit rates are extraordinarily low in DCP firms. Thus, the economic literature provides strong support for an association between human capital and pension information for firms with either defined benefit or defined contribution pension plans.

This implies that firms with pension plans are likely to have an economic human capital asset that increases the firm's value beyond that captured by the book value of the recorded assets. In linking pension disclosures to firm values, an interpretation problem arises because the measured pension variables can correspond to the legitimate pension assets, liabilities, and costs, but also to the *unrecorded* human asset. Thus, we have a *many to one* matching from the theoretical plane to the empirical plane.[11] Although we should see the confluence of pension plan variables qua assets, liabilities, and expenses and pension plan variables qua human capital most strongly in DBPs, the economic literature cited above indicates that it should apply to the pension cost of DCPs as well. The pension variables qua human capital should have a positive association with the market value of equity. This should prompt a more positive coefficient on pension

[11] Typically empirical studies take a theoretical construct and then attempt to find a good empirical proxy, here I have an empirical measure and I am interested in the theoretical constructs that it may be capturing, both intended, the pension asset and liability, and unintended, human capital.

variables than would otherwise be the case in regressions of market value of equity on pension and other explanatory variables.

For DBP firms, service cost represents the direct cost of the labor rendered this period that will be paid when the employee retires. As such service cost is the best measure of the deferred wage from the current period and should better capture human capital than the other elements of pension cost.[12] This link to human capital is consistent with the "unresolved" positive sign on service cost in Barth *et al.* (1992). None of the other elements of pension cost are directly traceable to the human capital of the work force. As a partial reflection of the amount of labor consumed the service cost should be an expense and reduce earnings and as an expense in regressions should reduce stock price and have a negative coefficient. On the other hand, to the degree that the service cost captures human capital it should have a positive coefficient and be associated with a higher stock price. All subsequent tests are two-tailed to reflect the conflicting theoretical constructs that are potentially embodied in the pension variables, since I do not know *a priori* which effect is likely to dominate. In this regard, the paper is empirically exploratory with respect to current financial reporting disclosures, taking them as given, but then assessing which of the competing effects is more powerful.

III Data and Sample

Data of market and firm returns are obtained from *CRSP*; common stock prices and accounting data are from *Compustat* Annual tape. The disclosure of pension accounts has changed since SFAS 87 came to be effective in December of 1985. *Compustat* data about the key variables related to defined benefit pension plans are available from 1991 and therefore I use the data of all *Compustat* firms from year 1991 to year 2002. Sample firms must meet the following requirements: (1) public firms; (2) with data available in both *CRSP* and *Compustat*.

The full sample includes 79,249 firm-years, which I classify as ALL-firm sample. About two-thirds of ALL firms, 52,222 firm-years, have non-zero pension costs and are thus classified as Pension Plan (PP) firms. About 35.8% of the PP firm-years, 18,696

[12] The other elements are either a function of the existing plan asset and liability (expected return on plan assets and interest cost) or amortizations of actuarial gains and losses and past plan adjustments.

firm-years have non-zero pension liabilities and are classified as DBP plan firms.[13] Market value of equity (MVE) is the fiscal year-end closing price times the number of shares outstanding. BVA and BVL are book value of assets and book value of liabilities less prepaid or unfunded accrued pension cost (BVPA and BVPL). Although there are three measures of pension liability (as in Barth 1991: VBO, ABO and PBO), I focus on the PBO since it is more likely to represent human capital as discussed in the previous section and also PBO is the only pension liability variable that FASB requires firms to report after 1998.

Table 1 summarizes descriptive size and market statistics for each sample set in total dollars and on a per share basis. I eliminate all observations with values for any key variable outside the first and ninety-ninth percentiles. Panel A of Table 1 indicates that DBP firms are bigger in terms of book value, sales and number of employees. It suggests that the large firms tend to implement DBP plans, which is consistent with my explanation that DBP plans help the large firms to attract and maintain employees with high human capital. Large firms are also viewed as better credit risks on average, so that employees have a stronger expectation that the firm will survive to guarantee their pension payments. Although DCP firms seem to be even smaller than non-pension firms, their sales and profitability (earnings) are comparable to those of non-pension firms, which in a sense also suggest a higher human capital of DCP firms.

Panel B of Table 1 reports all related pension variables for DBP firms and pension cost for DCP firms. Both magnitude and percentage are reported.[14] Pension assets and liability account for a significant percent of market value of equity. Pension cost and service cost are small relative to sales. Panel C of Table 1 presents the correlation matrix for control variables and pension variables. The correlations between control variables and price are based on the full sample – ALL-firm sample. For DCP firms, correlations between non-zero pension cost and price are reported. All other correlations between pension variables and price are based on DBP-firm sample. In the case of DCP firms, pension cost - the only pension variable, is significantly positively related to price, consistent with the

[13] As SFAS 87 applies to both defined benefit pension (DBP) plan and defined contribution pension (DCP) plans, I assume that all firms with either pension plan would disclose pension costs, while only firms with defined benefit plans would disclose pension assets and pension liabilities.

[14] Pension asset and liability as percentage of market value of equity, pension cost and service cost as percentage of sales

human capital interpretation. For DBP firms, all pension variables have significantly positive relationships with price. In particular, SC has a greater correlation coefficient (in terms of both Pearson and Spearman correlations) than other pension measures.

IV Model Development

4.1. Price Models:

The model for valuation of pension information commonly used in early studies (e.g. Landsman 1986 and Barth 1991) is as following:

$$MVE = \alpha + \beta_1 BVA + \beta_2 BVL + \beta_3 PA + \beta_4 PL + \varepsilon$$

where *MVE* is the market value of equity, *BVA* and *BVL* are book value of non-pension assets and liabilities, respectively. *PA* and *PL* represent pension assets and pension liability as disclosed in the footnotes of financial statements. This model is a special case of Ohlson (1995) model, where $\omega = 0$ (i.e., no persistence of abnormal earnings), and other information is ignored.[15] There are a number of problems with this equation. First, the model is susceptible to collinearity, heteroscedastisity, and the influence of large "outlying" observations.[16] Given the different skewed distributions of variables (Table 1), it is better to use a scaled model. I deflate all variables by the number of shares outstanding and will report several sensitivity tests.[17] Barth and McNicoles (1994) use essentially the same market value equation but all variables are deflated by number of shares outstanding in order to mitigate heteroscedasiticity. The descriptive statistics shown in Table 1 indicates that data scaled by the number of shares is closer to a normal distribution. Further, it is legitimate to look into the valuation of pension information on a per-share basis, as investors are likely to evaluate the return on their investment per share. After deflating the market value equation by number of shares, it becomes a regression of price:

$$P = \alpha + \beta_1 BVA + \beta_2 BVL + \beta_3 PA + \beta_4 PL + \varepsilon ,$$

[15] See Dechow, Hutton, and Sloan (1999) for detailed discussion on various special cases of Ohlson (1995) model.
[16] While I can replicate the results in Barth (1991), when I apply the gross model to the period from 1991 to 2002, the coefficients are unstable from year to year, with the pension asset often negative and the pension liability positive.
[17] Barth et al (1992) measure all the variables on a per-share basis.

where P is the closing price of common shares at fiscal year-end, with *BVA*, *BVL*, *PA* and *PL* in per-share form.

Another problem with the market value equation is the incomplete description of equity on the right hand side. To make the fundamental Balance Sheet equation balance, one has to take minority interest and preferred shares into account. Although some papers appear to omit minority interest and preferred stock, they are claims on the value of the firm and reduce the amount available for common equity holders. Preferred stock was included in Modigliani and Miller's classic 1958 paper and also in Begley and Feltham (2002). I also decompose *BVA* (*BVL*) to the non-pension asset (liability) and the pension asset (liability) recognized on the balance sheet (*BVPA* and *BVPL* whose definitions follow Barth 1991). Furthermore, by assuming the market value equal to book value, the unrecognized net assets are omitted, which results in biased coefficients.[18] Unfortunately unrecognized net assets are not perfectly observable or measurable. Following Barth, Beaver, and Landsman (1998), I use net income from income statements as a proxy for unrecognized net assets. In other words, I add *EPS* and the change in EPS (*ΔEPS*) as additional variables.[19] This crudely approximates an abnormal earnings model. An alternative would be to combine these variables into a beginning book value and add analyst forecasts of earnings to calculate abnormal earnings into the future.[20] However, including analyst I/B/E/S earnings forecast would significantly reduce sample size in a biased manner, eliminating smaller and non-covered firms.[21]

Based on the discussion above, the base model is as follows:

M0: $P = \alpha + \beta_1 BVA + \beta_2 BVL + \beta_3 BSPA + \beta_4 BSPL + \beta_5 MIN + \beta_6 PREF + \beta_7 EPS + \beta_8 \Delta EPS$

[18] Barth and McNicoles (1994) discuss in Appendix A the biased coefficients caused by measurement error and omitted unrecognized net assets.
[19] Our findings are insensitive to the inclusion of EPS and/or ΔEPS.
[20] As discussed in Barth et al (1998), the coefficients could be biased if net income is not an ideal proxy for unrecognized net assets. Aboody, Barth, and Kasznik (2004a) include analyst earnings growth forecast in addition to net income because some prior studies find that "expected future abnormal earnings are reflected in equity price before they are reflected in equity book value and net income".
[21] Nonetheless, as a sensitivity check, I plan to use a valuation model with analyst forecast picking up the abnormal earnings that are not captured by net income and discuss the results based on a more limited sample.

To examine the value relevance of pension variables, I develop 5 models (M1 – M5) by adding one or multiple pension variables to the base model. In M1, I add pension asset and pension liability (measured by *PBO* - Projected Benefit Obligation):

$$M1: P = \alpha + \beta_1 BVA + \beta_2 BVL + \beta_3 BSPA + \beta_4 BSPL + \beta_5 MIN + \beta_6 PREF + \beta_7 EPS + \beta_8 \Delta EPS + \beta_9 PA + \beta_{10} PBC$$

If investors perceive pension assets (liability) as pure assets (liabilities), as Barth 1991 suggests, β_9 and β_{10} should be close in absolute magnitude, and ideally equal to one. This implies that if I define NetPA (net pension assets) as the difference between pension assets and the *PBO*, the coefficient of NetPA should also to be equal to one, but the explanatory power of this reduced model should still be the same as M1. If, however, the coefficients also collectively capture human capital, then we would expect the pension asset to have an absolutely higher coefficient than the pension liability.[22] Conceptually, the portion of the coefficient on the pension asset that equals the pension liability would capture the asset/liability effect, while the portion by which the pension asset *exceeds* the pension liability would capture human capital. By extension, in the reduced model, under a human capital perspective, NetPA should have a coefficient greater than one, and the explanatory power observed in M1 will be reduced in the following model M2:

$$M2: P = \alpha + \beta_1 BVA + \beta_2 BVL + \beta_3 BSPA + \beta_4 BSPL + \beta_5 MIN + \beta_6 PREF + \beta_7 EPS + \beta_8 \Delta EPS + \beta_{11} NetPA$$

The "income statement" item pension cost also is associated with both the size of the pension plan and levels of compensation, and thus is another candidate for carrying information about human capital.[23] Similar to the pension asset and liability, this again creates the problem of mapping two conceptual or theoretical constructs into one physical observation. Compensation is an economic cost, pension cost as a part of compensation is correctly a cost. As described above, however, human capital is also likely a resource and the economic evidence reviewed suggests a positive correlation between the unrecorded human capital economic asset and pension cost. Thus, in a regression of price on pension cost, predicting the influence of pension cost is problematic. The human capital element implies that its coefficient should be less negative than other expenses. If the human

[22] This presumes that the pension asset is positive and the liability negative in the regression. It is possible for the obverse to occur in a particular sample because of the natural collinearity of the two variables.
[23] Again, I am aware that some pension cost flows first into inventory and fixed assets; however, in general most will be expensed in the period incurred.

capital element is sufficiently strong it could even be positive, rather than negative. Accordingly, I add pension cost to the base model in M3:[24]

M3: $P = \alpha + \beta_1 BVA + \beta_2 BVL + \beta_3 BSPA + \beta_4 BSPL + \beta_5 MIN + \beta_6 PREF + \beta_7 EPS + \beta_8 \Delta EPS + \beta_{12} PC$

For DCPs, the pension cost captures the service from employees simply and clearly. The pension cost represents the pension earned by the employee in that period. For DBPs the pension cost is a noisy measure of the service provided by employees in the period since it is composed of amortizations of past investment and actuarial gains and losses as well as amortizations of plan amendments and the initial net asset or obligation arising from the introduction of SFAS 87 plus the service cost. Further, the pension cost for DBP firms, may be subject to manipulation by firms choosing overly optimistic actuarial assumptions and assumed asset returns.[25] Analysts have complained that some companies have used unrealistically high hypothetical — or "expected" — rates of return for pension investments to enhance earnings.[26]

Thus, the service cost is the most permanent, timely, and ostensibly relevant of the DBP pension cost elements; however, these characteristics also make it more likely to be associated with the unrecorded human capital of the firm. It is the service cost that conceptually should be associated with the service provided in the period and the attendant human capital. Similar to pension cost for DCP firms, predicting its influence in a regression of price on service cost is problematic, with the legitimate labour cost/human capital elements implying negative/positive coefficients, respectively. Accordingly, I add service cost to the base model for DBP firms, leading to M4:

M4: $P = \alpha + \beta_1 BVA + \beta_2 BVL + \beta_3 BSPA + \beta_4 BSPL + \beta_5 MIN + \beta_6 PREF + \beta_7 EPS + \beta_8 \Delta EPS + \beta_{13} SC$

Finally, if service costs incorporates the unrecorded human capital more directly, and I include it along with PA and PL, this would make the estimates of the coefficients of the pension asset and liability more cleanly represent their values qua assets and liabilities. Or conceivably, if the pension asset and liability capture human capital better,

[24] In the models with an expense (i.e., pension cost or service cost) as a separate variable, I adjust EPS so that the pension expense is not included.
[25] For example, Ford and General Motors reported that the SEC had requested documents and information relating to pension and retiree benefits accounting.
[26] *Wall Street Journal*, October 20, 2004.

they could allow the service cost to cleanly capture the labour cost. It is more likely; however, that service cost will better capture human capital because service cost is more cleanly linked to employee productivity than either the pension asset or liability that incorporates investment returns, changes in interest rates, and funding policy. Accordingly, I add service cost to model M1 to create M5. If service cost does capture human capital better, then *PA* and *PBO* should behave more like assets and liabilities, so that the absolute values of β_9 and β_{10} below should be closer in magnitude than in model M1.[27] Model M5 follows:

M5: $$P = \alpha + \beta_1 BVA + \beta_2 BVL + \beta_3 BSPA + \beta_4 BSPL + \beta_5 MIN + \beta_6 PREF + \beta_7 EPS + \beta_8 \Delta EPS + \beta_9 PA + \beta_{10} PBO + \beta_{13} SC$$

4.2. Return Models:

While human capital is a stock that will change over time, there is less economic evidence on the process of change. Nevertheless, as a further analysis, I examine evidence on how these variables map into returns.[28] I use only firms' fiscal annual returns here. I am particularly interested in whether service cost for DBP firms and pension cost for DCP firms continue to capture *incremental growth* in human capital in the returns context or whether the compensation cost construct becomes more prevalent. Because pension assets are invested in the market, using market-adjusted returns would remove partially the return on pension assets. Accordingly, I explicitly use market return as a control variable rather than use market-adjusted returns, making the return regression similar to what is used in Aboody, Barth, and Kasznik (2004b).[29] Given that I am not sure how to capture the expectations for growth in human capital, the main test is to regress firm returns on the variables of interest and see whether service cost and pension cost

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[27] An alternative potential correlated omitted variable that would be correlated with the magnitude of pension assets, liabilities, and pension or service cost would be other (health) post retirement benefits (PRBs). It is important to note that if PRBs represent an important omitted liability, then if captured by SC, it should make SC more negative, not positive. Thus, to the degree that PRB is an important omitted variable it biases *against* the human capital hypothesis.

[28] As discussed in Kothari and Zimmerman (1995), while price models yield less biased coefficients, return models are less subject to econometrics problems. So I adopt both price and return models to strengthen the evidence.

[29] As in Aboody et al (2004b), firms' annual returns (*RET*) are calculated based on monthly holding returns, and the market returns (*MKTRET*) are calculated based on monthly value-weighted market returns.

influence returns qua *growth in human capital (positive coefficient)* or *compensation expense (negative coefficient)*.

Since I am using current fiscal year returns and the pension information is not yet available, I use a crude predictor of pension asset returns as the market return times pension assets at the beginning of the fiscal year ($PA*R_m$) to capture the return on pension assets. I also use a crude predictor of the growth in the liability measured as PBO times the risk free rate of return on long-term government bonds ($PBO*R_f$). The former ($PA*R_m$) should have a positive sign and the latter ($PBO*R_f$) a negative sign.

To aid in interpretation, I provide two simple models, RM0 regressing returns on only earnings and earnings changes (Easton and Harris, 1991), then RM1 that adds the market return. RM2 provides the model of interest for the ALL firms sample. In each model I deflate all continuous independent variables by the closing price of the prior year.

RM0: $RET = \alpha + \beta_1 EPS + \beta_2 \Delta EPS$

RM1: $RET = \alpha + \beta_1 EPS + \beta_2 \Delta EPS + \beta_3 MKTRET$

RM2: $$RET = \alpha + \beta_1 EPS + \beta_2 \Delta EPS + \beta_3 MKTRET + \beta_4 DBP + \beta_5 DCP + \beta_6 PA * R_m + \beta_7 PBO * R_f + \beta_8 SC + \beta_9 DCP * PC$$

V Empirical Results

5.1. Price Regressions: Pooled Sample –DBP Firms

First, to be consistent with previous papers on pensions, I focus on DBP firms only. The regression results are shown in Panel A of Table 2. M0 provides the base case. Adding the earnings variables increases explanatory power significantly relative to using only assets and liabilities as in Barth (1991). The adjusted-R^2 is less because I use per share measures that reduce the influence of large observations.[30]

In M1, PA and PBO have the proper signs and are significant; however, as expected, their coefficients are not close in magnitude, the coefficient for PA (.808) is approximately double in absolute magnitude the coefficient for PBO (-.371). The absolute value of these coefficients is significantly different (p<.0001). This is consistent with the hypothesis that these variables capture human capital as well as the pension asset

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[30] If I run the market value model using the same time period data, I obtain similar adjusted-R^2s. Her estimated coefficients while unbiased are less generalizable since they are influenced by the larger firms in the sample.

and liability. Accordingly, I substitute NetPA (PA less PL) in M2 and lose some explanatory power, R^2 decreases from .407 to .398. The individual disclosure of pension assets and liabilities provides more information than the aggregated disclosure.

Opposite to the traditional cost-based expectation, when pension cost (service cost) is added in model M3 (M4), the pension cost and service cost are strongly significantly positively, rather than negatively, correlated with firm value. This is consistent with the human capital perspective: higher service costs suggest both more numerous and more skilled employees and thus higher human capital. Consistent with service costs more cleanly capturing human capital than pension cost for DBP firms, the adjusted R^2 is higher in M4 (adjusted R^2 = .408) than in M3 (adjusted R^2 = .397). Finally, I include both service cost and the pension asset and liability in M5. All three are significant; the spread between the coefficients of PA and PBO shrinks considerably (now .744 versus -.589), although the coefficients are still significantly different ($p<.0001$).

In Panel A of Table 2, the coefficients for Balance Sheet recognized pension asset (BSPA) and pension liability (BSPL) are both positive with very large values in Model 0. This is further evidence of a latent human capital variable buried in the pension information. When I introduce the other pension variables in Models M1 to M5, the coefficients shrink considerably, although both remain positive.

5.2. Price Regressions: Pooled Sample - ALL Firms

While prior studies have focused on DBP firms, human capital should vary across all firms. As discussed earlier there is evidence that DCP firms have human capital, and may have more human capital than non-pension firms. Accordingly, I expand the sample by testing the hypotheses on all firms, employing pension cost for DCP firms. If human capital is generally associated with firm value and more prevalent for firms with pension plans, then the findings for DBP firms should continue to hold when the sample is expanded. Further, for DCP firms a simple cost interpretation would predict a negative coefficient for pension cost, however, if pension cost captures DCP firms' human capital it will be less negative and possibly positive.

I adjust models M1 to M5 as follows: recall that I expect pension cost to capture human capital well in DCP firms, but not in DBP firms where I expect service cost to capture human capital best. I use non-pension firms as the base case and add dummy variables DBP and DCP to capture the main effect of DBP and DCP firms. The dummies for DCP and DBP should be positive if there is a fixed human capital effect captured in having a pension plan. Pension cost, which was already included in model M3, is added to models M1, M2, and M4, and I also include an interaction between the DCP dummy and pension cost in all five models. To capture the influence of pension cost for DCP firms, one needs to add the coefficient of pension cost and the coefficient on the interaction of pension cost and DCP. The other pension variables PA, PBO and SC, only apply to DBP firms. Model M5 should be the best model since it includes pension cost only for DCP firms where it is likely to capture the human capital of the DCP firms, while service cost is used to capture human capital for the DBP firms.

I test these models in the ALL-Firm sample in Panel B of Table 2.[31]. In all of the models the DBP dummy is highly significant, having a DBP plan enhances the firm value, as one would predict given its ability to bind skilled workers to the firm. Being a DCP firm has a negligible positive effect. Consistent with the findings in Panel A of Table 2, PA and PBO (M1) adds more explanatory power than NetPA (M2), suggesting that PA and PBO provide information more than just asset-liability. Again, in M1 the absolute value of the coefficient of PA is significantly larger ($p<.0001$) than that of PBO (1.157 to -.750). When I include SC in model M5; however, they are much closer (1.001 versus -.942), and the difference is no longer significant. Thus, in this more complete sample it appears that once human capital is controlled for through the inclusion of SC, the pension asset and liability behave purely as assets and liabilities of equal economic value. Service cost is again highly significant and positive, rather than negative. Service cost qua human capital dominates service cost qua compensation expense for DBP firms in explaining price. Further, the human capital of the DBP firms relative to non-pension firms shows up in a significant fixed effect and an even higher coefficient per dollar of service cost than in the regressions with only DBP firms in Panel A. Thus, it appears that DBP firms have a human capital resource that is significantly larger than non-pension firms and that is increasing in service cost.

[31] Comparable results are achieved in tests on the firms with pension plans only sample.

The number and ability of the employees of DCP firms as captured by their pension costs has a positive effect with a highly significant coefficient of 10.617 (1.643 + 8.974). This coefficient of approximately 10 obtains for the influence of pension cost on the DCP firms in each of models M1 through M5. Thus, pension cost qua human capital dominates pension cost qua compensation expense for DCP firms in explaining price.[32]

Similar to M5 in Panel A, M5 in Panel B has the highest R^2 among the comparative regressions. M5 controls for the human capital effect by including SC. As a result, PA and PBO have very close coefficients and the absolute values of both are around the theoretical value of 1, as predicted under the asset-liability hypothesis.

Further, the coefficients for Balance Sheet recognized pension asset (BSPA) and pension liability (BSPL) are again both positive with very large values in Model 0 for the ALL-firm sample. Thus, they appear to capture human capital absent the other pension variables. When I introduce the other pension variables, the coefficients shrink considerably, and in Model 5, their coefficients attain correct signs, with BSPL becoming insignificant.

When I calculate White (1980) adjusted t-statistics, they are very similar to those reported and change no inferences. To ensure that the results are not driven by any unspecified fixed industry effects I add industry dummy variables classified by 2-digit SIC code. The results are again unchanged. Since the data cross 12 years, it is also necessary to control for the year effect. The pooled regressions (Table 2) do not allow different fixed (intercept shift) year effects. Adding 11 year dummy variables to each of the regressions in Table 2 does not alter the results for any of the models. Below I report results of allowing both intercept and slope to vary by year using annual regressions.

5.3. Price Regressions: Annual Regressions

While the analysis above is robust to incorporating fixed year effects, as a validity check, I run the price regressions in individual years and allow the coefficient on each variable to vary from year to year. It also helps to confirm the generality of the results over time. Table 3 reports the coefficients and t-value in each year and the average across the

[32] The negative coefficient on PC in model 4 likely arises from collinearity with SC since SC is a component of pension cost and the inclusion of PC actually decreases the adjusted R^2 for model M4 relative to M5.

sample period.[33] Since my major finding concerns the change in influence of the pension asset and liability after service and pension cost capture most of the human capital effect, I only tabulate the results of annual regressions for the key model – M5 for the DBP-firm sample and for the ALL-firm sample. If I do not control for SC, the coefficient of PBO is consistently significantly smaller than that of PA (not tabulated). For the DBP sample (Panel A of Table 3), when SC is present, the coefficients of PA and PBO vary from year to year, while on average the coefficient for PBO is smaller than that for PA in absolute value. The coefficient of SC is significantly positive in every year, except for one year (1993) in which it is positive but marginally significant. For the ALL-firm sample (Panel B), the coefficient of SC is significantly positive in every year. Another striking finding is that on average the coefficient for PA and that for PBO are equal in absolute value. There is a consistently positively significant main effect for having a DBP in every year, except in 1991 when the coefficient is insignificantly different from zero. As well, pension cost is significantly positive for the DCP firms in eleven years (with one year positive but only marginally significant). Thus, the main results hold annually, DBP firms have a fixed positive effect for human capital, and there is an additional significant positive effect for human capital captured by service cost, while pension cost appears to capture predominantly human capital for DCP firms, and the pension asset and liability behave as legitimate assets and liabilities with equal weight in firm value. Tests on the difference between the absolute values of the coefficients of pension asset versus liability indicate no significant difference. Thus, the economic value of pension assets and liabilities appear equal once human capital is explicitly captured in service cost.

5.4. Price Regressions: Additional Analysis on Human Capital

The evidence presented thus far is consistent with the human capital hypothesis and that service cost captures the higher human capital for defined benefit firms. In this section I examine variables that can help classify firms such that they are more or less likely to require higher human capital. Throughout this paper I argue that pension variables are correlated with two competing, legitimate effects; the actual cost of compensating employees which suggests a negative coefficient, and the human capital of the firm which

[33] Given the data constraint (only 12-year observations), it is inappropriate to conduct any sophisticated statistical test. The average coefficients are crude aggregations.

suggests a positive coefficient. Absent, a direct measure of human capital, the coefficient on SC will be the net of these two influences, with firms with higher human capital having higher coefficients on SC. Conversely, firms could have larger defined benefit plans and a high SC because labor is represented by unions who negotiate good pensions, so that the human capital explanation is less applicable and the SC coefficient should be smaller. Below I develop classification proxies for these two effects and test if the coefficient on SC can be reliably conditioned so that it is higher for higher human capital firms and lower for firms more likely to be unionized. I apply them to model M5a by inserting both a main effect as recommended by Aiken and West (1991) and the interaction with SC for each (0, 1) classification dummy. While the main effect for the human capital proxies should signal that a firm has human capital, it is insensitive to the magnitude of the human capital, which I expect to be correlated with SC. I test two human capital and one unionization classificatory variables below in the DBP subset.

First following on Barth (1991) I consider the information in the compensation increase rate (CIR). Relatively higher CIRs should be associated with productivity gains, which in turn are more likely with higher human capital. Since the CIR includes inflation expectations that vary from year to year, I divide each firm-year's CIR by the PBO discount rate since each firm in a given year is obliged to use comparable inflation expectations in the two forecast rates. Firms with large CIRs relative to the discount rate should have more human capital. I create the CIR dummy by assigning a value of 1 to firms with the scaled CIR greater than the median and obtain the following results.

$$P = 9.7 + 0.6NetBV + 2.3BSPA + 0.6BSPL + 3.4EPS - 1.0\Delta EPS + 0.7NetPA + 7.8SC$$
$$-0.7CIR + 6.4SC * CIR$$

where all the coefficients are significant at the 0.01 level, except for *BSPL* for which p-value is 0.260. The regression yields a significant large positive coefficient for the interaction term of 6.4. Thus, the SC coefficient for firms with rates of compensation increase below the median is 7.8, while the SC coefficient for firms with rates of compensation increase above the median is 14.2 (7.8+6.4). This result implies that firms with higher compensation increase rates, and which should have higher human capital, accordingly have larger positive coefficients on service cost.

High tech and research intensive firms should have higher human capital. Lev and Sougiannis (1996) show that there is a positive effect on firm value from R&D. To some degree this comes from non-capitalized patents; however, part of this is likely associated with the quality of the workforce that produce and market high tech products. Accordingly, I classify firms as R&D intensive or not based on whether they disclose R&D spending and obtain the following results.

$$P = 8.2 + 0.7NetBV + 2.1BSPA - 0.3BSPL + 3.3EPS - 1.0\Delta EPS + 0.7NetPA + 10.6SC$$
$$+ 1.8R\&D + 6.2SC * R\&D$$

where all the coefficients are significant at the 0.01 level, except for *BSPL* for which p-value is 0.51. The regression again yields a significant large positive coefficient for the interaction term, 6.2. Thus, the SC coefficient for non-R&D intensive firms is 10.6, while the SC coefficient for R&D intensive firms is 16.8 (10.6 + 6.2). Additionally, I divide the firms that disclose R&D at the median and created a second R&D dummy variable. I reran the above with a second interaction for the higher R+D firms. Consistent, with the view that more R&D implies higher human capital, SC had a coefficient of 10.3, the coefficient on the interaction of R&D firms with SC was 4.8, suggesting a coefficient for these firms of 15.1 (10.3+4.8), and the interaction between high R&D with SC was 4.5, suggesting a coefficient for these firms of 19.6 (10.3+4.8+4.5). Applying a comparable test to the DCP firms' pension cost produces a comparable positive sign but is not significant (p-value .16). Thus, the more research intensive the firm, the higher the human capital captured by each dollar of service cost.

Conversely, when unions are present, they may bargain for generous pension plans that are unrelated to human capital. I use U.S. Bureau of Labor data on percentage of employees represented by unions in different industries. The industries with the highest unionization are transportation and utilities.[34] Interactive dummies with these industries should provide negative coefficients on the interaction with SC, since SC is arguably capturing union influence more than human capital here. When I run regressions comparable to those above, the coefficients (p-value) for SC and for SC * Industry are for transportation 16.0 (.0001) and -7.9 (.014); and for utilities 18.2 (.0001) and -18.0 (.0001). Applying a comparable test to the DCP firms' pension cost produces a comparably

[34] Transportation includes SIC codes 37, 40, 44, 45, 47 and Utilities is 49.

significant negative sign. Thus, where unions are most likely to influence the existence of pension plans I see the interaction term reducing the coefficient pension cost or service cost for those firms.

Collectively, these additional analyses support the construct validity of service cost capturing human capital as well as the deferred cost of labour.

5.5. Price Regressions: Control for Collinearity

Many of the variables in the above analysis are correlated. I ran collinearity diagnostics on all of the tests. The collinearity diagnostics (un-tabulated) for the pooled models indicate that all the regressions in Table2 are subject to a collinearity problem. Models with Assets and Liabilities and Pension Assets and Liabilities had condition indices greater than 10, the point at which collinearity becomes a concern. For example, two condition indices (45.5 and 18.4) for the full model (M5) exceed 10. The existence of collinearity may make the estimate of coefficients unreliable and in some cases the sign of coefficients might flip. When I examine the proportions of variance for each variable in these models, it indicated that the collinearity is confined to the association between assets, liabilities, pension assets and pension liabilities, and neither service cost nor pension cost for DCP firms.

Nevertheless, to verify that the positive coefficient of service cost is not caused by the collinearity problem, I combine the collinear variables into a single variable.[35] Given the strong linear correlation between BVA and BVL and between PA and PBO (Panel C of Table 1),[36] I calculate net book value (NetBV = BVA – BVL – MINO – PREF), and net pension assets (NetPA = PA-PBO). The base model is reduced to:

M0a: $P = \alpha + \beta_1 NetBV + \beta_2 BSPA + \beta_3 BSPL + \beta_4 EPS + \beta_5 \Delta EPS$

In this form the base model is free from the collinearity problem, with the highest condition index of 3.99. Adding SC alone to the base model does not result in any collinearity problems and SC continues to show a strong positive coefficient (17.0, p-

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[35] See chapter 4 of "Applied Multivariate Data Analysis" (Jobson 1991) for more detailed discussion of collinearity.

[36] The proportion of variance also suggest that the regression coefficients for BVA and BVL are strongly related to the largest or second largest condition index for each regression and the regression coefficients for PA and PBO are strongly related to the highest condition index when PA and PBO are present.

value 0.0001). Similarly, collinearity is no longer a problem when I make comparable changes to M5 (Panel A of Table 2) and add SC:

M5a: $P = \alpha + \beta_1 NetBV + \beta_2 BSPA + \beta_3 BSPL + \beta_4 EPS + \beta_5 \Delta EPS + \beta_6 NetPA + \beta_7 SC$

The largest condition index is only 4.55 and SC continues to show a strong positive coefficient (16.1, p-value 0.0001). The results for pension costs for DCP firms are similarly robust. Therefore, collinearity does not drive the findings documented in this study.

5.6. Price Regressions: Sensitivity to Scale Effects

Compared with the market value equations used by Barth (1991) and Landsman (1986), the price-level model mitigates the effect of extreme observations and also reduces the problem of heteroscadasiticity. However, I recognize that even after deflating by the number of shares outstanding, the price-level models could still be subject to scale effects (see Lo 2005, Lo and Lys 2000, and Easton 1998 for discussions of scale effects)[37]. In particular, even on a per-share basis, the size effect (big firms may behave differently from small firms) confounds the relation and could affect any inferences. According to suggestions from prior studies, I do further tests regarding the scale effect. To keep the discussion concise, I describe tests for the DBP-firm sample only, but tests on the ALL-firm sample yield comparable results.

There are two commonly used remedies to the scale effect problem: including a scale proxy as a regressor or deflating all variables by a scale proxy. There is debate on the performance of these two methods. Barth and Kallapur (1996) indicate that the first method works better than the second one, while Lo (2005) argues that the latter one is at least as good as the first one and has smaller coefficient bias if the assumptions are economically reasonable. I employ both methods to show the robustness of the main results.

First, I add a size proxy, log(Sales), to the price-level model (as in Barth and Clinch 1998). The results of pooled regressions are summarized in Panel A of Table 5.

[37] The scale effects refer to the spurious relation between dependent variable and independent variables caused by the scale. In our case, if number of shares outstanding is an inappropriate scale, the statistical relation between price and balance sheet and/or income statement information documented here may not reflect the economic valuation relation *per se*.

All coefficients are close to those shown in Panel A of Table 2. Especially the spread between coefficients for PA and PBO is reduced in M1 and the magnitudes of these two coefficients are very close in M5. The coefficient of log(Sales) is significantly positive in M0 through M5. This is consistent with size as a risk measure so that all else equal, a larger, less risky firm, will have a higher price for a given configuration of assets, liabilities, and earnings. Panel B of Table 5 presents the results of M5 in each year from 1991 to 2002. The coefficient for service cost is positive in all twelve years and statistically significant in eleven years.

Secondly, I deflate all variables in the price-level model by a scale proxy. Two candidates for scale proxies are sales per share (Barth and Clinch 1998) and book value of equity (BVE) per share (Easton et al. 1993). By deflating all variables in the price-level model by sales per share, I essentially deflate the market value equation by sales. The basic regression M0 becomes:

$$\frac{MVE}{Sales} = \beta_0 \frac{1}{Sales} + \beta_1 \frac{BVA}{Sales} + \beta_2 \frac{BVL}{Sales} + \beta_3 \frac{BSPA}{Sales} + \beta_4 \frac{BSPL}{Sales} + \beta_5 \frac{MIN}{Sales} + \beta_6 \frac{PREF}{Sales} + \beta_7 \frac{EPS}{Sales} + \beta_9 \frac{\Delta EPS}{Sales}$$

In empirical tests, I allow an intercept term so that R^2 is well defined. The results (un-tabulated) for the pooled regression M0 – M5 are similar to those of the main tests. Service cost shows a strong positive correlation with price after controlling for the scale effect. Further, with the same transformation, I examine the robustness in annual regressions. In the annual regressions of M5 deflated by sales per share, the coefficient for service cost is significantly positive on average, and in nine of twelve years. When I deflate all variables in the price-level model by book value per share, the results (un-tabulated) show a similar pattern as when the deflator is sales per share.

5.7. Price Regressions: Rank Regressions

In addition, I run rank regressions to ensure that results cannot be driven by outliers. Further, rank regressions will capture any monotonically increasing functions whether linear or non-linear. To keep the same sample as in the main tests, for each variable I rank all observations remaining after eliminating values lying out of 1% and 99% boundary. A rank fraction (= (Raw Rank) / (# of observations)) is assigned to each observation as recommended by (Cheng, Hopwood, & McKeown, 1992). Observations with the same values have the same rank. The results of pooled OLS based on the ranks are shown in

Panel A of Table 6. The main results hold. In particular, the coefficient of PA is significantly bigger than that of PBO in M1. After controlling for SC in M5, the spread is reduced, but PA is still larger than PBO. Most importantly, the results for pension cost and service cost are supported. They have positive significant coefficients consistent with the human capital hypothesis.

Panels B and C of Table 6 reinforce these results in annual regressions on the DBP sample for models M4 and M5, respectively. In Panel B, M4 shows a strong positive coefficient on SC in every year, again consistent with the explanation that the human capital effect dominates. Similarly, in Panel C (M5) the coefficient of SC is significantly positive in eleven of twelve years. Except the first two years, the coefficient of PA is consistently bigger than that of PBO in magnitude and on average PA has a positive coefficient which is slightly larger than the coefficient of PBO in absolute value.

5.8. Returns Regressions

Since human capital is a stock that is developed over time, my primary tests have focused on the price of common shares. As an additional test, I examine returns and whether changes in the stock of human capital are captured by pension cost and service cost. I do this in Table 4 Panel A for DBP firms and Panel B for ALL firms. I test pooled models and check the robustness of results in individual years. The very last column provides the average coefficients and t-statistics for the annual regressions of model RM2 in both panels.

Earnings, earnings changes, and market returns are significant explanators as expected in models RM0 and RM1. $PA * R_m$ is insignificant in the regressions, while $PBO * R_f$ is significantly negative, albeit the magnitude is very small. Introducing the service cost for DBP firms and the pension cost for DCP firms results in *positive and significant*, rather than negative, coefficients for both pension and service cost consistent with the human capital hypothesis. Bringing in service cost increases the R^2. The coefficient of SC is positive and significant both economically and statistically. This is consistent with the explanation that the human capital effect dominates the compensation expense effect for both service cost for DBP firms and pension cost for DCP firms. The results of the annual regressions (last column of Panel A and B) support this finding, although the average results are weaker - each of them is statistically positive and significant in six out of twelve years.

VI Conclusion

I demonstrate that the reported pension information given in notes to the financial statements may capture more than the simple compensation expense and pension asset and liability that they are purported to represent. I find that when I use a more complete model the service cost for DBP firms and the pension cost for DCP firms capture the human capital of the firm in regressions explaining price and the growth in the human capital of the firm in regressions explaining returns. I do numerous specification tests that confirm that the results can not be attributed to collinearity, how variables are scaled, the influence of outliers, industry effects, or individual years.

For defined benefit pension plan firms when I incorporate service cost, the absolute values of the pension asset and liability converge and appear to behave as if the market values them as regular and legitimate assets and liabilities (measured as the pension benefit obligation). When I fail to control for service cost, however, the pension asset has a significantly higher absolute coefficient than does the pension liability, consistent with an omitted human capital variable flowing through the pension asset and liability. I provide additional corroboration for this interpretation that the coefficient on service cost can be predictably conditioned to be larger or smaller based on variables that indicate firms that are likely to have either more or less human capital.

The primary contribution of the paper is to resolve the questions posed in Barth et al (1992, 1994) concerning the inconsistent and/or unexpected mapping of pension information into the values of firms' equity. I cite evidence from economics and provide my own evidence that the former equivocal results can be attributed to a significant correlated omitted variable, human capital. Both users and researchers should be aware that so long as one does not explicitly control for human capital, pension variables will capture pension assets, liabilities, and costs qua assets, liabilities, and costs as accountants define them, but will also capture a firm's human capital. Any empirical analysis will observe the net of the two effects. Conceivably, service cost or pension cost would have the "correct" sign and magnitude if one could perfectly capture and control for human capital. While refining such a measure is beyond the scope of this paper, the evidence that the positive association between service cost and firm value is higher for firms that are expected to have more human capital based on anticipated productivity gains or technology suggest avenues for developing such a measure.

Thus, with respect to applying the results to practical valuation, it appears that pension information's association with the omitted human capital variable introduces an additional layer of complexity to the task of evaluating pension accounting disclosures and mapping them into price and returns beyond that arising from the concern over managers manipulating the components of pension cost and the concern over the smoothing of pension plan investment and actuarial gains and losses permitted under GAAP. This complexity arises because the cleanest measures of the annual compensation earned by employees in pension plans, service cost for DBP firms and pension cost for DCP firms, appear to be associated with an important and unrecorded economic human capital asset making the application of pension cost information to pricing securities problematic.

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Table 2-1. Descriptive Statistics for Each Sample Set

Panel A. Comparison across samples

	***ALL** Firms*			***DBP** Firms*			***DCP** Firms*			***Non-Pension** Firms*		
	Mean	Median	Std Dev	Mean	Median	Std Dev	Mean	Median	Std Dev	Mean	Median	Std Dev
TA [b]	1520.4	172.8	4854.2	3779.7	818.0	7657.1	759.5	102.3	3039.5	933.3	126.9	3612.4
TA / share [a]	34.4	13.4	61.7	48.0	24.4	74.7	21.1	9.5	43.0	41.5	12.9	67.9
TL [b]	1063.0	89.1	3606.6	2685.2	506.5	5774.7	495.4	44.1	2167.6	669.6	66.8	2687.2
TL / share [a]	26.7	6.9	57.1	37.6	14.9	70.3	14.6	4.2	38.3	34.1	6.7	63.2
BVA [b]	1364.1	168.2	4403.1	3215.2	749.1	6695.9	742.6	101.6	2985.9	922.2	126.8	3576.3
BVA / share [a]	34.4	13.3	61.7	47.9	24.3	74.7	21.1	9.5	43.0	41.5	12.9	67.9
BVL [b]	1010.6	88.1	3479.6	2499.8	486.8	5543.0	493.7	44.1	2160.4	663.7	66.7	2657.2
BVL / share [a]	26.6	6.9	57.1	37.4	14.8	70.3	14.6	4.2	38.3	34.1	6.7	63.2
BSPA [b]	1.2	0.0	7.2	5.1	0.0	14.3	0.0	0.0	0.4	0.1	0.0	1.9
BSPA / share [a]	0.0	0.0	0.1	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
BSPL [b]	1.7	0.0	9.2	7.2	0.5	17.8	0.0	0.0	0.7	0.1	0.0	2.2
BSPL / share [a]	0.0	0.0	0.1	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
MINO [b]	7.3	0.0	43.3	14.0	0.0	61.7	4.7	0.0	32.5	6.0	0.0	39.1
MINO / share [a]	0.1	0.0	0.6	0.2	0.0	0.6	0.1	0.0	0.5	0.1	0.0	0.6
PREF [b]	5.7	0.0	30.6	13.3	0.0	48.0	3.6	0.0	22.9	3.2	0.0	21.9
PREF / share [a]	0.2	0.0	1.0	0.3	0.0	1.0	0.2	0.0	1.0	0.2	0.0	1.0
NI [b]	38.0	3.1	141.4	102.6	23.9	216.1	17.8	1.9	98.4	19.6	1.5	105.5
EPS [a]	0.0	0.4	2.7	0.8	0.9	1.9		0.3	2.7		0.3	3.0
ΔNI [b]	1.8	0.6	77.8	8.0	2.3	112.7	0.2	0.5	59.2		0.3	68.8
ΔEPS [a]	0.0	0.1	2.6	0.0	0.1	2.0	0.0	0.1	2.7	0.0	0.1	3.0
Sales [b]	1292.8	110.0	6012.0	3104.4	656.6	9018.0	663.4	90.9	3825.8	819.6	45.2	5345.8
Sales / share [a]	18.4	9.5	55.4	27.9	19.0	35.9	17.1	8.2	73.7	13.3	7.0	35.8
Employees [c]	6.6	0.7	27.5	13.0	3.4	31.3	4.3	0.5	26.5	4.3	0.3	24.1
# of obs.	79,249			18,696			33,526			27,027		
% of obs.				23.60%			42.30%			34.10%		

Panel B. Descriptive Statistics for Pension Variables

Variables	DBP firms						DCP firms					
	Magnitude			Percentage[d]			Magnitude			Percentage[d]		
	Mean	Median	Std Dev	Mean	Median	Std Dev	Mean	Median	Std Dev	Mean	Median	Std Dev
PA [b]	526.06	47.4	2368	48.53%	10.50%	9.5						
PA / share [a]	3.23	1.6	4.8	48.53%	10.50%	9.5						
PBO [b]	356.49	48.52	988.6	56.84%	10.74%	14.6						
PBO / share [a]	3.15	1.64	4.5	57.11%	10.87%	14.5						
PC [b]	10.15	2.28	23.5	0.95%	0.46%	0.3	2.51	0.18	11.8	1.32%	0.22%	0.6
PC / share [a]	0.13	0.08	0.2	0.95%	0.46%	0.3	0.05	0.02	0.1	0.74%	0.22%	0.3
SC [b]	11.42	2.01	29.6	0.65%	0.38%	0.2						
SC / share [a]	0.09	0.06	0.1	0.62%	0.37%	0.2						

[a] Scaled by # of shares outstanding; [b] Dollars in millions; [c] Thousands; [d] Percentage of Market Value of Equity for Pension assets and liabilities; and percentage of Sales for pension costs and service costs.

Definitions of all variables:

TA = Total Assets

TL = Total Liabilities

BVA = Book Value of non-pension Assets

BVL = Book Value of non-pension Liabilities

BSPA = Pension asset recognized on Balance Sheet

BSPL = Pension liability recognized on Balance Sheet

Minority = Minority Interest

Preferred = Preferred Stocks

NI = Net Income Before Extraordinary Items

ΔNI = Change in Net Income Before Extraordinary Items

EPS = Earnings Per Share (basic)

ΔEPS = Change in Earnings Per Share

PA = Fair Value of Pension Asset

PBO = Projected Benefit Obligation

PC = Pension Cost

SC = Service Cost

Panel C. Correlations between price, control variables and pension variables

	Price	BVA	BVL	MINO	PREF	EPS	ΔEPS	PC[a]	PC[b]	PA	PBO	NetPA	SC
Price	1	0.353	0.284	0.146	0.075	0.133	0.008	0.247	0.197	0.271	0.251	0.058	0.32
		<.0001	<.0001	<.0001	<.0001	<.0001	0.017	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
BVA	0.535	1	0.952	0.092	0.102	0.059	-0.022	0.283	0.186	0.258	0.256	-0.116	0.195
	<.0001		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
BVL	0.42	0.926	1	0.069	0.102	0.06	-0.017	0.24	0.129	0.155	0.168	0.018	0.16
	<.0001	<.0001		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.012	<.0001
MINO	0.155	0.141	0.131	1	0.06	0.04	-0.005	0.073	0.096	0.112	0.126	-0.052	0.116
	<.0001	<.0001	<.0001		<.0001	<.0001	0.109	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PREF	-0.007	0.076	0.092	0.057	1	-0.084	-0.031	0.025	0.06	0.119	0.108	-0.001	0.128
	0.038	<.0001	<.0001	<.0001		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.904	<.0001
EPS	0.571	0.451	0.386	0.104	-0.077	1	0.497	0.052	-0.045	-0.007	-0.047	0.159	0.074
	<.0001	<.0001	<.0001	<.0001	<.0001		<.0001	<.0001	<.0001	0.313	<.0001	<.0001	<.0001
ΔEPS	0.122	0.053	0.039	0.003	-0.016	0.385	1	-0.021	-0.019	-0.028	-0.036	0.033	-0.012
	<.0001	<.0001	<.0001	0.305	<.0001	<.0001		<.0001	0.006	<.0001	<.0001	<.0001	0.094
PC[a]	0.35	0.422	0.382	0.112	-0.071	0.34	0.025	1	1				
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001						
PC[b]	0.192	0.299	0.241	0.057	0.024	0.117	0.012		1	0.44	0.525	-0.334	0.508
	<.0001	<.0001	<.0001	<.0001	0.001	<.0001	0.075		.	<.0001	<.0001	<.0001	<.0001
PA	0.363	0.448	0.424	0.089	0.173	0.271	0.023		0.386	1	0.956	0.162	0.714
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.001		<.0001		<.0001	<.0001	<.0001
PBO	0.359	0.462	0.434	0.112	0.166	0.259	0.019		0.484	0.973	1	-0.136	0.717
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.006		<.0001	<.0001		<.0001	<.0001
NetPA	0.096	-0.033	0.065	-0.059	0.064	0.13	0.017		-0.412	0.179	0.016	1	0.065
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.011		<.0001	<.0001	0.019		<.0001
SC	0.367	0.43	0.402	0.067	0.13	0.288	0.027		0.496	0.808	0.828	0.034	1
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001		<.0001	<.0001	<.0001	<.0001	

Note:

Above the diagonal are Pearson correlations and under the diagonal are Spearman correlations.

Correlations reported in the upper left square are based on ALL-firm sample; correlations reported in the middle are based on the sample of defined contribution pension (DCP) plan firms; correlations reported in the bottom right square are based on sample of defined benefit pension (DBP) plan firms.

[a] pension cost for DCP firms; [b] pension cost for DBP firms.

Table 2-2. Pooled Regressions of Price

Panel A. Results for Pooled Regressions Based on DBP-Firm Sample Set

	M0	M1	M2	M3	M4	M5
Intercept	9.818***	9.615***	9.818***	9.629***	9.356***	9.401***
BVA	0.574***	0.526***	0.571***	0.560***	0.510***	0.508***
BVL	-0.558***	-0.208***	-0.555***	-0.544***	-0.494***	-0.491***
BSPA	4.301***	1.153***	3.542***	4.199***	1.969***	1.064***
BSPL	3.094***	1.877***	3.885***	2.308***	0.469	1.096***
MINO	1.596***	1.442***	1.644***	1.592***	1.434***	1.444***
PREF	-0.754***	-0.904***	-0.798***	-0.731***	-0.846***	-0.898***
EPS	3.068***	3.035***	3.032***	3.089***	3.058***	3.031***
ΔEPS	-0.917***	-0.899***	-0.907***	-0.922***	-0.904***	-0.895***
PA		0.808***				0.744***
PBO		-0.371***				-0.589***
NetPA			0.916***			
PC				3.536***		
SC					19.641***	14.689***
Adj-R^2	**0.3958**	**0.4069**	**0.3983**	**0.3971**	**0.4079**	**0.4100**

Panel B. Results for Pooled Regressions Based on ALL-Firm Sample Set

	M0	M1	M2	M3	M4	M5
Intercept	7.776***	7.118***	7.061***	7.044***	7.14***	7.149***
BVA	0.784***	0.754***	0.761***	0.764***	0.751***	0.749***
BVL	-0.774***	-0.743***	-0.751***	-0.754***	-0.741***	-0.739***
BSPA	8.952***	1.904***	4.104***	5.336***	2.502***	1.743***
BSPL	6.195***	0.487	2.075***	1.27***	-0.883**	-0.325
MINO	1.123***	1.12***	1.162***	1.141***	1.089***	1.108***
PREF	-0.532***	-0.623***	-0.58***	-0.559***	-0.622***	-0.632***
EPS	0.33***	0.245***	0.251***	0.258***	0.243***	0.239***
ΔEPS	0.02	0.053***	0.051**	0.049**	0.055***	0.055***
PA		1.157***				1.001***
PBO		-0.75***				-0.942***
NetPA			1.373***			
PC		1.643**	4.215***	2.702***	-2.639***	
SC					22.788***	18.573***
DBP		2.627***	2.948***	3.121***	2.391***	2.277***
DCP		0.194*	0.206*	0.209*	0.199*	0.195*
DCP*PC		8.974***	6.25***	7.703***	13.189***	10.604***
Adj-R^2	**0.2792**	**0.2897**	**0.2880**	**0.2867**	**0.2905**	**0.2911**

Note: *** Significant at 0.01; ** Significant at 0.05; * Significant at 0.10

Table 2-3. Annual Regression of Price

Panel A. Results for Annual Regressions Based on DBP-Firm Sample Set (M5)

		Int.	BVA	BVL	BSPA	BSPL	MINO	PREF	EPS	ΔEPS	PA	PBO	SC	Adj R^2	N
Avg.	Coef.	11.04	1.29	-1.15	0.89	0.73	1.02	-0.68	4.81	-2.30	0.71	-0.55	15.24	**0.447**	
	T-stat.	(18.73)	(10.22)	(-9.55)	(0.58)	(0.56)	(2.41)	(-2.11)	(13.15)	(5.16)	(1.63)	(-1.42)	(4.92)		
1991	Coef.	6.90	0.56	-0.56	-0.83	-0.12	0.93	-0.29	2.06	-0.77	0.45	-0.62	24.35	**0.468**	1,466
	T-stat.	(18.85)	(14.79)	(-14.38)	(-0.71)	(-0.10)	(1.87)	(-1.42)	(14.23)	(-5.60)	(1.14)	(-1.40)	(6.31)		
1992	Coef.	7.22	0.64	-0.63	-0.39	0.60	1.32	-0.78	2.73	-0.93	0.90	-0.96	14.37	**0.507**	1,496
	T-stat.	(20.09)	(16.83)	(-16.10)	(-0.34)	(0.51)	(2.86)	(-3.76)	(17.26)	(-7.49)	(2.27)	(-2.18)	(3.45)		
1993	Coef.	7.44	0.71	-0.71	0.15	0.90	2.31	-0.77	2.47	-0.89	0.48	-0.15	6.35	**0.507**	1,487
	T-stat.	(20.11)	(17.91)	(-17.31)	(0.14)	(0.80)	(5.09)	(-3.80)	(13.65)	(-5.86)	(1.28)	(-0.36)	(1.48)		
1994	Coef.	7.24	0.61	-0.61	1.01	-0.08	1.23	-0.77	1.91	-0.41	0.14	-0.03	14.30	**0.448**	1,524
	T-stat.	(20.79)	(16.45)	(-16.08)	(1.00)	(-0.08)	(2.79)	(-3.79)	(11.99)	(-3.45)	(0.35)	(-0.06)	(3.68)		
1995	Coef.	7.89	0.62	-0.61	0.29	-1.05	1.63	-0.59	2.22	-0.61	0.55	-0.37	17.50	**0.498**	1,531
	T-stat.	(20.05)	(16.34)	(-15.29)	(0.26)	(-0.94)	(3.42)	(-2.41)	(12.87)	(-4.54)	(1.54)	(-0.91)	(3.70)		
1996	Coef.	9.60	0.50	-0.48	0.45	-0.85	1.76	-0.75	2.25	-0.10	0.28	-0.26	25.68	**0.469**	1,592
	T-stat.	(22.63)	(12.86)	(-11.71)	(0.37)	(-0.70)	(3.49)	(-2.36)	(12.81)	(-0.65)	(0.79)	(-0.65)	(5.51)		
1997	Coef.	12.47	0.35	-0.29	0.81	-0.40	-0.33	-0.86	4.52	-1.72	0.77	-0.80	23.43	**0.508**	1,544
	T-stat.	(25.45)	(7.40)	(-6.05)	(0.61)	(-0.30)	(-0.65)	(-2.34)	(18.31)	(-7.48)	(2.20)	(-2.01)	(4.63)		
1998	Coef.	11.67	0.30	-0.27	1.40	0.83	-0.06	-0.27	4.35	-2.33	0.32	-0.01	13.73	**0.379**	1,499
	T-stat.	(19.65)	(6.11)	(-5.19)	(0.94)	(0.54)	(-0.11)	(-0.67)	(15.13)	(-9.41)	(1.02)	(-0.02)	(2.41)		
1999	Coef.	11.76	0.40	-0.39	-0.01	1.37	2.46	-0.90	3.60	-0.59	1.71	-1.77	13.09	**0.311**	1,408
	T-stat.	(16.69)	(6.79)	(-6.47)	(-0.01)	(0.73)	(4.27)	(-2.03)	(11.57)	(-2.17)	(4.06)	(-3.44)	(2.01)		
2000	Coef.	10.76	0.45	-0.42	1.53	3.10	1.97	-0.73	3.92	-1.38	1.16	-1.46	20.35	**0.35**	1,386
	T-stat.	(14.56)	(7.97)	(-7.31)	(0.89)	(1.47)	(3.21)	(-1.39)	(12.92)	(-4.61)	(2.24)	(-2.39)	(2.88)		
2001	Coef.	11.92	0.38	-0.35	2.55	1.83	0.54	-1.18	3.63	-2.13	0.63	-0.70	20.40	**0.446**	1,347
	T-stat.	(20.59)	(8.56)	(-7.70)	(1.95)	(1.16)	(1.13)	(-2.98)	(17.52)	(-10.1)	(1.38)	(-1.51)	(3.71)		
2002	Coef.	10.39	0.39	-0.37	3.55	2.96	0.77	-0.31	3.50	-1.56	0.55	-0.53	14.92	**0.469**	1,270
	T-stat.	(19.19)	(10.29)	(-9.38)	(3.09)	(2.03)	(1.46)	(-0.77)	(18.62)	(-9.64)	(1.19)	(-1.35)	(2.97)		

Panel B. Results for Annual Regressions Based on ALL-Firm Sample Set (M5)

		Int.	BVA	BVL	BSPA	BSPL	MINO	PREF	EPS	ΔEPS	PA	PBO	DBP	DCP	DCP*PC	SC	Adj R^2	N
Avg.	Coef.	9.20	5.35	-4.85	1.08	-0.18	1.01	-0.87	0.5	0.58	1.41	-1.41	3.46	0.29	10.03	19.21	**0.332**	
	T-stat.	(20.82)	(32.27)	(-30.13)	(0.77)	(-0.04)	(3.26)	(-2.47)	(2.61)	(0.95)	(2.32)	(-2.31)	(4.54)	(0.49)	(5.87)	(6.74)		
1991	Coef.	7.01	0.73	-0.75	-0.55	-0.87	0.95	-0.05	0.45	-0.05	0.64	-0.85	-0.26	-1.87	10.65	20.72	**0.338**	4,350
	T-stat.	(21.54)	(38.61)	(-37.05)	(-0.34)	(-0.54)	(2.25)	(-0.28)	(5.73)	(-0.69)	(1.21)	(-1.42)	(-0.49)	(-4.29)	(4.90)	(4.25)		
1992	Coef.	6.61	0.85	-0.86	-1.67	-0.62	1.66	-0.6	-0.21	0.32	1.66	-1.84	0.77	-1.59	10.24	14.66	**0.331**	4,602
	T-stat.	(19.9)	(39.81)	(-37.69)	(-1.05)	(-0.38)	(3.95)	(-2.97)	(-2.62)	(4.50)	(2.95)	(-2.97)	(1.45)	(-3.71)	(4.47)	(2.66)		
1993	Coef.	7.44	0.72	-0.73	-0.29	-0.63	1.48	-0.22	0.13	0.07	0.63	-0.39	1.12	-0.67	9.38	13.81	**0.303**	5,585
	T-stat.	(26.5)	(39.9)	(-37.78)	(-0.20)	(-0.42)	(4.45)	(-1.28)	(1.80)	(1.00)	(1.23)	(-0.70)	(2.24)	(-1.80)	(4.35)	(2.53)		
1994	Coef.	5.07	0.88	-0.89	1.39	-1.09	1.07	-0.82	-0.21	0.1	0.23	-0.17	1.72	0.64	4.4	15.29	**0.386**	6,059
	T-stat.	(22.2)	(51.32)	(-49.06)	(1.11)	(-0.91)	(4.60)	(-5.64)	(-3.73)	(1.86)	(0.46)	(-0.32)	(4.26)	(2.19)	(2.57)	(3.63)		
1995	Coef.	5.93	0.95	-0.96	1.02	-2.42	0.75	-0.66	-0.25	0.45	0.61	-0.31	1.96	1.25	2.59	10.59	**0.345**	6,475
	T-stat.	(22.56)	(47.06)	(-44.61)	(0.72)	(-1.75)	(2.75)	(-3.63)	(-3.73)	(6.87)	(1.32)	(-0.60)	(4.12)	(3.74)	(1.33)	(2.00)		
1996	Coef.	7.04	0.78	-0.76	2.21	-2.48	1.10	-0.76	0.00	0.14	0.04	-0.20	2.5	0.91	9.4	29.89	**0.341**	6,914
	T-stat.	(26.59)	(43.19)	(-39.74)	(1.51)	(-1.79)	(4.43)	(-4.04)	(0.02)	(2.01)	(0.09)	(-0.40)	(5.23)	(2.77)	(4.75)	(6.20)		
1997	Coef.	7.49	0.83	-0.78	1.48	-1.29	0.37	-0.29	0.13	-0.06	1.56	-1.81	4.39	0.24	18.39	30.94	**0.415**	6,948
	T-stat.	(26.91)	(43.49)	(-38.69)	(0.99)	(-0.91)	(1.56)	(-1.58)	(1.81)	(-0.83)	(3.66)	(-3.84)	(8.82)	(0.70)	(9.69)	(6.23)		
1998	Coef.	6.82	0.72	-0.68	1.70	0.50	0.19	-0.55	0.17	0.26	1.05	-0.94	4.59	0.45	12.3	21.08	**0.321**	6,746
	T-stat.	(22.54)	(32.9)	(-29.49)	(1.12)	(0.34)	(0.79)	(-3.02)	(2.29)	(3.52)	(2.59)	(-2.16)	(8.64)	(1.25)	(6.35)	(4.14)		
1999	Coef.	10.74	0.51	-0.5	0.07	1.32	1.86	-0.46	-0.24	0.23	2.67	-2.85	2.56	0.49	10.99	22.14	**0.124**	6,668
	T-stat.	(25.68)	(20.44)	(-18.94)	(0.03)	(0.60)	(5.52)	(-1.92)	(-2.40)	(2.43)	(4.58)	(-4.15)	(3.34)	(0.97)	(3.85)	(3.25)		
2000	Coef.	6.88	0.75	-0.74	-0.65	2.74	1.34	-0.74	0.38	0.12	2.61	-2.95	4.2	0.92	9.99	30.33	**0.236**	6,367
	T-stat.	(17.45)	(30.97)	(-29.04)	(-0.33)	(1.28)	(4.24)	(-3.52)	(5.06)	(1.43)	(3.75)	(-3.84)	(6.15)	(2.00)	(3.83)	(4.52)		
2001	Coef.	6.56	0.7	-0.69	3.15	0.21	0.83	-0.77	0.62	-0.04	2.13	-2.19	4.57	1.00	13.7	30.69	**0.353**	5,653
	T-stat.	(19.15)	(31.77)	(-29.61)	(2.25)	(0.14)	(3.30)	(-4.28)	(10.46)	(-0.76)	(3.50)	(-3.78)	(8.37)	(2.59)	(5.80)	(5.82)		
2002	Coef.	6.09	0.63	-0.61	5.04	1.44	0.94	-0.23	1.49	-0.47	0.76	-0.88	3.05	-0.17	15.73	20.5	**0.487**	5,003
	T-stat.	(18.97)	(31.36)	(-29.09)	(4.85)	(1.14)	(4.06)	(-1.52)	(22.45)	(-8.49)	(1.86)	(-2.55)	(6.28)	(-0.48)	(8.39)	(4.86)		

Table 2-4. Regressions with Annual Returns as the Dependent Variable

For consistency, I use the same labels for the variables as in the Table 1 – 3. However, I deflated all the continuous variables by the closing price as of the end of last fiscal year.

Panel A. Results for Regressions on Returns Based on DBP-Firm Sample Set

	Pooled Models			Avg. of Annual Regressions
	RM0	**RM1**	**RM2**	**RM2**
Intercept	0.13	0.08	0.07	0.05
(t-stat.)	(37.68)	(19.50)	(14.67)	(1.40)
EPS	0.43	0.42	0.45	0.48
(t-stat.)	(25.28)	(24.64)	(27.77)	(7.91)
ΔEPS	0.11	0.12	0.05	0.17
(t-stat.)	(9.06)	(9.64)	(6.02)	(3.41)
R_m		0.39	0.39	0.70
(t-stat.)		(21.71)	(18.82)	(3.62)
PA*R_m			-0.01	0.46
(t-stat.)			(-0.18)	(1.14)
PBO*R_f			-0.001	-0.001
(t-stat.)			(-12.84)	(-3.60)
SC			5.63	2.41
(t-stat.)			(13.96)	(1.84)
Adjusted R^2	**0.053**	**0.078**	**0.085**	**0.102**

Panel B. Results for Regressions on Returns Based on ALL-Firm Sample Set

	Pooled Models			Avg. of Annual Regressions
	RM0	RM1	RM2	RM2
Intercept	0.14	0.07	0.07	-0.005
(t-stat.)	(55.60)	(23.83)	(15.88)	(0.149)
EPS	0.39	0.37	0.39	0.398
(t-stat.)	(43.44)	(41.62)	(45.36)	(13.289)
ΔEPS	0.08	0.09	0.02	0.070
(t-stat.)	(13.08)	(14.58)	(8.56)	(3.573)
Rm		0.54	0.54	1.431
(t-stat.)		(40.01)	(38.30)	(10.384)
DBP			-0.02	-0.025
(t-stat.)			(-2.05)	(-0.814)
DCP			-0.01	-0.003
(t-stat.)			(1.61)	(-0.288)
PA*Rm			0.01	0.127
(t-stat.)			(0.14)	(0.420)
PBO*Rf			-0.001	-0.001
(t-stat.)			(-7.93)	(-2.287)
SC			4.72	2.184
(t-stat.)			(8.03)	(1.166)
DCP*PC			2.84	2.198
(t-stat.)			(9.82)	(2.512)
Adjusted R^2	**0.037**	**0.062**	**0.062**	**0.074**

Table 2-5. Add log(Sales) as a Regressor to Price Regressions

Panel A. Add log(Sales) to Pooled Regressions – ALL-Firm Sample Set

	M0	M1	M2	M3	M4	M5
Intercept	-4.58	-4.32	-4.62	-4.58	-4.30	-4.35
(t-stat.)	(-14.36)	(-13.50)	(-14.54)	(-14.36)	(-13.50)	(-13.62)
BVA	0.55	0.52	0.54	0.54	0.51	0.51
(t-stat.)	(45.30)	(42.47)	(45.16)	(44.45)	(40.98)	(41.01)
BVL	-0.54	-0.51	-0.53	-0.54	-0.50	-0.50
(t-stat.)	(-42.80)	(-39.99)	(-42.63)	(-42.03)	(-38.71)	(-38.70)
BSPA	2.54	0.59	1.71	2.53	1.21	0.53
(t-stat.)	(7.21)	(1.52)	(4.73)	(7.18)	(3.28)	(1.37)
BSPL	1.79	1.69	2.64	1.69	0.26	1.13
(t-stat.)	(4.91)	(4.33)	(7.08)	(4.41)	(0.69)	(2.84)
MINO	0.37	0.35	0.41	0.37	0.32	0.36
(t-stat.)	(2.46)	(2.36)	(2.79)	(2.47)	(2.14)	(2.44)
PREF	-1.05	-1.14	-1.09	-1.04	-1.09	-1.13
(t-stat.)	(-11.87)	(-12.94)	(-12.44)	(-11.82)	(-12.41)	(-12.89)
EPS	2.62	2.60	2.58	2.63	2.63	2.60
(t-stat.)	(44.4)	(44.06)	(43.75)	(44.34)	(44.77)	(44.14)
ΔEPS	-0.73	-0.72	-0.72	-0.73	-0.73	-0.72
(t-stat.)	(-15.53)	(-15.37)	(-15.31)	(-15.54)	(-15.58)	(-15.37)
log(Sales)	2.47	2.40	2.47	2.46	2.37	2.38
(t-stat.)	(50.16)	(48.37)	(50.44)	(49.76)	(47.76)	(47.94)
PA		0.94				0.89
(t-stat.)		(9.29)				(8.81)
PBO		-0.73				-0.88
(t-stat.)		(-6.82)				(-8.13)
NetPA			0.99			
(t-stat.)			(9.84)			
PC				0.45		
(t-stat.)				(0.80)		
SC					11.77	10.59
(t-stat.)					(11.73)	(7.28)
Adjusted R^2	**0.473**	**0.478**	**0.476**	**0.473**	**0.478**	**0.480**

Panel B. Add log(Sales) to Annual Regression (M5) – ALL-Firm Sample Set

		Int.	BVA	BVL	BSPA	BSPL	MINO	PREF	EPS	ΔEPS	lg(Sale)	PA	PBO	SC	Adj R^2	N
Avg.	Coef.	-0.28	5.32	-4.86	0.88	-0.24	0.14	-1.14	-0.52	1.19	5.60	1.41	-1.43	14.65	**0.373**	
	(t-stat.)	(1.92)	(32.84)	(-30.74)	(0.51)	(-0.39)	(1.35)	(-3.31)	(-0.41)	(2.81)	(16.50)	(2.45)	(-2.50)	(4.50)		
1991	Coef.	4.30	0.67	-0.68	-1.67	-0.86	0.98	0.01	0.02	0.07	0.56	0.87	-1.11	17.73	**0.333**	4,180
	(t-stat.)	(9.42)	(39.05)	(-36.98)	(-1.06)	(-0.51)	(2.14)	(0.05)	(0.22)	(1.15)	(5.92)	(1.62)	(-1.83)	(3.56)		
1992	Coef.	3.82	0.87	-0.88	-1.78	-0.51	1.41	-0.67	-0.26	0.35	0.57	1.59	-1.81	14.18	**0.338**	4,607
	(t-stat.)	(8.74)	(40.92)	(-38.8)	(-1.17)	(-0.33)	(3.40)	(-3.34)	(-3.23)	(4.92)	(6.33)	(2.97)	(-3.05)	(2.70)		
1993	Coef.	4.03	0.74	-0.74	-0.30	-1.06	1.15	-0.31	-0.03	0.17	0.82	0.76	-0.63	13.13	**0.318**	5,574
	(t-stat.)	(10.13)	(41.19)	(-39.07)	(-0.22)	(-0.75)	(3.49)	(-1.82)	(-0.41)	(2.25)	(9.87)	(1.55)	(-1.19)	(2.55)		
1994	Coef.	1.44	0.88	-0.90	0.52	-1.51	0.67	-0.89	-0.41	0.24	1.01	0.48	-0.50	11.29	**0.408**	6,044
	(t-stat.)	(4.56)	(52.41)	(-50.27)	(0.45)	(-1.36)	(2.97)	(-6.29)	(-7.07)	(4.37)	(15.51)	(1.06)	(-1.03)	(2.87)		
1995	Coef.	1.58	0.93	-0.94	0.28	-3.03	0.32	-0.76	-0.41	0.58	1.24	0.91	-0.67	5.16	**0.386**	6,460
	(t-stat.)	(4.47)	(49.14)	(-46.84)	(0.22)	(-2.44)	(1.24)	(-4.35)	(-6.17)	(9.15)	(17.19)	(2.19)	(-1.45)	(1.06)		
1996	Coef.	2.21	0.76	-0.75	0.50	-2.56	0.63	-0.87	-0.25	0.26	1.37	0.61	-0.71	22.01	**0.368**	6,899
	(t-stat.)	(6.08)	(42.87)	(-39.72)	(0.39)	(-2.00)	(2.59)	(-4.78)	(-3.56)	(3.75)	(18.46)	(1.59)	(-1.65)	(4.99)		
1997	Coef.	-0.11	0.81	-0.76	1.84	-0.61	-0.16	-0.67	-0.15	0.23	1.98	1.05	-1.34	26.48	**0.469**	6,956
	(t-stat.)	(-0.29)	(44.98)	(-40.26)	(1.44)	(-0.49)	(-0.73)	(-3.79)	(-2.16)	(3.22)	(27.10)	(3.05)	(-3.43)	(5.98)		
1998	Coef.	-2.70	0.67	-0.64	2.13	1.38	-0.44	-0.69	-0.24	0.47	2.37	0.96	-0.84	13.00	**0.400**	6,779
	(t-stat.)	(-6.69)	(32.82)	(-29.62)	(1.71)	(1.07)	(-1.90)	(-3.98)	(-3.33)	(6.89)	(30.03)	(3.55)	(-2.87)	(2.97)		
1999	Coef.	1.06	0.65	-0.65	-1.01	-0.43	0.77	-0.76	-0.75	0.39	2.11	2.20	-2.36	10.25	**0.192**	6,703
	(t-stat.)	(1.88)	(23.66)	(-22.52)	(-0.57)	(-0.22)	(2.40)	(-3.27)	(-7.26)	(4.29)	(19.19)	(4.78)	(-4.21)	(1.66)		
2000	Coef.	-3.02	0.68	-0.68	0.99	2.24	0.38	-1.03	0.02	0.34	2.44	1.55	-2.04	23.15	**0.305**	6,428
	(t-stat.)	(-5.92)	(29.69)	(-27.93)	(0.64)	(1.20)	(1.24)	(-5.10)	(0.31)	(4.28)	(25.22)	(3.24)	(-3.62)	(3.90)		
2001	Coef.	-2.05	0.64	-0.63	3.33	0.09	-0.07	-0.98	0.45	0.13	2.17	1.05	-1.31	22.46	**0.424**	5,697
	(t-stat.)	(-4.87)	(30.85)	(-28.73)	(2.95)	(0.07)	(-0.29)	(-5.71)	(7.81)	(2.26)	(27.92)	(2.55)	(-3.18)	(4.89)		
2002	Coef.	-1.06	0.59	-0.57	4.01	1.38	0.19	-0.35	1.32	-0.42	1.65	0.65	-0.90	20.26	**0.530**	5,017
	(t-stat.)	(-2.81)	(30.82)	(-28.29)	(4.44)	(1.23)	(0.82)	(-2.46)	(20.66)	(-7.95)	(24.04)	(1.73)	(-2.80)	(5.33)		

Table 2-6. Rank Regressions of Price

Panel A. Pooled Rank Regressions of Price

	M0	M1	M2	M3	M4	M5
Intercept	-0.34	-0.18	-0.35	-0.34	-0.24	-0.19
(t-stat.)	(-10.62)	(-5.26)	(-10.90)	(-10.63)	(-7.26)	(-5.63)
BVA	0.63	0.62	0.63	0.62	0.60	0.61
(t-stat.)	(31.67)	(31.32)	(31.69)	(31.07)	(30.07)	(30.53)
BVL	-0.46	-0.47	-0.46	-0.46	-0.45	-0.46
(t-stat.)	(-24.46)	(-24.85)	(-24.40)	(-24.24)	(-23.94)	(-24.36)
BSPA	0.12	-0.03	0.11	0.11	0.02	-0.02
(t-stat.)	(7.47)	(-1.44)	(6.58)	(7.04)	(1.28)	(-1.22)
BSPL	0.08	0.03	0.09	0.06	0.01	0.02
(t-stat.)	(7.94)	(2.12)	(9.02)	(5.52)	(1.36)	(1.82)
MINO	0.50	0.48	0.51	0.50	0.49	0.48
(t-stat.)	(17.35)	(16.40)	(17.54)	(17.26)	(16.87)	(16.60)
PREF	-0.05	-0.11	-0.07	-0.04	-0.08	-0.10
(t-stat.)	(-2.10)	(-4.30)	(-2.59)	(-1.76)	(-3.01)	(-4.05)
EPS	0.62	0.60	0.63	0.62	0.60	0.60
(t-stat.)	(89.84)	(86.99)	(88.95)	(89.82)	(87.69)	(86.77)
ΔEPS	-0.11	-0.10	-0.11	-0.11	-0.10	-0.10
(t-stat.)	(-17.96)	(-17.20)	(-17.88)	(-17.91)	(-17.28)	(-17.13)
PA		0.18				0.17
(t-stat.)		(5.82)				(5.56)
PBO		-0.07				-0.11
(t-stat.)		(-2.25)				(-3.29)
NetPA			0.03			
(t-stat.)			(4.69)			
PC				0.03		
(t-stat.)				(5.39)		
SC					0.10	0.05
(t-stat.)					(13.99)	(4.90)
Adj-R2	**0.540**	**0.546**	**0.541**	**0.541**	**0.546**	**0.547**

Panel B. Annual Rank Regressions of Price (M5)

		Int.	BVA	BVL	BSPA	BSPL	MINO	PREF	EPS	ΔEPS	PA	PBO	SC	Adj R^2	N
Avg.	Coef.	-0.30	1.48	-0.89	-0.10	0.05	0.83	-0.03	3.50	-0.71	0.70	-0.57	0.27	**0.561**	
	(t-stat.)	(-1.67)	(7.69)	(-6.19)	(-0.37)	(0.49)	(4.29)	(-0.64)	(21.96)	(-4.18)	(1.73)	(-1.38)	(2.18)		
1991	Coef.	-0.43	0.69	-0.59	-0.08	0.01	0.58	0.03	0.56	0.02	-0.03	0.14	0.08	**0.612**	1,399
	(t-stat.)	(-3.98)	(10.39)	(-9.27)	(-1.34)	(0.19)	(5.83)	(0.48)	(24.89)	(1.15)	(-0.27)	(1.26)	(2.53)		
1992	Coef.	-0.34	0.62	-0.48	-0.05	-0.04	0.67	-0.10	0.64	-0.13	-0.07	0.11	0.11	**0.645**	1,496
	(t-stat.)	(-3.43)	(10.64)	(-8.81)	(-0.91)	(-1.26)	(7.64)	(-1.52)	(32.02)	(-7.38)	(-0.68)	(1.04)	(3.41)		
1993	Coef.	-0.41	0.74	-0.60	0.00	0.05	0.67	-0.03	0.53	-0.12	0.04	0.11	0.01	**0.585**	1,486
	(t-stat.)	(-4.06)	(12.44)	(-10.61)	(-0.05)	(1.34)	(7.32)	(-0.51)	(24.6)	(-6.07)	(0.41)	(1.01)	(0.37)		
1994	Coef.	-0.25	0.61	-0.53	-0.05	0.01	0.56	-0.14	0.54	-0.05	0.10	-0.03	0.10	**0.576**	1,523
	(t-stat.)	(-2.61)	(10.52)	(-9.83)	(-0.99)	(0.33)	(6.61)	(-2.06)	(25.77)	(-2.75)	(0.99)	(-0.32)	(3.52)		
1995	Coef.	-0.13	0.67	-0.49	-0.06	0.00	0.44	-0.10	0.54	-0.14	0.22	-0.14	0.08	**0.567**	1,531
	(t-stat.)	(-1.17)	(10.46)	(-8.09)	(-1.07)	(0.07)	(4.72)	(-1.27)	(23.11)	(-6.79)	(2.07)	(-1.27)	(2.45)		
1996	Coef.	-0.18	0.56	-0.39	0.02	0.03	0.48	-0.14	0.55	-0.08	0.20	-0.19	0.10	**0.542**	1,591
	(t-stat.)	(-1.69)	(8.77)	(-6.53)	(0.33)	(0.80)	(5.21)	(-1.71)	(23.47)	(-4.34)	(1.77)	(-1.67)	(3.09)		
1997	Coef.	0.11	0.43	-0.19	-0.03	0.02	0.24	-0.15	0.62	-0.16	0.29	-0.29	0.07	**0.583**	1,544
	(t-stat.)	(1.01)	(6.79)	(-3.25)	(-0.45)	(0.60)	(2.63)	(-1.84)	(26.13)	(-7.57)	(2.88)	(-2.76)	(2.16)		
1998	Coef.	-0.11	0.49	-0.25	-0.04	0.01	0.30	0.01	0.54	-0.10	0.42	-0.35	0.05	**0.485**	1,499
	(t-stat.)	(-0.84)	(6.83)	(-3.60)	(-0.56)	(0.21)	(2.97)	(0.13)	(20.95)	(-4.39)	(3.57)	(-2.81)	(1.34)		
1999	Coef.	-0.41	0.49	-0.41	-0.05	-0.02	0.60	0.14	0.55	-0.02	0.38	-0.42	0.13	**0.431**	1,407
	(t-stat.)	(-2.94)	(6.15)	(-5.51)	(-0.68)	(-0.33)	(5.48)	(1.26)	(20.01)	(-0.89)	(3.19)	(-3.31)	(3.23)		
2000	Coef.	-0.54	0.59	-0.50	0.07	0.12	0.55	0.13	0.64	-0.07	0.57	-0.67	0.12	**0.505**	1,386
	(t-stat.)	(-3.81)	(7.30)	(-6.56)	(0.90)	(2.43)	(4.99)	(1.10)	(24.03)	(-2.61)	(4.49)	(-5.03)	(2.75)		
2001	Coef.	0.06	0.62	-0.49	-0.02	0.06	0.25	-0.12	0.64	-0.18	0.39	-0.39	0.10	**0.565**	1,346
	(t-stat.)	(0.47)	(8.76)	(-7.33)	(-0.22)	(1.35)	(2.68)	(-1.19)	(28.80)	(-8.88)	(3.12)	(-3.02)	(2.75)		
2002	Coef.	0.05	0.49	-0.39	0.00	0.05	0.27	-0.22	0.70	-0.15	0.20	-0.17	0.09	**0.638**	1,270
	(t-stat.)	(0.46)	(7.69)	(-6.48)	(-0.04)	(1.15)	(2.80)	(-2.17)	(32.52)	(-7.93)	(1.89)	(-1.66)	(2.69)		

Chapter 3.

Internal and External Monitoring, Regulations and Quality of Financial Reporting: Evidence from the 2002 Sarbanes-Oxley Act[38]

I Introduction

In response to a string of highly publicized corporate scandals, the US Congress passed the Sarbanes-Oxley Act (SOX) on July 30, 2002 and instructed the Securities Exchange Commission (SEC) to come up with rules and policies with respect to the implementation of the SOX. Opponents of the SOX believe that it was hastily enacted as a political reaction to fraudulent conduct by a few bad apples such as Enron and Worldcom, and argue that the SOX imposed significant direct and indirect costs.[39] Zhang (2007) for example finds that the *loss* in total market value surrounding the three major legislative events in July 2002, aggregated over NYSE, AMEX and NASDAQ, amounted to $1.4 trillion. Butler and Ribstein (2006) estimate that direct compliance costs are only about one-fifth of the total SOX-related costs. Defenders of the SOX, on the other hand, claim that its benefits outweigh the costs. Harvey Goldschmidt, a former SEC commissioner, remarks that the SOX "... has been a great success in terms of the effect it has had on improved corporate governance...There is no question it has been a great piece of legislation, and anybody who says otherwise is talking like a darn fool."[40] Several empirical studies, reviewed in Section 2, appear to support this sentiment.

The provisions of the SOX, intended to restore the investor's confidence in financial and public reporting, are comprehensive and far-reaching. Some speak directly to the certification of financial reporting by CEO/CFO (i.e., Section 302)[41], whereas

[38] The working paper version of this chapter is coauthored with Jennifer Kao (University of Alberta) and Sati Bandyopadhyay (University of Waterloo).
[39] AMR Research estimates that firms will spend a total of $6 billion in 2006, similar to the spending for 2005 (available at http://www.amrresearch.com/Content/View.asp?pmillid=18967).
[40] See http://www.law.columbia.edu/faculty/faculty_news/facnews_2005_1/fall05.
[41] Section 302 of the SOX requires CEO and CFO of all publicly traded companies in the US to certify that their annual and quarterly filings with the SEC subsequent to August 29, 2002 represent in all material respects the financial condition and results of operations. According to a recent survey of CEOs and CFOs by Protiviti, the certification requirement along with penalties imposed by the SEC for false representation

others are designed to improve the overall reporting environment that generates financial reports (e.g., Sections 301 and 404).[42] The first objective of the study is to address the question of whether any improvement in the accuracy and reliability of financial reports depends on the reporting entity's strength of internal monitoring over its reporting process and the quality of its external auditors prevailing in the pre- versus the post-SOX period. For this so-called GAP analysis, I compare the reporting quality of Big4 clients with strong internal monitoring (labeled (S, S) firms hereafter) with that of non-Big4 clients with weak internal monitoring (labeled (W, W) firms hereafter) surrounding the SOX. Implicitly, I assume that Big4 auditors offer better audit quality than non-Big4 and that both sources of monitoring are necessary to improve financial reporting quality (see Francis et al 1999; Becker et al 1998; DeAngelo 1981). In the short run, I expect the magnitude of reporting gap between the (S, S) and (W, W) firms to widen at least temporarily, as fixing deficiencies in internal monitoring and switching auditors from non-Big4 to Big4 are costly and time-consuming. The (S, S) firms are in a better position to comply with the SOX. However, in the long run once all the provisions of the SOX have come into effect, both types of firms must bring their reporting quality up to meet the tougher requirements of the SOX. Thus, any short-term increase in report gap may reverse itself.

The second objective of the study is to examine the relative importance of internal versus external monitoring in bringing about an improvement to the quality of financial reporting surrounding the SOX. In this so-called Sufficiency analysis, I allow the two aspects of governance structure to have different quality and analyze the impact that internal (external) monitoring has on reporting quality, conditional on the strength of external (internal) monitoring. To my knowledge, the extant corporate governance literature has not explored the condition under which internal (or external) monitoring

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has prompted senior executives to re-evaluate their role in the reporting process and take action to ensure that their responsibilities are not only fulfilled but also clearly documented. Many companies have introduced a system whereby employees with significant financial and/or operational responsibilities are required to sign representation letters internally before CEO and CFO attach their signatures to the public filings.

[42] Section 301, effective as of January 2004, requires all audit committee members to be independent directors. Section 404, one of the most costly SOX provisions, requires management to assess internal controls by November 2004. Please refer to Figure 1-B of Begley, Cheng and Gao (2007) for a complete schedule of the SOX regulations.

alone may be sufficient to raise the quality of financial reporting in the face of a common regulatory intervention.

The final sample consists of up to 2,981 firm-year observations drawn from 2001 (pre-SOX) and 2004 (post-SOX). To address both research questions, I use the performance adjusted absolute value of discretionary accruals, estimated based on the cross-sectional version of the modified Jones model, to proxy for a firm's reporting quality; three measures of internal monitoring constructed by reference to the financial expertise and/or independence of an audit committee; and one measure of external monitoring proxied by the quality of external auditors (i.e., Big4 versus non-Big4). I perform separate level regressions for each of the three internal monitoring variables. Results from the GAP-based analysis generally support the prediction that the (S, S) firms improve their reporting quality from the pre-SOX period (2001) to the post-period (2004) more than the (W, W) firms, perhaps due to peer pressure or a desire by better firms to separate themselves from the average firms. Effectiveness of both internal and external monitoring allows these firms to react quickly to common legislative changes. While the certification regulation may have widened the gap between good and bad reporting entities in the short run, the latter group appears to catch up with the former group over a period of time. By 2005, the reporting quality for both groups of firms exceeded that prevailing before the SOX went into effect. These findings would appear to lend support for government intervention to regulate what had been essentially a private-sector decision concerning the quality of corporate reporting.

Results based on the Sufficiency analysis indicate that firms with weak internal monitoring can achieve much greater improvement to their reporting quality following the SOX by retaining a Big4 auditor, rather than a non-Big4. Likewise, firms audited by non-Big4 can improve financial reporting quality by a greater extent when their internal monitoring is effective compared to the case when it is weak. However, if internal (or external) monitoring is already strong, I find that firms cannot attain further improvement to reporting quality following the SOX with strong external (or internal) monitoring. Evidence that one of the monitoring mechanisms may be sufficient to produce high reporting quality even if the other is weak suggests that regulations such as Sections 404 and 301 of the SOX, calling changes to internal as well as external monitoring, may not be necessary especially given the high costs of compliance.

The remainder of the paper proceeds as follows: Section 2 reviews the related literature; Section 3 develops the research hypotheses; Section 4 describes the study's research design and variable measurement; Section 5 explains the sample selection criteria and data sources; Section 6 reports results from univariate and multivariate analyses along with the associated F-tests. Section 7 presents results based on robustness checks; Section 8 concludes the study.

II Literature Review

2.1. Effects of Regulations on Reporting Quality

Since the enactment of the SOX, many studies have examined its effects on a firm's reporting quality. Cohen, Dey and Lys (2007) for example find a steady decline in artificial earnings management (proxied by the *absolute value* of discretionary accruals) between 2002 and 2005. Lai (2003) also reports a significant reduction in unsigned discretionary accruals from 0.171 in the fiscal year dated before August 1, 2002 to 0.131 in the fiscal year dated on or after August 1, 2002. These empirical findings are consistent with the notion that the SOX has led to less volatile and arguably improved quality of financial reporting. Focusing on the effect of the SOX on accounting conservatism (proxied by the *signed* discretionary accruals), Lobo and Zhou (2006) conclude that Section 302 of the SOX has resulted in more conservative financial reporting.

Parallel to this line of research are works that look into the question of whether reporting credibility as perceived by the market has increased following the SOX. Jain and Razaee (2006) examine capital-market reaction to 12 events that would point to the eventual passage of the SOX. Their results indicate that average daily abnormal returns for the S&P 500 Index are 3.11% and –1.51% for favorable and unfavorable events, respectively. A concurrent study by Li, Pincus and Rego (2007) also documents significantly positive cumulative abnormal returns (CAR) in the week leading to the enactment of the SOX. Both studies conclude that the SOX has increased the credibility of financial reporting and reduced information uncertainty. Using slightly different windows, Zhang (2007) however finds significantly negative CAR surrounding key events that pre-dated the passage of the SOX.[43] Butler and Ribstein (2006) cite Zhang (2007) as support and argue that there are considerable direct compliance and indirect costs associated with the SOX.[44] Leuz (2007) cautions that the pre-SOX period examined by Zhang (2007) coincided with several major economic and political news taking place in the US and around the world,[45] thus making it difficult to attribute the unfavorable market reaction solely to the SOX.

2.2. Internal and External Monitoring and Effects of Regulations on Reporting Quality

Levitt, the former chairman of SEC, remarks that "the link between a company's directors and its financial reporting system has never been more crucial". Not surprisingly, several provisions in the SOX deal with corporate governance.[46] The potential link between the strength of internal/ external monitoring and the effectiveness of the SOX has received increasing attention from academic researchers in recent years. Jain and Rezaee (2006) for example examine market reaction to the SOX by the more versus less compliant firms, where compliance is defined by reference to the strength of corporate governance, financial reporting attributes and audit functions measured as of June 30, 2002. They find that market returns to compliant firms are more positive than those for non-compliant firms, implying that firms with strong governance are perceived as more likely to benefit from the SOX. Using Governance Indices to measure the strength of governance structure, Zhang (2007) also reports a positive association

[43] It is beyond the scope of this study to reconcile the conflicting findings reported in these three studies. But, I should point out one notable difference: Rezaee and Jain (2006) and Li et al (2007) include the event of Presidential approval of the SOX (July 30) and center their calculation of CAR on this date, whereas Zhang (2007) does not.

[44] Examples of indirect costs include costs of managing in the "climate of fear" created by the SOX's myriad new liabilities and rules (e.g., constraints on managerial risk-taking); limits on executive compensation through the insider loan prohibition; opportunity costs of diverting executives' time from business management to paper management; high costs imposed on small firms; reduced flow of information and trust in firms; major new burdens and risks placed on auditors; regulation of securities analysts reducing their incentives to gather information that is important to market efficiency; interference with state regulation of corporate governance; discouraging foreign firms from trading in the U.S., thereby eroding the U.S. dominance in world securities markets.

[45] See Table 1 of Leuz (2007) for examples of such events extracted from *New York Times* headlines.

[46] Examples include enhancing the effectiveness of audit committees (Sections 301 and 407); making the board of directors and management more accountable to the reliability of the financial reporting system (Sections 302 and 404); and increasing the independence of external auditors (Sections 201 and 203).

between corporate governance and abnormal market returns. In contrast to these two studies, Chhaochharia and Grinstein (2007) find that firms that are less compliant with the provisions of the SOX have significantly more positive abnormal returns between November 2001 and October 2002 than compliant firms. An analogous finding is also reported by Li, Pincus and Rego (2007) who show that firms engaging in greater earnings management in the pre-SOX period, on average, enjoy higher positive returns following the SOX. These results suggest that the investor may hold the belief that the SOX targets more fraudulent and less compliant firms.

Rather than focusing on the association between market reaction to the SOX and the strength of a firm's governance structure, I address the question of whether a firm's internal and external monitoring mechanisms would interact to affect the extent of improvement in reporting quality achieved following the SOX. This focus differs from the extant literature which typically models the effect of internal (external) monitoring on financial reporting, independent of the strength of external (internal) monitoring (see Dhaliwal, Naiker and Navissi 2006; Felo, Krishnamurthy and Solieri 2003; Klein 2002; Carcello and Neal 2000; Becker, DeFond, Jiambalvo and Subramanyam 1998; Beasley 1996; Dechow, Sloan and Sweeney 1996).[47]

III Hypotheses Development

3.1 Hypothesis for the GAP-Based Analysis

Absent regulation, there is a wide array of reporting quality, ranging from excellent to poor. Factors that could contribute to high quality financial reporting include strong internal governance structure and/or effective external monitoring. Government regulations, such as the SOX, can fundamentally change the reporting environment facing all the firms.

There are two competing views concerning how firms with varying degrees of governance strength would react to stricter regulations. On one hand, it may be argued that the (S, S) firms whose internal-external monitoring, and hence reporting quality, was already good prior to the introduction of the SOX would benefit the least from the SOX,

[47] Please refer to the survey paper by Cohen, Krishnamoorthy and Wright (2004) for a review of these studies.

compared to the (W, W) firms with weak internal-external monitoring. Provisions of the SOX speaking to the process that generates financial reports would merely narrow the gap between these two groups of firms. The relatively large positive market returns surrounding events favorable to the SOX, enjoyed by either less compliant firms or firms with serious earnings management problems in the pre-SOX period seem to support this view (see Section 2.2). Presumably, these firms have more room to improve their financial reporting quality. Alternatively, one may subscribe to the view that the (S, S) firms are better positioned to deal with the tougher reporting standards required by the SOX because fixing deficiencies in internal monitoring and switching auditors from non-Big4 to Big4 can be costly and time-consuming. It is comparably more difficult for the (W, W) firms to make major changes over night, implying a widening of reporting wedge at least in the short run. On balance, the second perspective seems relatively more compelling, especially in light of the substantial evidence concerning total costs of the SOX put forth by Zhang (2007) and Butler and Ribstein (2006). The above discussion leads to my first (GAP) hypothesis, stated in the alternate:

> H_{1a}: *Ceteris paribus*, in the short run, the reporting gap between firms with good internal-external monitoring and those with bad internal-external monitoring widens from the pre- to the post-SOX period.

3.2 Hypotheses for the Sufficiency-Based Analysis

Not all firms have equally strong internal and external monitoring mechanisms. Firms with weak internal monitoring may choose to be audited by a Big4 auditor. Conversely, non-Big4 clients may have strong internal monitoring. In the Sufficiency-based analysis, I un-bundle internal and external monitoring to see if the strength in one dimension is sufficient to improve reporting quality, given that the other dimension is strong (or weak).

Quality of financial reporting relies on the strength of external monitoring exercised by various stakeholders and monitoring agencies, such as external auditors, financial analysts and institutional holdings. I focus on the role played by external auditors, as the incentives of financial analysts and institutional investors over financial reporting are unclear. Take analysts for example. While they may benefit from more credible financial disclosures, their services may not be as in demand if financial reports are transparent and contain full disclosures. Similarly, large institutional investors often have access to other information sources and hence may not place much reliance on published financial reports per se. Audit quality varies with the size of external auditors. Palmrose (1988) finds that large auditors have lower litigation rates than small auditors. Francis et al (1999) and Becker et al (1998) report that Big6 audit clients use less income-increasing discretionary accruals and have smaller unsigned discretionary accruals than those of non-Big6. Recently, Blokdijk et al (2006) links high audit quality with better audit technologies. Specifically, large auditors tend to deploy audit effort in a more contextual and less procedural way. These studies suggest that large audit firms have stronger incentives to provide high quality audits than small audit firms, as the former group is generally perceived as having deep pockets. The collapse of Arthur Andersen exposes the Big4 auditors to increasing litigation risks, which in turn may motivate them to demand even less aggressive earnings management from their clients in the post-SOX period. Thus, irrespective of the strength of internal monitoring I expect financial reporting quality of Big4 clients to improve more than that of non-Big4's following the SOX. This prediction is consistent with evidence that former Andersen's clients that switch to a non-Big4 auditor have more negative market returns than those that switch to a Big4 (see Krishnamurthy et al 2006). Presumably, the market perceives Big4 auditors as providing higher audit quality than non-Big4 auditors even after the SOX.

The strength of internal monitoring has been shown to relate to financial reporting quality. Beasley (1996) for example finds that firms committing financial statement frauds on average have fewer outside directors sitting on their boards than those that do not. Dechow, Sloan and Sweeney (1996) report that weak governance structure is an important criterion used by the SEC to select firms for investigations of alleged earnings manipulation. Klein (2002) documents an inverse (direct) relationship between abnormal accruals (quality of financial reports) and the independence of the board, especially the audit committee. Finally, Lennox and Park (2007) find that firms with independent audit committees are less likely to hire their senior management's former employers as the external auditors. Following these studies, I expect a strong internal monitoring to facilitate compliance with tougher reporting standards more than the case when a firm's internal financial reporting generating process is weak, holding constant the strength of external monitoring.

While having a Big4 as the external auditor can benefit the firm, the influence of a Big4 auditor on the reporting quality need not be uniform across firms. In particular, for firms that do not have an effective internal oversight, they are expected to benefit greatly from the expertise offered and vigilance exercised by a Big4 auditor. By comparison, for firms whose internal monitoring is already strong, the essential governance framework is already in place to affect changes and ensure compliance with new reporting standards. Thus, they may benefit only marginally from the retention of a Big4 auditor. This view is similar in spirit to evidence from international accounting that auditors play a strong governance role in weak legal environments (see Choi and Wong 2007). By the same argument, if there are deficiencies in external monitoring, internal monitors are expected to be particularly vigilant concerning the accuracy and reliability of financial reporting, especially in the post-SOX regime when they can be jailed or fined financially should the previously certified financial reports turn out to be false.

The above discussion leads to the second set of (Sufficiency) hypotheses, stated in the alternate:

> H_{2a}: Conditional on <u>strong</u> internal (external) monitoring, *ceteris paribus*, the reporting gap between firms with strong external (internal) monitoring and those with weak external (internal) monitoring widens from the pre- to the post-SOX period.
>
> H_{2b}: Conditional on <u>weak</u> internal (external) monitoring, *ceteris paribus*, the reporting gap between firms with strong external (internal) monitoring and those with weak external (internal) monitoring widens from the pre- to the post-SOX period.
>
> H_{2c}: *Ceteris paribus*, the reporting gap between firms with strong external (internal) monitoring and those with weak external (internal) monitoring widens by a greater extent from the pre- to the post-SOX period, when their internal (external) monitoring is weak than when it is strong.

IV Measurement and Research Design

To address both research questions for this study, I employ the following empirical model:[48]

$$\begin{aligned} Adj\_|DACC| = {} & \beta_0 + \beta_1 SOX + \beta_2 INT + \beta_3 Big4 + \beta_4 SOX \bullet INT \\ & + \beta_5 SOX \bullet Big4 + \beta_6 INT \bullet Big4 + \beta_7 SOX \bullet INT \bullet Big4 \\ & + \beta_8 \log(TA) + \beta_9 \Delta NI + \beta_{10} BM + \beta_{11} IND + e \end{aligned} \quad (1)$$

where $Adj\_|DACC|$ denotes the performance-adjusted absolute value of discretionary accruals.[49] Implicitly, I assume that stricter reporting requirements of the SOX limit a firm's ability to manipulate financial reports through discretionary accruals. Equation (1) includes three test variables: strength of internal monitoring (*INT*), quality of external auditor (*Big4*) and regulatory dummy (*SOX*); three two-way interaction terms ($SOX \bullet INT$, $SOX \bullet Big4$ and $INT \bullet Big4$); and a three-way interaction term ($SOX \bullet INT \bullet Big4$). To control for the potential influence of firm size, financial performance, growth prospects and industries on unsigned DACC,[50] I also include four control variables, i.e., log transformation of average total assets (*log*(*TA*)), changes in net income before extraordinary items (ΔNI), book-to-market ratio (*BM*) and industry dummies (*IND*) (see Ahmed, Duellman and Abdel-Meguid 2006; Larcker and Richardson 2004; Chung and Kallapur 2003; Dechow, Richardson and Tuna 2003). Definitions and measurements for the dependent variable, along with each of the model variables, are discussed below and summarized in Table 1.

[Insert Table 1 about Here]

4.1. Measurement of Performance-Adjusted Discretionary Accruals

I adopt the following two-step procedure to calculate the performance-adjusted discretionary accruals: First, I use the modified Jones model proposed by Dechow, Sloan

[48] I use the level specification because only a very small number of firms (304) switched from a non-Big4 auditor to a Big-4 or vice versa during my sample period. A change specification would severely limit the sample size and lower the power of my tests.

[49] While both the signed and the unsigned discretionary accruals have been used to proxy for earnings quality in the extant literature, they tend to generate conflicting findings. Since firms with unusually large positive DACC are arguably motivated by a desire to maximize income and those with abnormally large negative DACC may be motivated by a tax minimization objective, it would appear more difficult to interpret average results based on the signed DACC. For these reasons, I choose to focus on the absolute value of discretionary accruals in this study. A similar approach can be found in Li et al (2007), Chung and Kallapur (2003), Lai (2003), Dechow and Dichev (2002), Frankel et al (2002) and Becker et al (1998).

[50] According to Hribar and Nichols (2006), using unsigned DACC as a proxy for earnings quality may be subject to correlated omitted variables problems.

and Sweeney (1995) to estimate the normal level of total accruals by running cross-sectional regressions for each year and every 2-digit SIC industry, as described below:

$$\frac{TACC_{ijt}}{TA_{ijt}} = \frac{\beta_0}{TA_{ijt}} + \beta_1 \frac{(\Delta REV_{ijt} - \Delta AR_{ijt})}{TA_{ijt}} + \beta_2 \frac{PPE_{ijt}}{TA_{ijt}} + \varepsilon \tag{2}$$

where $TACC_{ijt}$ denotes the total accruals for firm i in industry j and year t, computed as the difference between net income before extraordinary items (COMPUSTAT Item 18) and cash flows from operating activities (COMPUSTAT Item 308); ΔREV_{ijt} is the year-to-year change in net revenues (COMPUSTAT Item 12); ΔAR_{ijt} is the year-to-year change in accounts receivables (COMPUSTAT Item 2); PPE_{ijt} is gross property, plant and equipment (COMPUSTAT Item 7). I scale all the variables by average total assets TA_{ijt}. The two change variables, ΔREV_{ijt} and ΔAR_{ijt}, control for the expected components of total accruals. To deal with the potential effect of outliers, I winsorize total accruals and all independent variables at the 1^{st} and 99^{th} percentiles prior to estimating the normal accruals. Unadjusted discretionary accruals are given by the residual from Equation (2). Second, I adjust for firm performance using the method suggested by Francis, LaFond, Olsson and Schipper (2005, Appendix A) and Cahan and Zhang (2006).[51] In particular, I partition the sample (discussed in Section 5) into deciles based on contemporary return on assets (*ROA*) and calculate the performance-adjusted discretionary accruals as the difference between firm *i*'s unadjusted discretionary accruals and the median unadjusted discretionary accruals for firm *i*'s industry and *ROA* decile after excluding firm *i* from the calculation.

4.2. Proxies for Internal Monitoring

Audit committee is an integral part of a firm's internal governance structure, which works closely with the external auditor to monitor financial reporting practice. Klein (2002) finds that the independence of the board of directors, especially audit committee, helps mitigate problems associated with earnings management. Several recent studies also show that the financial expertise of audit committee members is a key attribute of a

[51] According to Dechow et al (2003) and Kothari et al (2005), the discretionary accruals obtained using either Jones or modified Jones model are overestimated for firms with high growth prospects and good performance. Performance matching is intended to address these problems. As robustness checks, I also use the unadjusted discretionary accruals as the proxy for financial reporting quality. Both GAP and Sufficiency results (not reported in a table) are qualitatively similar to those presented in Table 5.

firm's overall corporate governance profile and that the presence of financial experts helps improve financial reporting quality (see Carcello et al 2006; Dhaliwal et al 2006; DeFond et al 2005; Felo et al 2003).

Following these studies, I focus on the financial expertise and independence of audit committees[52] and use the following three proxy variables to measure these attributes: **(1).** *INT1*, representing the percentage of audit committee members who are labeled as financial experts in the proxy statements based on a broad definition by the SEC and the applicable stock exchange.[53] **(2).** *INT2*, representing the percentage of independent directors sitting on the audit committee. **(3).** *INT3* = (1/2)(*INT1* + *INT2*), representing a composite measure of the above two aspects of an audit committee. To facilitate my interpretation of the two-way and three-way interaction terms in Equation (1), I replace each continuous measure of internal monitoring with a dummy measure, defined by reference to the median of distribution for that proxy over all available sample firms in each of the sample years in the regressions. For example, *INT1* is set equal to 1 if it takes on a value greater than the median of *INT1* distribution and 0 otherwise. An analogous convention is also adopted for *INT2* and *INT3*.

4.3. Proxies for External Monitoring

External auditors have direct control over firms' financial reporting quality and they interact closely with audit committees. As reviewed in Section 3.2, prior research finds that the effectiveness of auditors as an external monitor over financial reporting depends on the auditor quality, proxied by audit firm size. Following these studies, I use audit firm size to measure the quality of external monitoring. In particular, the variable, *Big4*, is set equal to one if firms are audited by a Big4 auditor and zero otherwise.

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[52] I recognize that internal monitoring encompasses more attributes than audit committee. As robustness checks, I also consider the independence of entire board of directors in Section 7.1. Another measure, which I considered but chose not to pursue further, is governance index (*Gindex*) compiled by Gompers, Ishii and Metrick (2003) for reasons that *Gindex* captures both *internal* and *external* governance rules and that it is only available for about 2,000 firms every other year since 1998.

[53] I also consider a dummy variable, set equal to 1 when the chair of the audit committee is a financial expert. Results (not reported in a table) are very similar to those based on *INT1*. A more refined measure of financial expertise, based on an audit committee member's accounting expertise, has been proposed in the literature recently. Dhaliwal et al (2006) report a positive relation between accruals quality and audit committee consisting of accounting experts only. Defond et al (2005) fail to find any positive market reaction to audit committee that consists of non-accounting experts. It follows that using a less refined definition of financial experts, as I do in this study, would likely work against us.

4.4. Research Methodology

To address the first research question (GAP predictions), I treat internal and external monitoring as a bundle under the assumption that both monitoring mechanisms are required to ensure an effective oversight on a firm's financial reporting. Figure 1a summarizes regression coefficients for the key variables of interest to us, i.e., *SOX*, *INT*, *EXT*, three two-way interaction terms and one three-way interaction term. The reporting gap between the (S, S) firms and the (W, W) firms is given by the sum of regression coefficients $\beta_2 + \beta_3 + \beta_6$ in the pre-period; whereas that for the post-SOX period is $\beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7$ (see Column 3). The prediction of the GAP hypothesis (H_{1a}) that the reporting gap widens shortly after the introduction of the SOX is consistent with a significantly negative value on the difference between these two reporting gaps (i.e., $\beta_4 + \beta_5 + \beta_7$).

To address the second research question (Sufficiency predictions), I first un-bundle internal and external monitoring and then hold the quality of one of the dimensions constant at strong (or weak) and contrast the improvement in financial reporting when the strength of the other dimension is effective versus ineffective. Following the convention employed above to describe (S, S) and (W, W) firms, I label firms with strong internal monitoring and weak external monitoring as (S, W) and those with weak internal but strong external monitoring as (W, S). The key regression coefficients are summarized in Figures 1b-1e. The prediction of the first Sufficiency hypothesis H_{2a} is supported if the sum of coefficients, $\beta_5 + \beta_7$ in Figure 1b (or $\beta_4 + \beta_7$ in Figure 1d), is significantly negative. On the other hand, the prediction of the second Sufficiency hypothesis H_{2b} is consistent with a significantly negative value on the coefficient β_5 in Figure 1c (or β_4 in Figure 1e). Finally, the prediction of the third Sufficiency hypothesis H_{2c} holds if the coefficient β_5 in Figure 1c (or β_4 in Figure 1e) is significantly more negative than the sum of coefficients, $\beta_5 + \beta_7$ in Figure 1b (or $\beta_4 + \beta_7$ in Figure 1d), implying that the regression coefficient β_7 is significantly positive.

[Insert Figures 1a-1e about here]

V Sample and Data

I obtain financial, governance and audit-related data from COMPUSTAT, IRRC and Audit Analytics, respectively. My initial sample consists of 9,232 firm-year observations with sufficient COMPUSTAT data to compute DACC for calendar years 2001 (pre-SOX) and 2004 (post-SOX).[54] I do not consider 2003 as part of the post-SOX period because DACC computation requires lagged variables, which would have come from the event year (2002).

I then impose the following filter rules: **(1).** Each firm must stay in both the pre- and the post-SOX periods; **(2).** Every industry must have at least 20 firms to allow a meaningful calculation of median DACC for each industry-ROA decile. These two filters remove 2,054 and 524 firm-year observations respectively from further consideration, leaving us with 6,654 firm-year observations (or 3,327 firms in each period). Finally, I construct subsamples for each of the three internal monitoring proxies by partitioning the sample into high (i.e., above median) versus low (i.e., below median) quality of internal monitoring over all available sample firms in a given time period. The sample size varies with the choice of internal monitoring proxy. Take *INT1* for example. A firm whose value of *INT1* is higher (lower) than the median value of *INT1* in 2001 is classified as having strong (weak) internal monitoring in 2001. I do not require firms to stay in the same governance category from the pre- to the post-SOX period.[55] The sample consists of 3,140 and 2,991 firm-year observations for the *INT1*-based univariate and regression analysis, respectively. The sample size for the *INT2*-based multivariate analysis is much smaller due to data constraints (i.e., 1,175 firm-year observations). To ensure that I have a reasonable sample size for the composite measure, in constructing *INT3* I choose to set *INT2* = 0 if *INT2* is missing. Thus, the number of total firm-year observations for *INT3* is equal to that for *INT1*.[56]

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[54] I delete firms in financial service industries (SIC codes, 6000-6900) and those with non-December fiscal year-ends. As robustness checks, I also consider year 2005 as the post-SOX period (see Section 7.2).

[55] Only a handful of firms switched governance categories. Results are qualitatively similar with this restriction.

[56] I also consider the alternative of requiring the sample size to be given by the intersection between *INT1*and *INT2*. However, data restrictions attributable mainly to *INT2* lead to very small cell size in some cases (e.g., less than 10), making it difficult to interpret statistical test results.

VI Empirical Results

6.1. Descriptive Statistics

Panels A-D of Table 2 present descriptive statistics for *Adj_|DACC|*, three measures of internal monitoring and all the control variables used in the regressions by audit firm type and sample period. To provide a common reference point for *INT1*, *INT2* and *INT3*, I only report descriptive statistics based on the sample defined by *INT1*.

For the Big4 subsample, the mean (median) value of *Adj_|DACC|* decreases from 0.093 (0.056) in the pre-SOX period to 0.089 (0.055) in the post-period (see Panels A and B). In contrast, for the non-Big4 subsample the post-SOX mean and median *Adj_|DACC|* are both higher than the corresponding figures in the pre-period, i.e., 0.160 and 0.105 versus 0.108 and 0.056 (see Panel C and D).[57] This preliminary evidence suggests that Big4 auditors may have felt relatively more pressure to monitor their clients' financial reporting practice following the SOX. The raw (continuous) measure of *INT1*, i.e., financial expertise of audit committee members, displays an almost identical pattern of distribution across time periods for not just the Big4 but also the non-Big4 subsamples. On average, about 41.5% of audit committee members in the former group are financial experts and relatively fewer financial experts serve on the audit committees in the latter group (i.e., 38.4% versus 35.2% in the pre- and the post-SOX period, respectively). For both Big4 and non-Big4 subsamples, audit committees become more independent from the pre- to the post-SOX period due to the provisions of Section 301 that went into effect in January of 2004 requiring all audit committee members to be independent directors. The mean *INT2* for the Big4 (non-Big4) clients are 0.885 (0.886) in 2001 and 0.947 (0.923) in 2004. Finally, irrespective of audit firm types, my sample firms tend to be larger in size and enjoy better performance and greater growth prospects in the post-SOX period than in the pre-period, pointing to the importance of controlling for these variables in regressions that pool across time periods, as I do in Equation (1).

[Insert Table 2 about Here]

Table 3 reports the Pearson and Spearman correlation coefficients between *Adj_|DACC|* and each of the independent variables considered in the level regressions.

[57] Results reported in Section 6 continue to hold if former Arthur Andersen clients are excluded from my sample.

Focusing on the above-the-diagonal Pearson correlations first. I find that *Adj_|DACC|* is negatively correlated with *INT1*, *INT3* and *Big4*, all significant at the 1% level. The latter result imply that Big4 auditors help produce high quality financial reports. The strength of external and internal monitoring is positively correlated at the univariate level, with pair-wise Pearson correlations between *Big4* and *INT1*, *INT2* and *INT3* of 0.068, 0.066 and 0.146, respectively, significant at the 1% level. Results are largely similar when the below-the-diagonal Spearman correlations are employed. Thus, at the univariate level a firm's financial reporting quality appears to be related to the strength of its internal as well as external monitoring systems. Moreover, Big4 clients generally have more effective internal monitoring than their non-Big4 counterparts.

[Insert Table 3 about Here]

6.2 Results Based on Univariate Analyses

Panels A and B of Table 4 present univariate evidence on the GAP and Sufficiency analyses, respectively. Since results are qualitatively similar, to conserve space I only report those pertaining to *INT3* calculated based on a simple weighted average of financial expertise (*INT1*) and independence of audit committees (*INT2*).

The pre-SOX (post-SOX) reporting quality for the (S, S) and (W, W) firms appears in Row 1 (2) of Columns 1 and 2, Panel A, respectively. The corresponding differences in reporting quality between these two groups of firms, defined as $Adj\_|DACC|^{(S,S)} - Adj\_|DACC|^{(W,W)}$, can be found in Column 3. Results indicate that for each time period the (S, S) firms have smaller *Adj_|DACC|*, or equivalently better financial reporting quality, than the (W, W) firms. The median difference in *Adj_|DACC|* is –0.030 (–0.056) in the pre-SOX (post-SOX) period, significant at the 1% (1%) level. Thus, it would appear that internal and external monitoring systems work together to ensure high quality reporting. However, a more stringent post-SOX regulatory regime has an effect of widening the reporting wedge.

Turning next to the question of Sufficiency. The first (second) set of columns in the upper half of Panel B compares the mean and median *Adj_|DACC|* of the Big4 (non-Big4) clients which have good versus bad internal monitoring. For the Big4 subsample, the mean *Adj_|DACC|* is smaller for the (S, S) firms compared to the (W, S) firms in both time periods (i.e., 0.082 versus 0.108 and 0.075 versus 0.107 in the pre- and post-period, respectively). Both differences are significant at the 1% level. While the mean *Adj_|DACC|* for the (W, S) firms remains essentially unchanged from 2001 to 2004, the corresponding mean for the (S, S) firms decreases substantially over time. These results suggest that when the external auditor is effective, firms with strong internal monitoring react to strict regulations more swiftly and enjoy a wider reporting wedge over firms with weak internal monitoring in the short run. On the other hand, for the non-Big4 subsample the mean *Adj_|DACC|* for the (S, W) firms is significantly lower than that of the (W, W) firms in the pre-SOX period (i.e., 0.083 versus 0.134), but not so in the post-period. Thus, without an effective external auditor, the strength of internal monitoring appears not sufficient to ensure quality financial reporting in a strict post-SOX regulatory regime.

I now partition the sample by the strength of internal monitoring and compare the mean and median *Adj_|DACC|* for the Big4 versus non-Big4 clients (see the lower half of Panel B). As is evident from the first set of columns, the mean *Adj_|DACC|* for the (S, S) firms is insignificantly different from that of the (S, W) firms in the pre-period (i.e., 0.082 versus 0.083), though the former group on average has significantly lower *Adj_|DACC|* in the post-period (i.e., 0.075 versus 0.159). In contrast, the (W, S) firms have significantly lower mean *Adj_|DACC|* than the (W, W) firms in both the pre-and the post-SOX periods (i.e., 0.108 versus 0.134 and 0.107 versus 0.161, respectively) and enjoy a widening reporting wedge after the SOX (see the second set of columns). These patterns suggest that Big4 auditors are under relatively more pressure than non-Big4 in the post-SOX period, prompting them to demand greater improvement to reporting quality from their clients. Taken together, I find that, in an environment characterized by strong reporting standards and enforcement mechanisms (such as the post-SOX period), having an effective external auditor plays a dominant role in bringing upgrades to reporting quality. However, an effective internal monitoring may not be enough to improve financial reporting quality unless it is also accompanied by strong external monitoring.

[Insert Table 4 about Here]

6.3 Results Based on Regression Analyses

Panel A (B) of Table 5 reports results from the level regressions (the associated F-tests) for the GAP as well as the Sufficiency analyses. In both panels, results for each of the three internal monitoring proxies, *INT1*, *INT2* and *INT3*, are presented in Columns 1, 2 and 3, respectively.

As is evident from Panel A, the coefficient estimates on the two-way interaction term, $SOX \bullet Big4$, are significantly negative in all three level regressions (i.e., –0.031, –0.128 and –0.036), implying that Big4 clients improve their reporting quality far more than those of non-Big4 following the SOX. Moreover, firms with strong internal monitoring achieve greater improvement to reporting quality from the pre- to the post-SOX period compared to those with weak internal monitoring, though the coefficient estimate on the two-way interaction term ($SOX \bullet INT$) is negative and significant only in the *INT2* regression. Since my primary interest lies in the extent of quality improvement among firms with different strength of external and internal monitoring, regression coefficients alone cannot be readily interpreted.

To gain further insight into these issues, I now turn to a series of five F-test results in Panel B. Focusing on the first set of F-tests that speaks to the GAP Hypothesis (H_{1a}) next. I find that firms with strong internal as well as strong external monitoring have significantly lower $Adj\_|DACC|$ than those with weak internal-external monitoring in the post-SOX period after controlling for covariates. Nonetheless, these two groups of firms did not exhibit any difference in reporting quality prior to the introduction of the SOX. For all three internal monitoring proxies, the change in reporting gap surrounding the SOX between the (S, S) and the (W, W) firms, defined as $Post^{(S, S)-(W, W)} - Pre^{(S, S)-(W, W)}$, widens. Take *INT3* for example, the wedge increases from –0.008 (insignificant) in the pre-period to –0.049 (significant at the 1% level) in the post-period. The net change of –0.042 is significant at the 1% level. These findings are consistent with earlier univariate evidence and lend support for the prediction of the GAP hypothesis (H_{1a}). The increased reporting wedge between good and bad reporting entities in 2004 may imply an attempt by the (S, S) firms to further improve their financial reporting quality in response to stricter government regulations, presumably to help better separate themselves from the average firms. Alternatively, the observed pattern may also suggest a delay by the (W, W) firms to comply with a common legislative event due to cost considerations. In Section

7.2, I attempt to distinguish between these two competing arguments by extending the analysis to 2005.

Turning next to the second and fourth set of F-tests that address the predictions of Sufficiency Hypothesis H_{2a}. The relevant comparisons are $Post^{(S, S)-(W, S)} - Pre^{(S, S)-(W, S)}$ and $Post^{(S, S)-(S, W)} - Pre^{(S, S)-(S, W)}$. Irrespective of my choice of internal monitoring proxies, the reporting quality of the (S, S) firms is insignificantly different from that of the (W, S) firms in both time periods after controlling for covariates. Results are largely similar when I contrast the change in reporting gap between the (S, S) and the (S, W) firms across time periods. Thus, contrary to my predictions and univariate evidence, the SOX has not widened the reporting wedge between either (S, S) versus (W, S) firms or (S, S) versus (S, W) firms. It would appear that the strength of a firm's internal monitoring does not contribute to further enhancement to reporting quality provided external monitoring is effective. Likewise, the effectiveness of external monitoring also fails to raise the quality of financial reporting if internal monitoring is already strong.

I now consider the question of whether the strength in one of the monitoring dimensions can yield better reporting quality if the other dimension is weak, as predicted in Sufficiency Hypothesis H_{2b}. The pair-wise contrasts are provided by $Post^{(S, W)-(W, W)} - Pre^{(S, W)-(W, W)}$ and $Post^{(W, S)-(W, W)} - Pre^{(W, S)-(W, W)}$. Results indicate that better reporting quality in the post-SOX period can be achieved by firms with weak internal monitoring, if they retain a Big4 auditor, rather than a non-Big4 (see the fifth set of F-tests). The differences in the post-SOX *Adj_|DACC|* between the (W, S) and the (W, W) firms are –0.032 (significant at the 5% level), –0.080 (significant at the 10% level) and –0.036 (significant at the 1% level) when *INT1*, *INT2* and *INT3* are employed, respectively. The corresponding net changes in reporting gap between these two groups of firms are –0.031, –0.128 and –0.036, all significant at the 5% level. Results are weaker when I focus on the subset of firms audited by non-Big4 (see the third set of F-tests). In this case, the (S, W) firms widen their reporting gap over the (W, W) firms after the SOX, only for one of the internal monitoring proxies (i.e., *INT2*). These findings are largely consistent with the univariate evidence and the predictions of H_{2b}. While strength in external monitoring (as proxied by Big4) is important to improving financial reporting quality from the pre- to the post-SOX period for firms lacking effective internal monitoring, the strength in internal monitoring (as proxied by financial expertise of an audit committee) does not appear to be sufficient to yield noticeable quality improvement if external auditors are perceived to be of low quality. The observed Big4's response to the SOX is not surprising given that they have been under intense scrutiny from not just the regulator but also the public, ever since the alleged involvement by Arthur Andersen in the collapse of Enron came to light.

Finally, comparing the change in reporting gap between Big4 and non-Big4 clients from the pre- to the post-SOX period when their internal monitoring is strong versus when it is weak, I find that the contrast $Post^{(W, S)-(W, W)} - Pre^{(W, S)-(W, W)}$ is consistently more negative than that involving $Post^{(S, S)-(S, W)} - Pre^{(S, S)-(S, W)}$ (see the last row of the fourth and fifth set of F-tests). Results are qualitatively similar but weaker when I compare the corresponding changes given by $Post^{(S, S)-(W, S)} - Pre^{(S, S)-(W, S)}$ and $Post^{(S, W)(W, W)} - Pre^{(S, W)-(W, W)}$. Formal tests of these contrasts, implied by the Sufficiency Hypothesis H_{2c}, can be found in the three-way interaction term, $SOX \bullet INT \bullet Big4$ (see Panel A). For all three internal monitoring proxies, the coefficient estimate is positive, though only one of the coefficients (i.e., *INT2*) is significant at the conventional level. These results offer some support for the predictions of Hypothesis H_{2c}. Firms with a strong external (or internal) monitoring need not improve reporting quality more than those with weak external (or internal) monitoring, if both groups of firms already have an effective internal (or external) monitoring. The strength in one of the monitoring dimensions is particularly valuable in the post-SOX period, when the other dimension is weak.

[Insert Table 5 about Here]

VII Sensitivity Tests

7.1 Alternative Measure of Internal Monitoring

Board independence helps reduce agency problems arising due to a separation of ownership and management and is generally viewed as a good internal governance practice. Prior empirical research shows that board independence is inversely related to the extent of earnings management (see Klein 2002; Beasley 1996; Dechow et al 1995). In this section, I consider the robustness of the main results when the percentage of independent directors serving on the board, labeled *INT4*, is used an alternative measure of internal monitoring. Regression results and associated F-tests for the GAP and Sufficiency analyses are reported in Table 6.

As is evident in the first set of F-tests, there is no reporting gap between the (S, S) firms and the (W, W) firms for both time periods. Moreover, neither internal nor external monitoring alone is sufficient to bring about improvement to reporting quality when the other dimension is already strong (see the second and fourth set of F-tests). Contrary to the main findings, strengthening one of the monitoring dimensions also does not lead to better reporting quality even when the second dimension is weak (see the third and fifth set of F-tests). Turning next to the composite measure, *INT5* = (1/3)(*INT1* + *INT2* + *INT4*), that takes into account both attributes of audit committee (i.e., *INT1* and *INT2*), in addition to board independence (*INT4*). The GAP analysis now shows a widening gap between the (S, S) firms and the (W, W) surrounding the SOX, consistent with the main results. The change is negative (–0.042) and significant at the 5% level. However, I find no support for the Sufficiency predictions H_{2a} or H_{2c} and only a weak support for H_{2b}.

The comparably weaker results when board independence is considered as part of the strength of internal monitoring may be attributable to many non-financial functions assumed by the board. Alternatively, it may also suggest that board independence does not capture the interaction between internal monitoring and external auditors.

[Insert Table 6 about Here]

7.2 Alternative Definition of Post-SOX Period

As Butler and Ribstein (2006) point out, complying with a myriad of reporting regulations can take time and require substantial financial resources, especially for firms with weak internal and/or external monitoring prior to the SOX. While their speed of compliance may lag behind those whose internal and/or external monitoring is already strong, the delay may be temporary. Once all the major provisions of the SOX have taken effect, both types of firms must upgrade their reporting quality to meet the tougher standards of the SOX. Thus, any short-term increase in reporting gap between these two groups of firms is expected to reverse itself. To examine these conjectures and distinguish between two competing explanations for the GAP results, discussed in Section 6.3, I extend the analysis to fiscal year 2005 in this section.

Results based on univariate tests of the GAP and Sufficiency Hypotheses are presented in the last row of Panels A and B of Table 4, respectively. While the reduction in the (S, S) firms' *Adj_|DACC|* started in 2004 and continued into 2005, the (W, W) firms did not lower their *Adj_|DACC|* from the pre-SOX level until 2005. The widening of reporting gap that I documented previously using fiscal year 2004 as the post-period is no longer present. In fact, by 2005, the reporting gap between these two groups of firms largely returned to the 2001 level. The mean (median) reporting gap in 2005 is –0.049 (–0.036), compared to –0.052 (–0.030) in 2001, all significant at the 1% level. Similar patterns extend to each of the four univariate Sufficiency tests. Take the contrast involving the (S, S) and the (W, S) firms for example. The latter group's mean *Adj_|DACC|* are 0.108, 0.107 and 0.090 in 2001, 2004 and 2005, respectively. The corresponding figures for the former group are 0.082, 0.075 and 0.062. Using 2001 as the reference point, I find that the reporting gap, while widened in 2004, reverted back to the 2001 level by 2005. These univariate findings extend to the multivariate level. Results based on level regressions and the corresponding F-tests are reported in Panels A and B of Table 7, respectively. Take the contrast $\text{Post}^{(S, S)-(W, W)} - \text{Pre}^{(S, S)-(W, W)}$ for example. It is positive though insignificant. Thus, the (W, W) firms appear to have caught up with the (S, S) firms by 2005, such that their reporting gap returns to the pre-SOX level. Finally, none of the F-tests for Sufficiency analyses are significant at the conventional level.

[Insert Table 7 about Here]

In short, the 2005 results suggest that any reporting advantage that firms with strong internal (or external) monitoring might have enjoyed over those with weak internal (or external) monitoring shortly after the introduction of the SOX (i.e., 2004) is temporary. Once key provisions of the SOX have taken effect (e.g., Section 404, Internal Control Regulation, became effective in late 2004), the reporting gap returned to the pre-SOX level. While the SOX has succeeded in shifting up the reporting quality of both good and bad reporting entities, neither group of firms opted to drastically alter their reporting quality over a long run to widen or narrow the reporting gap that existed before the SOX. The response might have been motivated out of concern for the magnitude of direct and indirect compliance costs.

VIII Conclusion

One of the objectives of the SOX is to improve the quality of reported accounting numbers so as to restore investors' confidence. In this study, I contribute to the growing body of literature that shows an improvement in the overall reporting quality following the SOX by examining the issue of whether any enhancement to reporting accuracy and reliability would depend on the strength of internal and external monitoring prevailing surrounding the SOX.

Results from the GAP analysis indicate that firms with strong internal/external improved their reporting quality far more than those with weak internal/external monitoring in the short run. This has an effect of widening the reporting gap between these two groups of firms from the pre- to the post-SOX period. Extending the post-SOX period to 2005, I find the reporting gap reverted back to the pre-SOX level. Taken together, these results suggest that while both types of firms improved their financial reporting quality under a stricter post-SOX regulatory regime better firms reacted more quickly and improved reporting quality to a greater degree, at least in the short run. Given a longer time horizon however, average firms would catch up to narrow the reporting wedge.

I then unbundled the two sources of monitoring to examine the separate effects of internal and external monitoring on reporting quality. Results from the Sufficiency analysis indicate that when one of the monitoring dimensions is strong, firms were unable to achieve higher quality reporting by strengthening the other dimension. By comparison, firms with weak monitoring in one of these two dimensions could substantially improve their financial reporting quality by strengthening monitoring in the second dimension. The finding that an effective auditor may be sufficient to enhance reporting quality even if internal monitoring is weak implies that regulations such as Sections 404 and 301 of the SOX requiring major changes to the financial report-generating process may not be necessary, especially given the high cost of compliance.

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Figure 3-1

Figure 1a.	(S, S) Firms	(W, W) Firms	(S, S) – (W, W)
Pre-SOX	$\beta_0+\beta_2+\beta_3+\beta_6$	β_0	$\beta_2+\beta_3+\beta_6$
Post-SOX	$\beta_0+\beta_1+\beta_2+\beta_3+\beta_4+\beta_5+\beta_6+\beta_7$	$\beta_0+\beta_1$	$\beta_2+\beta_3+\beta_4+\beta_5+\beta_6+\beta_7$
Post - Pre	$\beta_1+\beta_4+\beta_5+\beta_7$	β_1	$\beta_4+\beta_5+\beta_7$

Figure 1b.	(S, S) Firms	(S, W) Firms	(S, S) – (S, W)
Pre-SOX	$\beta_0+\beta_2+\beta_3+\beta_6$	$\beta_0+\beta_2$	$\beta_3+\beta_6$
Post-SOX	$\beta_0+\beta_1+\beta_2+\beta_3+\beta_4+\beta_5+\beta_6+\beta_7$	$\beta_0+\beta_1+\beta_2+\beta_4$	$\beta_3+\beta_5+\beta_6+\beta_7$
Post – Pre	$\beta_1+\beta_4+\beta_5+\beta_7$	$\beta_1+\beta_4$	$\beta_5+\beta_7$

Figure 1c.	(W, S) Firms	(W, W) Firms	(W, S) – (W, W)
Pre-SOX	$\beta_0+\beta_3$	β_0	β_3
Post-SOX	$\beta_0+\beta_1+\beta_3+\beta_5$	$\beta_0+\beta_1$	$\beta_3+\beta_5$
Post – Pre	$\beta_1+\beta_5$	β_1	β_5

Figure 1d.	(S, S) Firms	(W, S) Firms	(S, S) – (W, S)
Pre-SOX	$\beta_0+\beta_2+\beta_3+\beta_6$	$\beta_0+\beta_3$	$\beta_2+\beta_6$
Post-SOX	$\beta_0+\beta_1+\beta_2+\beta_3+\beta_4+\beta_5+\beta_6+\beta_7$	$\beta_0+\beta_1+\beta_3+\beta_5$	$\beta_2+\beta_4+\beta_6+\beta_7$
Post – Pre	$\beta_1+\beta_4+\beta_5+\beta_7$	$\beta_1+\beta_5$	$\beta_4+\beta_7$

Figure 1e.	(S, W) Firms	(W, W) Firms	(S, W) – (W, W)
Pre-SOX	$\beta_0+\beta_2$	β_0	β_2
Post-SOX	$\beta_0+\beta_1+\beta_2+\beta_4$	$\beta_0+\beta_1$	$\beta_2+\beta_4$
Post – Pre	$\beta_1+\beta_4$	β_1	β_4

Notes:

1. In the above figures, the first letter within a parenthesis denotes the quality of internal monitoring, strong (S) or weak (W); and the second letter describes the quality of external monitoring, strong (S) or weak (W). For example, the notation (S, S) denotes firms with strong internal as well as external monitoring; and the notation (W, S) refers to firms with weak internal monitoring and strong external monitoring.
2. For each type of firms, the effects of both monitoring mechanisms on reporting quality in the pre-SOX (post-SOX) period can be found in the first (second) row of each figure

Table 3-1

Definitions and Measurement of Variables

Variables	Definition and Measurement
	Financial Reporting Quality
Adj_|DACC|	Absolute value of performance adjusted discretionary accruals. The difference between a firm's discretionary accruals estimated from modified Jones model and the median discretionary accruals of other firms in the same industry-ROA decile.
|DACC|	Absolute value of discretionary accruals. The discretionary accruals are estimated by cross-sectional modified Jones model.
	Period Dummy Variable
SOX	= 1, if a firm-year observation is for post-SOX period (2004); = 0, otherwise.
	Internal Monitoring (INT)
INT1	Percentage of audit committee members who are financial experts.
INT2	Percentage of independent directors on the audit committee.
INT3	Composite of audit committee measures: (1/2)**INT1* + (1/2)**INT2*.
INT4	Percentage of independent directors on the board of directors.
INT5	Composite of internal monitoring measure: (1/3)**INT1* + (1/3)**INT2* + (1/3)**INT4*.
	External Monitoring (EXT)
Big4	= 1, if the auditor is a Big-4 company; = 0, otherwise.
	Control Variables
log(TA)	Log transformation of average total assets.
ΔNI	Change in earnings before extraordinary items.
BM	Book-to-Market ratio: book value of common equity divided by market value of common equity.
IND	Industry dummy variable for each 2-digit SIC industry.

Table 3-2

Descriptive Statistics

Panel A. Big4 Clinents (Big4 = 1), Year=2001	N	Mean	Median	Minimum	25th Pctl	75th Pctl	Maximum	Std Dev
Adj_|DACC|	1,108	0.093	0.056	0.002	0.024	0.118	0.527	0.106
INT1	1,108	0.416	0.333	0.000	0.250	0.500	1.000	0.255
INT2	520	0.885	1.000	0.000	0.750	1.000	1.000	0.198
INT3	1,108	0.521	0.500	0.000	0.333	0.667	1.000	0.245
Log(TA)	1,108	6.087	5.945	1.840	4.666	7.417	10.349	1.981
ΔNI	1,108	-0.033	-0.010	-0.683	-0.072	0.024	0.589	0.182
B/M	1,100	0.563	0.431	-0.365	0.238	0.708	2.518	0.538
Panel B. Big4 Clinents (Big4 = 1), Year=2004	**N**	**Mean**	**Median**	**Minimum**	**25th Pctl**	**75th Pctl**	**Maximum**	**Std Dev**
Adj_|DACC|	1,346	0.089	0.055	0.001	0.023	0.110	0.571	0.105
INT1	1,346	0.415	0.333	0.000	0.250	0.500	1.000	0.257
INT2	602	0.947	1.000	0.000	1.000	1.000	1.000	0.127
INT3	1,346	0.527	0.500	0.000	0.333	0.667	1.000	0.253
Log(TA)	1,346	6.429	6.308	2.077	5.079	7.774	10.384	1.920
ΔNI	1,346	0.019	0.013	-0.347	-0.007	0.045	0.403	0.108
B/M	1,346	0.407	0.378	-0.165	0.230	0.560	1.215	0.267
Panel C. Non-Big4 Clinents (Big4 = 0), Year=2001	**N**	**Mean**	**Median**	**Minimum**	**25th Pctl**	**75th Pctl**	**Maximum**	**Std Dev**
Adj_|DACC|	462	0.108	0.056	0.002	0.026	0.149	0.527	0.122
INT1	462	0.384	0.333	0.000	0.250	0.400	1.000	0.250
INT2	172	0.886	1.000	0.000	0.750	1.000	1.000	0.194
INT3	462	0.471	0.333	0.000	0.333	0.667	1.000	0.255
Log(TA)	462	5.409	5.307	1.840	3.693	6.890	10.349	2.188
ΔNI	461	-0.018	-0.008	-0.683	-0.057	0.024	0.589	0.195
B/M	458	0.623	0.485	-0.365	0.258	0.836	2.518	0.576
Panel D. Non-Big4 Clinents (Big4 = 0), Year=2004	**N**	**Mean**	**Median**	**Minimum**	**25th Pctl**	**75th Pctl**	**Maximum**	**Std Dev**
Adj_|DACC|	224	0.160	0.105	0.001	0.045	0.204	0.571	0.161
INT1	224	0.352	0.333	0.000	0.333	0.333	1.000	0.227
INT2	13	0.923	1.000	0.333	1.000	1.000	1.000	0.200
INT3	224	0.366	0.333	0.000	0.333	0.333	1.000	0.231
Log(TA)	224	3.785	3.657	2.077	2.741	4.543	8.382	1.336
ΔNI	224	0.013	0.008	-0.347	-0.043	0.064	0.403	0.163
B/M	223	0.433	0.368	-0.165	0.208	0.607	1.215	0.320

Please refer to Table 1 for the definitions and measurement of each variable.

Variables *Adj_|DACC|*, *Log(TA)*, *ΔNI*, and *B/M* are winsorized at 2nd and 98th percentile of their distributions.

Table 3-3

Pearson and Spearman Correlations

	Adj_|DACC|	*INT1*	*INT2*	*INT3*	*Big4*	*log(TA)*	*ΔNI*	*B/M*
Adj_|DACC|	1	-0.051	-0.006	-0.140	-0.100	-0.286	-0.207	-0.008
		0.005	0.841	<.0001	<.0001	<.0001	<.0001	0.662
INT1	-0.027	1	0.050	0.810	0.068	0.132	0.012	-0.030
	0.128		0.070	<.0001	0.000	<.0001	0.501	0.103
INT2	0.009	0.048	1	0.550	0.066	0.004	0.052	-0.028
	0.757	0.082		<.0001	0.016	0.879	0.059	0.310
INT3	-0.158	0.682	0.522	1	0.146	0.425	-0.002	-0.059
	<.0001	<.0001	<.0001		<.0001	<.0001	0.926	0.001
Big4	-0.072	0.045	0.067	0.141	1	0.278	0.014	-0.094
	<.0001	0.012	0.015	<.0001		<.0001	0.422	<.0001
log(TA)	-0.315	0.029	-0.031	0.449	0.275	1	-0.016	-0.037
	<.0001	0.108	0.269	<.0001	<.0001		0.368	0.044
ΔNI	-0.031	0.012	0.038	-0.002	0.053	-0.008	1	-0.059
	0.082	0.503	0.169	0.922	0.003	0.670		0.001
B/M	-0.097	-0.046	-0.025	-0.021	-0.062	0.070	-0.135	1
	<.0001	0.012	0.380	0.248	0.001	0.000	<.0001	

Please refer to Table 1 for variable definitions and measurements.

The correlation coefficients and corresponding p-values are reported. Pearson (Spearman) correlations are reported in the top-right (bottom-left) half of the table. The numbers of observations vary with alternative internal monitoring measures.

Table 3-4
Univariate Tests on the GAP and Sufficiency: EXT = *Big4* and INT = *INT3*

Panel A. Univariate Tests on the GAP: *Big4* and *INT3*

••	••	(S, S) Firms *Big4* = 1 and *INT3* > Median	(W, W) Firms *Big4* = 0 and *INT3* < Median	(S, S) – (W, W)
Pre-SOX (2001)	Mean	0.082	0.134	-0.052 (-4.93)***
	Median	0.050	0.080	-0.030 (-5.34)***
	N	599	252	•
Post-SOX (2004)	Mean	0.075	0.161	-0.087 (-6.84)***
	Median	0.046	0.102	-0.056 (-7.62)***
	N	736	170	•
Post-SOX (2005)	Mean	0.062	0.112	-0.049 (-6.38)***
	Median	0.041	0.077	-0.036 (-6.83)***
	N	698	224	•

Panel B. Univariate Tests on the Sufficiency: *Big4* and *INT3*

••	•••	*Big4* = 1 (EXT=S)			*Big4* = 0 (EXT=W)		
••	•••	(S, S) Firms *INT3*>Median (INT=S)	(W, S) Firms *INT3*< Median (INT=W)	(S, S) – (W, S)	(S, W) Firms *INT3*>Median (INT=S)	(W, W) Firms *INT3* <Median (INT=W)	(S, W) – (W, W)
Pre-SOX (2001)	Mean	0.082	0.108	-0.026 (-3.74)***	0.083	0.134	-0.051 (-4.30)***
	Median	0.050	0.066	-0.016 (-4.66)***	0.044	0.080	-0.036 (-4.30)***
	N	599	509	•	210	252	•
Post-SOX (2004)	Mean	0.075	0.107	-0.032 (-5.47)***	0.159	0.161	-0.003 (-0.11)
	Median	0.046	0.068	-0.022 (-5.97)***	0.114	0.102	0.012 (-0.40)
	N	736	610	•	54	170	•
Post-SOX (2005)	Mean	0.062	0.090	-0.028 (-5.30)***	0.110	0.112	-0.002 (-0.12)
	Median	0.041	0.056	-0.015 (4.99)***	0.058	0.077	-0.019 (-0.66)
	N	698	473	•	78	224	•
•••	•••	•	•	•	•	•	•
••	•••	*INT3* > Median (INT=S)			*INT3* < Median (INT=W)		
••	•••	(S, S) Firms *Big4* = 1 (EXT=S)	(S, W) Firms *Big4* = 0 (EXT=W)	(S, S) – (S, W)	(W, S) Firms *Big4* = 1 (EXT=S)	(W, W) Firms *Big4* = 0 (EXT=W)	(W, S) – (W, W)
Pre-SOX (2001)	Mean	0.082	0.083	-0.001 (-0.11)	0.108	0.134	-0.027 (-2.41)***
	Median	0.050	0.044	0.006 (-0.30)	0.066	0.080	-0.014 (1.75)**
	N	599	210	•	509	252	•
Post-SOX (2004)	Mean	0.075	0.159	-0.084 (-3.63)***	0.107	0.161	-0.055 (-4.13)***
	Median	0.046	0.114	-0.068 (-4.37)***	0.068	0.102	-0.034 (-4.24)***
	N	736	54	•	610	170	•
Post-SOX (2005)	Mean	0.062	0.110	-0.047 (-3.39)***	0.090	0.112	-0.021 (-2.53)***
	Median	0.041	0.058	-0.017 (-3.57)***	0.056	0.077	-0.020 (2.86)***
	N	698	78	•	473	224	•

Please refer to Table 1 for variable definitions and measurements.

[a] In the bracket are t-statistics for the mean difference tests or Wilcoxon Scores for the median difference tests.

*, **, and *** represent significance at 10%, 5%, and 1% respectively, based on one-tailed p-values.

Table 3-5
Level Regression Results and Corresponding F-Tests: *Big4* and *INT1-INT3*

Regression Model:

$$Adj\_|DACC| = \beta_0 + \beta_1 SOX + \beta_2 INT + \beta_3 Big4 + \beta_4 SOX \bullet INT + \beta_5 SOX \bullet Big4 + \beta_6 INT \bullet Big4 + \beta_7 SOX \bullet INT \bullet Big4 + \beta_8 \log(TA) + \beta_9 \Delta NI + \beta_{10} BM + \beta_{11} IND + e$$

Panel A. Level Regression Results based on *Adj_|DACC|*: *Big4* and *INT1-INT3*

		Internal = *INT1*		Internal = *INT2*		Internal = *INT3*	
		Coeff	T-stat	Coeff	T-stat	Coeff	T-stat
Intercept	β_0	0.196	13.43 ***	0.116	3.57 ***	0.194	12.71 ***
SOX	β_1	0.035	2.16 **	0.135	2.40 **	0.042	2.44 ***
INT	β_2	0.004	0.2	0.053	1.99 **	0.003	0.14
Big4	β_3	-0.001	-0.05	0.048	1.56	0.001	0.06
SOX•INT	β_4	-0.010	-0.27	-0.166	-2.80 ***	-0.027	-0.72
SOX•Big4	β_5	-0.031	-1.69 *	-0.128	-2.01 **	-0.036	-1.81 *
INT•Big4	β_6	-0.010	-0.42	-0.064	-1.92 **	-0.011	-0.46
SOX•INT•Big4	β_7	0.008	0.18	0.162	2.40 **	0.021	0.52
Log(TA)		-0.011	-10.5 ***	-0.002	-1.25	-0.011	-9.42 ***
NI		-0.030	-4.08 ***	0.000	-0.01	-0.030	-4.08 ***
B/M		0.000	3.68 ***	-0.006	-0.71	0.000	3.68 ***
Adjusted R^2		0.119		0.098		0.119	
N		2,991		1,175		2,991	

Panel B. F-Tests Results based on *Adj |DACC|*: *Big4* and *INT1-INT3*

	INT1	*INT2*	*INT3*
Test on the Gap:			
Pre: (S. S) vs. (W.W) $\beta_2 + \beta_3 + \beta_6$	-0.006 (0.27)	0.037 (2.23)*	-0.008 (0.30)
Post: (S. S) vs. (W.W) $\beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7$	-0.040 (6.65)***	-0.095 (3.48)**	-0.049 (9.70)***
Post-Pre: (S. S) vs. (W.W) $\beta_4 + \beta_5 + \beta_7$	-0.034 (2.97)**	-0.133 (5.50)***	-0.042 (4.48)***
Tests on the Sufficiency:			
Pre: SS – WS = $\beta_2 + \beta_6$	-0.006 (0.21)	-0.011 (0.29)	-0.008 (0.35)
Post: SS – WS = $\beta_2 + \beta_4 + \beta_6 + \beta_7$	-0.009 (0.55)	-0.015 (0.35)	-0.013 (1.21)
Post – Pre: SS – WS = $\beta_4 + \beta_7$	-0.003 (0.02)	-0.004 (0.02)	-0.005 (0.09)
Pre: SW - WW = β_2	0.004 (0.04)	0.053 (3.97)**	0.003 (0.02)
Post: SW – WW = $\beta_2 + \beta_4$	-0.006 (0.04)	-0.113 (4.46)***	-0.024 (0.59)
Post – Pre: SW – WW = β_4	-0.010 (0.08)	-0.166 (7.82)***	-0.027 (0.52)
Pre: SS – SW = $\beta_3 + \beta_6$	-0.011 (0.45)	-0.016 (5.31)***	-0.010 (0.56)
Post: SS – SW = $\beta_3 + \beta_5 + \beta_6 + \beta_7$	-0.034 (2.22)*	0.018 (3.65)**	-0.025 (1.33)
Post-Pre: SS – SW = $\beta_5 + \beta_7$	-0.023 (0.72)	0.034 (8.67)***	-0.015 (0.34)
Pre: WS – WW = β_3	-0.001 (0.00)	0.048 (2.44)*	0.001 (0.00)
Post: WS – WW = $\beta_3 + \beta_5$	-0.032 (4.64)**	-0.080 (2.04)*	-0.036 (5.44)***
Post – Pre: WS – WW = β_5	-0.031 (2.86)**	-0.128 (4.05)**	-0.036 (3.27)**

Refer to Table 1 for variable definitions and measurements. The sums of corresponding coefficients are reported in each case, with the F-values reported in the brackets. *, ** and *** represent significance at the 10%, 5% and 1% level, respectively, based on one-tailed p-values.

Table 3-6
Sensitivity Analysis Using an Alternative Measure of Internal Monitoring

Panel A. Level Regression Results based on Adjusted |*DACC*|: *Big4* and *INT4-INT5*

		Internal = *INT4*			Internal = *INT5*		
		Coeff	T-stat		Coeff	T-stat	
Intercept	β_0	0.153	5.33	***	0.193	12.52	***
SOX	β_1	-0.001	-0.02		0.043	2.44	***
INT	β_2	0.017	0.61		0.006	0.26	
Big4	β_3	0.014	0.57		0.002	0.16	
SOX·INT	β_4	-0.027	-0.46		-0.027	-0.73	
SOX·Big4	β_5	-0.030	-0.62		-0.037	-1.82	*
INT·Big4	β_6	-0.035	-1.02		-0.014	-0.56	
SOX·INT·Big4	β_7	0.074	1.11		0.023	0.55	
Log(TA)		-0.002	-1.32		-0.011	-9.38	***
NI		-0.001	-0.07		-0.030	-4.08	***
B/M		-0.006	-0.80		0.000	3.68	***
Adjusted R^2		0.093			0.119		
N		1,175			2,991		

Panel B. F-Tests Results based on Adjusted |*DACC*|: *Big4* and *INT4-INT5*

	INT4	*INT5*
Test on the Gap:		
Pre: (S, S) vs. (W,W) $\beta_2 + \beta_3 + \beta_6$	-0.004 (0.04)	-0.006 (0.20)
Post: (S, S) vs. (W,W) $\beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7$	0.013 (0.10)	-0.048 (9.04)***
Post-Pre: (S, S) vs. (W,W) $\beta_4 + \beta_5 + \beta_7$	0.017 (0.15)	-0.042 (4.34)***
Tests on the Sufficiency:		
Pre: SS – WS = $\beta_2 + \beta_6$	-0.018 (0.77)	-0.008 (0.34)
Post: SS – WS = $\beta_2 + \beta_4 + \beta_6 + \beta_7$	0.028 (1.42)	-0.013 (1.03)
Post – Pre: SS – WS = $\beta_4 + \beta_7$	0.047 (2.29)*	-0.004 (0.06)
Pre: SW - WW = β_2	0.017 (0.38)	0.006 (0.07)
Post: SW – WW = $\beta_2 + \beta_4$	-0.010 (0.04)	-0.022 (0.48)
Post – Pre: SW – WW = β_4	-0.027 (0.21)	-0.027 (0.53)
Pre: SS – SW = $\beta_3 + \beta_6$	-0.022 (2.72)**	-0.012 (0.69)
Post: SS – SW = $\beta_3 + \beta_5 + \beta_6 + \beta_7$	0.023 (1.48)*	-0.026 (1.38)
Post-Pre: SS – SW = $\beta_5 + \beta_7$	0.044 (3.81)**	-0.014 (0.30)
Pre: WS – WW = β_3	0.014 (0.33)	0.002 (0.02)
Post: WS – WW = $\beta_3 + \beta_5$	-0.016 (0.14)	-0.035 (5.15)***
Post – Pre: WS – WW = β_5	-0.030 (0.38)	-0.037 (3.30)**

Refer to Table 1 for variable definitions and measurements. The sums of corresponding coefficients are reported in each case, with the F-value reported in the brackets. *, ** and *** represent significance at the 10%, 5% and 1% level, respectively, based on one-tailed p-values.

Table 3-7
Sensitivity Analysis Using an Alternative Measure of the Post-SOX Period

Regression Model:

$$Adj\_|DACC| = \beta_0 + \beta_1 SOX + \beta_2 INT + \beta_3 Big4 + \beta_4 SOX \bullet INT + \beta_5 SOX \bullet Big4 + \beta_6 INT \bullet Big4 + \beta_7 SOX \bullet INT \bullet Big4 + \beta_8 \log(TA) + \beta_9 \Delta NI + \beta_{10} BM + \beta_{11} IND + e$$

Panel A. **Level Regression Results Based on 2001 Versus 2005: *Big4* and *INT1-INT3***

		Internal = *INT1*		Internal = *INT2*		Internal = *INT3*	
		Coeff	T-stat	Coeff	T-stat	Coeff	T-stat
Intercept	β_0	0.296	6.84 ***	0.149	3.65 ***	0.296	6.82 ***
SOX	β_1	-0.008	-0.62 ***	0.083	0.95	-0.015	-1.05
INT	β_2	0.003	0.15	0.025	0.86	-0.004	-0.23
Big4	β_3	0.004	0.37	0.027	0.85	0.006	0.47
SOX•INT	β_4	-0.012	-0.39	-0.106	-1.18	0.010	0.34
SOX•Big4	β_5	-0.009	-0.57	-0.102	-1.12	-0.003	-0.16
INT•Big4	β_6	-0.017	-0.8	-0.035	-1.00	-0.014	-0.66
SOX•INT•Big4	β_7	0.029	0.84	0.117	1.24	0.003	0.09
Log(TA)		-0.012	-12.36 ***	-0.004	-2.51 **	-0.012	-10.99 ***
NI		-0.036	-4.93 ***	-0.015	-1.24	-0.036	-4.91 ***
B/M		0.002	1.52	0.000	-0.04	0.002	1.55
Adjusted R^2		0.119		0.106		0.119	
N		2,981		1,080		2,981	

Panel B. F-Tests Results Based on 2001 Versus 2005: *Big4* and *INT1-INT3*

	INT1	*INT2*	*INT3*
F-Tests on the GAP:			
Pre: (S, S) vs. (W,W) $\beta_2 + \beta_3 + \beta_6$	-0.011 (0.93)	0.018 (0.42)	-0.013 (1.12)
Post: (S, S) vs. (W,W) $\beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7$	-0.003 (0.04)	-0.073 (0.79)	-0.003 (0.04)
Post – Pre: (S, S) vs. (W,W) $\beta_4 + \beta_5 + \beta_7$	0.008 (0.24)	-0.091 (1.10)	0.010 (0.39)
F-Tests on the Sufficiency:			
(SS – WS) = $\beta_4 + \beta_7$	0.017 (1.18)	0.011 (0.14)	0.013 (0.62)
(SW – WW) = β_4	-0.012 (0.15)	-0.106 (1.39)	0.010 (0.11)
(SS – SW) = $\beta_5 + \beta_7$	0.020 (0.79)	0.015 (1.45)	0.000 (0.00)
(WS – WW) = β_5	-0.009 (0.32)	-0.102 (1.26)	-0.003 (0.02)

Please refer to Table 1 for variable definitions and measurements.
The sums of corresponding coefficients are reported in each case, with the F-value reported in the bracket.
*, ** and *** represent significance at the 10%, 5% and 1% level, respectively, based on one-tailed p-values.

Chapter 4.

How Earnings Are Managed Through Discretionary Accruals and Abnormal R&D Spending Toward Earnings Targets: Analyses on Annual and Quarterly Basis

I Introduction

In this study I examine how managers manage earnings through accruals and/or R&D spending which are examples of two alternative approaches to manage earnings: "pure accounting decision" and "real productive decision", as discussed in Jiambalvo (1996). In the literature of earnings management, most studies examine these two approaches separately. A few recent works start looking at them together (Cohen, Dey, and Lys (2007) and Zang (2005)). Cohen et al. (2007) investigate the change in accrual-based and real earnings management from pre-SOX to post-SOX era. Their finding that accrual-based earnings management declines and real earnings management increases after the SOX provides evidence that managers, facing the stricter regulations of financial reporting imposed by the SOX, tend to switch from the former to the latter. Zang (2005) directly studies the decision to trade off accrual-based and real earnings management. She argues that the accrual and real earnings management are substitutes and they are determined sequentially with real earnings management preceding accrual management.

The first objective of this study is to test whether managers manage earnings through discretionary accruals and/or R&D spending strategically depending on the level of the pre-managed earnings relative to the earnings target. DeFond and Park (1997) find that managers manage earnings through discretionary accruals as a reaction to the income objective. In particular, they find that the discretionary accruals are significantly positive when pre-managed earnings cannot meet the target and are significantly negative when pre-managed earnings are above the earnings threshold, indicating that managers manage earnings through discretionary accruals to consistently meet the earnings target. Baber, Fairfield, and Haggard (1991) argue that firms cut R&D spending when it jeopardizes their ability to meet or beat the income objectives in the current period. Both studies suggest that the earnings targets provide incentives for managers to manage earnings. But they consider only one aspect of earnings management: accrual-based manipulation or real activities such as R&D spending. I extend this literature by consider both as alternative earnings management tools at the same time.

The second objective of this study is to investigate whether managers use accrual-based and real activity earnings management as complementary or substitutive approaches. The third objective examines the primary direction of the influence, that is from discretionary accruals to abnormal R&D or vice versa, and is this influence evidenced by the timing of these two decisions – are they simultaneously determined or does one precede the other? Cohen et al (2007) examine the trends of these two earnings management approaches separately as if they are independent decisions. Zang (2005) provides more direct evidence by examining accrual-based and real earnings management together in the multivariate setting. She concludes that they are substitutive and the decision on real earnings management precedes accrual-based earnings management. But she uses annual data which do not allow her to examine the timing of earnings management within a fiscal year. Further, while she uses Ex ante distance (i.e., how far the pre-managed earnings are to the earnings threshold) as a control variable, she uses analysts' forecasts at the end of the third quarter which essentially only allows one quarter (4^{th} quarter) of discretionary decision. I examine the quarterly patterns by directly using quarterly data to see if there is a sequence of accrual-based and real earnings management on quarterly basis.

The fourth and last objective of this study is to examine whether the complementary or substitutive relationship between accrual-based and real earnings management has changed after the SOX. Nearly half of respondents of the CFO magazine survey report that after the passage of SOX they still feel pressure from their superiors to "make the numbers work".[58] Given the pressure from external auditor and public scrutiny following SOX, managers are probably more cautious in taking the low-cost approach of accrual-based earnings management and use more real activities to manage earnings. In their sensitivity tests, Cohen et al (2007) construct a sample of suspect firms whose earnings meet the target by a small number. Based on the findings

[58] "It is better (and worse) than you think", *CFO Magazine*, September 01, 2003, available at http://www.cfo.com/article.cfm/3013527?f=related

that the level of accrual-based earnings management of those suspect firms declined but the level of real earnings management increased significantly after SOX, they claim that there is a shift from accrual-based to real earnings management following SOX.

I use performance-adjusted discretionary accruals (*DACC*) estimated from the modified Jones model (Dechow et al 1995) and abnormal R&D spending (*ab_RD*) estimated from Berger (1993) model as the measures of accrual-based and real activity earnings management. My sample requires both annual and quarterly data available and covers 1989-2005. The final sample contains 16,328 firm-year and 64,981 firm-quarter observations. I classify the sample firms into three cases to capture the effect of the income objective. Two-stage least square (2SLS) regressions are used because I assume discretionary accruals and abnormal R&D spending are two mutually dependent decisions.

I document that the discretionary accruals are used symmetrically around the positive and negative pre-managed earnings while abnormal R&D spending is asymmetrically distributed. *DACC* is significantly positive in the case of negative pre-managed earnings and significantly negative in the case of positive pre-managed earnings, consistent with managers manage earnings through *DACC* in order to meet the earnings target. For *ab_RD*, only the univariate tests suggest that *ab_RD* is significantly negative when pre-managed earnings are negative or barely above the border line, consistent with the earning management hypothesis. When the pre-managed earnings are positive, *ab_RD* is not significantly positive, indicating that managers do not irrationally over-invest in R&D even when they have higher earnings.

The results from 2SLS regressions consistently suggest that the level of abnormal R&D spending does not influence the decision of discretionary accruals, while the latter always influence the decision of abnormal R&D spending in a substitutive way. The quarterly regression with lags of *DACC* and *ab_RD* further confirm that the lagged *DACC* has an impact on the *ab_RD* decision. These findings seem to suggest that if *DACC* and *ab_RD* are not determined simultaneously *DACC* is likely to precede *ab_RD*, contrary to the argument by Zang (2005).

Neither the univariate tests nor the regressions regarding SOX support the notion that after the passage of SOX managers tend to switch to real earnings management.

Although the univariate tests provide some evidence that the level of *DACC* declined after SOX, I do not find evidence that earnings management through ab_RD increases following SOX.

The rest of this paper is organized as following: Section 2 reviews the related literature; Section 3 describes the research method including measurement of variables and empirical models; Section 4 explains the data and sample; Section 5 presents the empirical findings; Section 6 discusses extensive work subsequent to current study; and Section 7 concludes.

II Literature Review

2.1. Reporting Incentives

Managers' reporting incentives commonly used in prior studies include: a) avoid reporting losses; b) avoid reporting decreasing income; c) meet/beat analyst forecasts. A widely cited study, Degeorge, Patel & Zeckhauser (1999), identified all three thresholds as listed above and found that managers manage earnings upwards when they are close to the thresholds and either increase or decrease earnings when they are far from the thresholds so that it is easier in the future to meet the thresholds.[59] They also explore the hierarchy of the three thresholds. According to their model, managers are most concerned with the first threshold, i.e., reporting positive earnings; then they try to meet the earnings of last year (or same quarter of last year); lastly they aim to meet/beat analyst forecasts. The income objective of reporting positive earnings has been largely used in prior empirical studies. Burgstahler & Dichev (1997) examined the cross-sectional distributions of earnings and find evidence of unproportionally high frequency of firms with small positive earnings, consistent with managers managing earnings to avoid reporting earnings losses. DeFond and Park (1997) rely primarily on gains or losses for evidence of income smoothing where managers 'borrow' from ('save' for) the future if current performance is below (above) the earnings threshold of zero.

On the other hand, Graham, Harvey & Rajgopal (2005) who run a survey with over 400 executives report that the two most important earnings benchmarks for the managers are quarterly earnings of the same quarter of last year and analyst forecast.

[59] The sample of Degeorge et al (1999) covers quarterly data of 1974 – 1996.

Brown & Caylor (2005) conduct a temporal analysis and find that earlier, 1985 – 1993, managers focus more on quarterly gains or losses, but later, 1996 – 2002, become more concerned with meeting/beating analysts' forecasts. Since my sample covers the full time period, it is legitimate to use zero as a consistent earnings target throughout the whole sample period.

There are a few additional problems of using analysts' forecast as the earnings benchmark in the setting of this study. Firstly, it is not clear whether annual forecasts or quarterly forecasts are the benchmarks managers care more about. Prior works which study or use analysts' forecasts as the income objective are not consistent. While many studies use quarterly forecasts (e.g., Bartov et al 2002, Matsumoto 2002, Barua et al 2006, and Brown and Caylor 2005), some studies use annual forecasts (e.g., Dechow, Richardson, and Tuna 2003, and Burgstahler and Eames 2006). When we examine the accrual and/or real earnings management, annual rather than quarterly forecasts should be the benchmark if forecasts are the target managers are shooting for. Zang (2005) intended to use annual analyst forecast as the earnings target, however, she essentially uses the last quarter's forecast.[60] Since I am interested in earnings management relative to both annual and quarterly expectations, it is unclear how managers react to them and the reconciliation of annual and quarterly analysts' forecasts is beyond the scope of this study.

Further, forecasts are subject to managers' guidance (i.e., expectation management). Bartov et al (2002) discussed two ways of meeting/beating analysts' forecasts: manage earnings or manage expectations (analysts' forecasts), which implies that analysts' forecasts are not exogenous. Bartov and Cohen (2007) treat the expectation management as a third mechanism that managers use to achieve the earnings targets. In this study I am not interest in how managers manage earnings expectations. Instead, I assume the earnings targets are exogenous and then examine how managers, facing the given targets, manage earnings through accruals and real earnings management.

Therefore, I choose to use zero as the earnings threshold, that is, managers are motivated to report positive earnings.

2.2. Approaches of Earnings Management

[60] She uses the analysts' forecasts for annual earnings at the end of the third quarter when there is only one quarter (the fourth quarter) left for discretionary decisions.

Jiambalvo (1996) summarized two alternative approaches that managers could use to manage earnings: pure accounting decisions, and real productive activities. There is a large body of research using Jones model or later revised models to detect earnings management through pure accounting decisions. In contrast, management of real productive activities received relatively little attention. Here I briefly review some studies examining real earnings management, especially through cutting R&D spending.

Baber et al (1991) assume the income objectives that managers intend to achieve are reporting positive income and reporting increasing income. They group the sample firms into three cases: case (1) Current period income exceeds the income objective whether firms accept or reject all expected R&D opportunities; case (2) Accepting (rejecting) all expected R&D opportunities results in current period income less (greater) than the income objective; case (3) The anticipated current period income before R&D is less than the income objective. In contrast, for case (2), the R&D investment decision makes a difference in a firm's ability to report earnings that meet or beat the income objective. Therefore, if managers are motivated to meet/beat the income objective, one would expect lower R&D spending for case (2) than for case (1) or (3), and that is what Baber et al (1991) find, suggesting that firms manage earnings by cutting R&D. Kasznik (1999) also reports that R&D spending and advertising expenses for firms whose reported earnings are greater than management forecast are smaller than those whose reported earnings are less than management forecast, though only results with advertising expenses are significant. Roychowdhury (2006) examine earnings management through real productive activities, with a focus on operational activities. He finds evidence that managers aggressively reduce discretionary expenses (the sum of R&D spending, advertising, and SG&A expenses) to meet the income objective.[61]

One common problem with most studies along this line is that they focus on either accrual-based earnings management or real earnings management alone. Fields, Lys, and Vincent (2001) warned that examining only one accounting choice at a time cannot explain the overall effect of a portfolio of multiple choices. There are two studies examining both accrual-based earning management and real earnings management. Cohen, Dey, and Lys (2007) investigate both accrual-based and real earnings

[61] Same as the income objective I use in this study, Roychowdhury (2006) chooses to use reporting positive earnings as the income objecvtive.

management surrounding SOX. They found that the former declined after SOX while the latter increases, and thus claim that there is a shift from accrual-based earnings management to real earnings management after SOX. But they do not examine the two alternative methods as a joint decision. So their study shed little light on the relation between the two earnings management methods.

Zang (2005) explicitly brings together accrual-based and real earning management and directly studies the timing and relation between them. Based on Hausman tests. Zang (2005) decided that these two earnings management decisions are made sequentially (not simultaneously) with real earnings management preceding accrual-based management. One important limitation of her study involves the mismatch of earnings management measures and the income objective. The regression was run based on annual data but the income objective used (*ExAnteDistance*) is analysts' forecast at the end of third quarter which already includes the earning management in the first three quarters and leaves only one last quarter during which additional earnings management decisions can be made. I overcome (at least partially) this,problem by match my income objective with corresponding earnings management measures (that is, use annual income objective for annual measures and use quarterly income objective for quarterly measures). I also conduct analyses on a quarterly basis to see if the quarterly pattern suggests the same timing of the two earnings management decisions as Zang (2005) suggested.

2.3. SOX and Earnings Management

Since the enactment of SOX, many studies have examined its effects on the firm's quality of financial reporting. Those studies are largely focused on discretionary accruals, i.e., earnings management through pure accounting decisions. For example, Lai (2003) reports a significant reduction in unsigned discretionary accruals from pre-SOX period (one fiscal year dated before August 1, 2002) to the post-SOX period (one fiscal year dated on or after August 1, 2002). These empirical findings are consistent with the notion that the SOX has led to less volatile and more caution in accruals reporting. Lobo and Zhou (2006) choose to focus on the effect of the SOX on accounting conservatism, as proxied by the *signed* discretionary accruals. They document a significant decrease in discretionary accruals, implying that Section 302 of the SOX has led to increased conservatism in financial reporting.

As mentioned earlier, a recent study Cohen et al (2007) investigates both discretionary accruals and real productive activities surrounding SOX. They find a steady decline in artificial earnings management (i.e., earnings management through discretionary accruals, proxied by the *absolute value* of discretionary accruals, in the post-SOX (2002-2004) period. In contrast, they report that real activity management (proxied by abnormal production cost and abnormal discretionary expenses) has increased significantly after the passage of SOX. Cohen et al simply examine the overall distribution of discretionary accruals and measures of real activities. They fail to separate firms based on their different reporting incentives and they fail to control for the macro factors that could have driven the different distribution of accruals and real activities in the post-SOX period. Bartov and Cohen (2007) examine the three mechanisms used to meet/beat analyst' forecasts in the pre- and post- SOX periods. They find while there is a decline in the use of expectations management and accruals management, there seems to be no change in real earnings management. As a consequence, the propensity to meet/beat analysts' forecasts has declined in the post-SOX period.

In the setting of this study, the earnings targets are fixed for the managers. I hypothesize that in the post-SOX period managers, still facing an incentive to meet or beat the earnings target, use more real earnings management as a substitute for accruals management which is easier to detect. This is consistent with Graham et al (2005) survey where the interviewed executives admit that to meet the earnings benchmarks they rather undertake real activities than through within-GAAP adjustments (such as accruals), perhaps due to the fear of lawsuits after the publicized frauds and stricter scrutiny from external auditors and other governance mechanisms.

III Research Method

3.1. Measurement of Variables

Discretionary Accruals (DACC)

I estimate normal total accruals based on the Jones and the Modified Jones model for both annual and quarterly data. The discretionary accruals are the residuals from the corresponding estimation models. I then adjust performance by subtracting the median of firms in the same industry-ROA portfolio. Appendix A describes the details of estimating discretionary accruals and performance adjustment. I denote unadjusted discretionary accruals from the Jones and the Modified Jones model as *DA_ann* and *DAMJ_ann*; the performance-adjusted discretionary accruals are denoted as *DAadj_ann* and *DAMJadj_ann*. Similarly, the corresponding quarterly estimated discretionary accruals are denoted as *DA_qtr*, *DAMJ_qtr*, *DAadj_qtr*, and *DAMJadj_qtr*.

As a validity check, I compare the discretionary accruals based on annual estimations (*DACC_ann*) and on quarterly estimations (*DACC_qtr*). Panel A of Appendix C reports the mean/median of annual *DACC* and quarterly *DACC* and the right half compares the difference of mean/median between annual *DACC* and the sum of quarterly *DACC*. Empirically, there is little difference between the Jones and modified Jones models. Unadjusted *DACC* has a similar magnitude of mean and median, regardless of whether they are estimated from the Jones or modified Jones model (i.e., *DA* and *DAMJ*). Similarly, there is little difference in the adjusted *DACC* based on the Jones or modified Jones models (i.e., *DAadj* and *DAMJadj*). The magnitude of adjusted *DACC* is considerably smaller than that of unadjusted *DACC*, since the former is after the adjustment of the median of industry-ROA portfolio. The t-test on the mean difference and Wilcoxon test on the median difference show that the annual and quarterly estimated adjusted *DACC* converge better than unadjusted *DACC*. The difference between annual adjusted *DACC* and sum of quarterly adjusted *DACC* is smaller than the difference of unadjusted *DACC*. In fact, the mean of *DAadj_ann* is not significantly different from the mean of sum of *DAadj_qtr*. The median of the difference between *DAMJadj_ann* and sum of *DAMJadj_qtr* is also much smaller than the unadjusted *DACC*, although still statistically significant.

Further Panel B of Appendix C shows the correlation between annually estimated *DACC* and the sum of quarterly estimated *DACC*. Again the adjusted DACC (*DAadj* and *DAMJadj*) shows a higher correlation than unadjusted *DACC* (*DA* and *DAMJ*), suggesting better convergence of annual and quarterly estimations. In short, the comparison of all alternative measures of *DACC* suggests that adjusted *DACC* outperforms unadjusted *DACC*, consistent with prior work supporting performance adjustment (e.g., Dechow et al. 2003, Kothari, Leone & Wasley 2005). As long as adjusted by performance, estimation from the Jones or modified Jones model does not seem to matter. In the empirical tests, I use performance-adjusted *DACC* estimated from the more-widely used modified Jones model (i.e., *DAMJadj*) as the measure of discretionary accruals.

Abnormal R&D Spending (ab_RD)

A simple way of estimating R&D spending is to assume that R&D spending follows a random walk and use last year's R&D expenses as the expectation of current year's R&D expenses (e.g., Baber et al 1991, and Kasznik 1999). Berger (1993) modifies the estimation by incorporating more firm-specific characteristics, such as resource constraint, investment in capital assets, and growth opportunities. I use this model in the annual setting, with a slight modification (on seasonality) in the quarterly setting, to estimate normal level of R&D spending.[62] The residuals from the estimation model are abnormal R&D spending, defined as *abRD_ann* and *abRD_qtr* respectively for annual and quarterly estimation.

Income Objectives and Three Cases of Pre-managed Earnings

As discussed earlier, the income objective I use is reporting a positive income. I define firms' pre-managed earnings (PME) as (earnings before tax + R&D spending - discretionary accruals).[63] Based on the level of pre-managed earnings relative to the earnings threshold, I classify firms into three cases, similar to Baber et al (1991):

a. Case 1: PME < 0, where even without any R&D spending in current period, managers will not be able to report positive earnings.
b. Case 2: 0 < PME < E(R&D), where without R&D spending firms meet the earnings target; but spending as much as expected will jeopardize meeting the earnings target.
c. Case 3: PME > E(R&D), where managers could spend as much as expected on R&D without missing the target.

Managers' incentive to manage earnings through discretionary accruals is symmetric. When the pre-managed earnings are below the threshold, income-increasing (i.e., positive)

[62] Part b) of Appendix B explains the details.
[63] I borrow the term of "pre-managed" earnings from the literature to define earnings before R&D spending and discretionary accruals.

discretionary accruals will be encouraged; while when the pre-managed earnings are above the threshold, one would expect to see more income-decreasing (i.e., negative) discretionary accruals to help meet the target in the future when the accruals reverse. Therefore I predict significantly positive (negative) discretionary accruals in Case 1 (Case 3), and a smaller positive discretionary accrual in Case 2 because substituting R&D is a viable alternative.

Predictions for abnormal R&D across earnings cases are not as straightforward as discretionary accruals. There are always two competing interpretations on abnormal R&D spending: an economic interpretation and a manipulation interpretation. The economic interpretation predicts that firms with poor performance cut R&D because of inadequate resources, while firms with good performance do not have to cut R&D. The manipulation interpretation predicts managers will cut R&D spending leading to negative abnormal R&D based on the managers' incentive to meet the earnings target when meeting the target is at risk. Both the economic and manipulation interpretations are asymmetric in that presumably firms would not choose to spend money on negative net present value research simply because earnings are positive, thus, negative abnormal R&D is logically more predictable than positive abnormal R&D. The latter should be a function of firms' unobservable private and idiosyncratic knowledge of new investment opportunities.[64]

In Case 1, the economic interpretation suggests cutting R&D because of inadequate resources. The manipulation interpretation also predicts that managers have an incentive to cut R&D aggressively to help to meet the earnings target, but they can do so only if they have room to augment this with positive discretionary accruals. In Case 2, the economic interpretation does not predict the sign of abnormal R&D but relatively speaking it should be less negative than in Case 1. However, under a manipulation perspective, managers in Case 2 face the greatest incentive to cut R&D because they would miss the earnings target if they invest in R&D at a normal level, and the R&D spending is sufficiently material that cutting it completely would allow the firm to meet

[64] Cases 1 and 2 likely have an unobservable idiosyncratic element as well corresponding to firms lacking good investment opportunities cutting R&D.

its earnings target.[65] In Case 3, the economic interpretation predicts non-negative abnormal R&D since it is more likely that there are sufficient resources to accept all profitable projects.[66] In contrast, the manipulation interpretation predicts zero abnormal R&D in Case 3. Managers do not need to cut R&D because spending normally on R&D will not jeopardize the firm meeting the target. On the other hand, managers do not want to overspend on R&D because doing so will not buy them slack for the future as negative discretionary accruals do.

On balance, the economic interpretation predicts the most negative abnormal R&D for Case 1, followed by Case 2 and non-negative abnormal R&D for Case 3. According to the manipulation interpretation, Case 2 provides managers the greatest incentive to cut R&D and thus has the most negative abnormal R&D then followed by Case 1 and Case 3. The abnormal R&D in Case 1 is expected to be less negative than Case 2 because managers' need to look to positive discretionary accruals first since cutting R&D alone is not sufficient. The abnormal R&D in Case 3 is predicted to be zero under the manipulation perspective because in the case of unequivocally positive earnings managers do not have an incentive to either increase or decrease abnormal R&D spending.

3.2. Empirical Models

There are two dependent variables under concern: discretionary accruals (*DACC*) and abnormal R&D (*ab_RD*), which are two mutually dependent decisions. Any analysis of these two should take into account the endogenous relation between them. With the presence of simultaneity, OLS estimators are biased and inconsistent. A two stage least squares (2SLS) model generates consistent estimators. However if there is no simultaneity problem 2SLS estimators are not efficient. So it is important to check if there is simultaneity before we decide to use 2SLS. Hausman test results in significant coefficients for the residuals, suggesting that there is a simultaneity problem. Accordingly, I employ 2SLS instead of OLS.

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[65] Materiality in this case is based on the ability to reach the earnings target. R&D can be material for a low spending R&D firm if it is very close to the target or a high spending R&D firm that is much farther from its target in absolute dollar terms.

[66] The economic interpretation in Case 3 does not clearly predict a positive abnormal R&D because good performance is not equivalent to availability of good investment opportunities.

To test the relation between *DACC* and *ab_RD*, the following structural equations for the two stage least squares regressions are run on both annual and quarterly basis:

$$DACC = \alpha_0 + \alpha_1 ab\_RD + \alpha_2 D_1 + \alpha_3 D_2 + \alpha_4 D_1 \times ab\_RD + \alpha_5 D_2 \times ab\_RD + \alpha_6 \lg TA + \alpha_7 \Delta NI + \alpha_8 MB + \alpha_9 CFO + \alpha_{10} Big4 \quad (1)$$

$$ab\_RD = \beta_0 + \beta_1 DACC + \beta_2 D_1 + \beta_3 D_2 + \beta_4 D_1 \times DACC + \beta_5 D_2 \times DACC + \beta_6 \lg TA + \beta_7 \Delta NI + \beta_8 GDP\_growth + \beta_9 MktRet \quad (2)$$

DACC is performance-adjusted discretionary accruals estimated from either annual or quarterly modified Jones model. *ab_RD* is abnormal R&D spending estimated from either annual or quarterly estimation model as discussed in Appendix B. D_1 and D_2 in both equations refer to the dummy variable for Cases 1 and 2, followed by the interaction between the cases and the alternative earnings management approach ($D_1 \times ab\_RD$ and $D_2 \times ab\_RD$; $D_1 \times DACC$ and $D_2 \times DACC$). The control variables used in equation (1) include log of total assets (*lgTA*); change in earnings before R&D and discretionary accruals (ΔNI); market-to-book ratio (*MB*); cash flow from operating adjusted by R&D and working capital investment (*CFO*); and an indicator variable for large auditors (*Big4*).[67] The control variables *MB* and *CFO* were already included in the estimation model of normal R&D spending and thus are excluded from equation (2). Extraordinary R&D spending might be caused by macro economy factors which were not considered in the estimation model of normal R&D spending. I include the U.S. GDP growth (*GDP_growth*) and market return of US stock exchanges (*MktRet*) to control for the economic factors that legitimately influence firms' R&D spending.

Zang's (2005) method of running annual models cannot examine directly the timing issue of discretionary accruals and abnormal R&D decisions. An ideal approach is to observe, given the annual earnings target, how the annual discretionary accruals (or abnormal R&D) influence the abnormal R&D (or discretionary accruals) in the four individual quarters which sum up to the annual abnormal R&D (or discretionary accruals). That is, regress annual discretionary accruals (DACC) or annual abnormal R&D (ab_RD) on four quarters abnormal R&D or four quarters of *DACC*. If as Zang (2005) claimed *DACC* and *ab_RD* are substitutes and *ab_RD* precedes *DACC*, one would expect to see a

[67] Data for auditor identity is only available in annual file of Compustat (Data149). So the control variable Big4 is only used in the annual model not the quarterly model.

significantly positive coefficient for *ab_RD*, at least for the early quarters, in the regression of *DACC* and insignificant coefficient for *DACC* in the regression of *ab_RD* since she claimed *ab_RD* is determined prior to *DACC*.

However, the approach discussed above is not empirically feasible because we cannot break down the annual *DACC* (or *ab_RD*) perfectly in quarters. The quarterly *DACC* (or *ab_RD*) I computed are based on quarterly, not annual, expectations and estimations and therefore they do not sum up to the annual *DACC* (or *ab_RD*). The best I can do is to use quarterly *DACC* (or *ab_RD*) on the left hand side under the assumption that quarterly *DACC* (or *ab_RD*) is an appropriate proxy for annual *DACC* (or *ab_RD*). In other words, I include the contemporary *ab_RD* (*DACC*) and lagged *ab_RD* and *DACC* in the regression of quarterly *DACC* (*ab_RD*).[68] To keep the model concise, I use one dummy variable *D* for the combined Cases 1 and 2. The following structural equations are employed to check the timing of earnings management through accrual-based and R&D spending in the quarterly pattern:

$$\begin{aligned} DACC = {} & \alpha_0 + \alpha_1 D + \alpha_2 ab\_RD + \alpha_3 D \times ab\_RD + \alpha_4 lag(ab\_RD) + \alpha_5 D \times lag(ab\_RD) \\ & + \alpha_6 lag2(ab\_RD) + \alpha_7 D \times lag2(ab\_RD) + \alpha_8 lag3(ab\_RD) + \alpha_9 D \times lag3(ab\_RD) \\ & + \alpha_{10} lag(DACC) + \alpha_{11} D \times lag(DACC) + \alpha_{12} lag2(DACC) + \alpha_{13} D \times lag2(DACC) \\ & + \alpha_{14} lag3(DACC) + \alpha_{15} D \times lag3(DACC) + \alpha_{16} \lg TA + \alpha_{17} \Delta NI + \alpha_{18} MB + \alpha_{19} CFO \end{aligned} \quad \textbf{(3)}$$

$$\begin{aligned} ab\_RD = {} & \alpha_0 + \alpha_1 D + \alpha_2 DACC + \alpha_3 D \times DACC + \alpha_4 lag(ab\_RD) + \alpha_5 D \times lag(ab\_RD) \\ & + \alpha_6 lag2(ab\_RD) + \alpha_7 D \times lag2(ab\_RD) + \alpha_8 lag3(ab\_RD) + \alpha_9 D \times lag3(ab\_RD) \\ & + \alpha_{10} lag(DACC) + \alpha_{11} D \times lag(DACC) + \alpha_{12} lag2(DACC) + \alpha_{13} D \times lag2(DACC) \\ & + \alpha_{14} lag3(DACC) + \alpha_{15} D \times lag3(DACC) + \alpha_{16} \lg TA + \alpha_{17} \Delta NI + \alpha_{18} GDP\_growth + \alpha_{19} MktRet \end{aligned} \quad \textbf{(4)}$$

The above equations are first run by defining the fourth quarter as current quarter and thus keep the tests within a fiscal year window to minimize the linkage of annual *ab_RD* and *DACC*. Then they are also run with all quarters pooled to see if previous quarterly abnormal R&D spending have impact on current quarter *DACC* or vise versa.

[68] The lags of dependent variables are also included in the regression because untabulated autocorrelations show that current *DACC* (*ab_RD*) are significantly related to previous *DACC* (*ab_RD*). Absent the lags of the dependent variable will cause a problem of omitted correlated variables.

IV Data and Sample

The variables used in estimating the normal level of accruals and R&D spending are from the Compustat Annual or Quarterly file. Annual market returns are computed based on the monthly return data from CRSP. GDP growth rates are obtained from the statistics provided by Bureau of Economics Analysis, US Department of Commerce.[69]

The sample period covers 1989 – 2005. It started from 1989 because data for cash flow which I need to calculate accruals are not available until1988 and I need one-year lag measures. For the analysis regarding the change after SOX, I define 1989 – 2000 as the pre-SOX period and 2004-2005 as post-SOX period. Since SOX was enacted in July of 2002, I rule out the event year of 2002. Year 2001 is excluded from pre-SOX period because many accounting scandals and auditing failures came to light in 2001 which may result in unusual accruals and/or R&D spending. Year 2003 is excluded from post-SOX period to allow full adoption of SOX rules and to avoid using event year 2002 data as the lagged measures.

Firms in financial industries (SIC code between 6000 and 6999) and regulated industries (SIC between 4500 and 5000) are eliminated from the sample. I restricted my sample to firms with (1) available data to estimate annual and quarterly normal level of accruals and R&D spending; (2) at least 15 firms in each Fama-French (1997) industry; (3) R&D expenses no less than 1% of sales; (4) all four fiscal quarters data and estimations of discretionary accruals and abnormal R&D available. Further, to ensure the annual and quarterly analyses are based on the same sample of firms, I require both annual and quarterly data available. The final sample contains 16,328 firm-year observations for annual analyses and 64,981 firm-quarter observations for quarterly analyses.[70]

V Empirical Tests and Results

5.1. Descriptive Statistics

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[69] Available at http://www.bea.gov/national/index.htm#gdp.

[70] The number of observations for quarterly analysis is a little less than 65,312 (= 16,328 x 4) because when I classify the sample firm-quarters to the three cases based on quarterly pre-managed earnings I lose 331 observations.

Table 1 reports the descriptive statistics of discretionary accruals and abnormal R&D spending, along with earnings, R&D expenses, and control variables used in the regressions. It starts with the distribution of the overall annual sample, followed by the distributions for each of the three earnings contingent cases.

[Insert Table 1 about here]

While the overall sample performance-adjusted discretionary accruals (DACC) are close to zero (mean and median are respectively -0.004 and 0.000), it varies significantly across cases (see Table 2 for the statistical comparison between cases). *DACC* has big positive mean and median in Case 1, comparable but negative mean/median in Case 3, and is close to zero in Case 2. This symmetric distribution of *DACC* based on negative and positive pre-managed earnings suggests that partitioning the sample based on the level of pre-managed earnings is very important because otherwise we will simply observe zero *DACC* after the positive *DACC* in Case 1 offsets the negative *DACC* in Case 3. The overall abnormal R&D spending are on average negative (mean/median is -0.004 based on the overall sample) with variation across cases which will be discussed in more detail in Section 5.2. The raw R&D spending reveals the effect of financial performance. Given the lowest earnings (*EBT*) and cash flow (*CFO*) in Case 1, it is not surprising to see substantially lower R&D expenses in Case 1 than the other two cases. The statistics for total assets and log of total assets indicate that firms in Case 1 are the smallest and firms in Case 3 tend to be large firms. The higher market-to-book ratio for Case 1 may be attributable to the smaller firms in this case than in other two cases. The variation across cases suggests again the necessity of grouping firms into cases.

5.2. Univariate Tests

In the univariate tests, I partition the sample into three cases based on the level of pre-managed earnings relative to the earnings target, and compare the discretionary accruals (DACC) and abnormal R&D spending (ab_RD) among the cases. This analysis focuses on the first objective of this study – to see how managers manage earnings through *DACC* and/or *ab_RD* as independent approaches to meet an earnings target. Panel A of Table 2 (for annual sample) and Table 3 (for quarterly sample) report the mean, median, and percentage of positive *DACC* and *ab_RD*. The t-tests (nonparametric Wilcoxon test) on the mean (median) difference between the cases are also provided. Panel B of these two tables gives the Pearson and Spearman correlation coefficients of *DACC* and *ab_RD*. Although analyses based on the annual and quarterly sample are reported in separate tables, the results are qualitatively the same. To keep my discussion efficient, I combine my discussion of the corresponding results in Tables 2 and 3.

[Insert Tables 2 and 3 about here]

First focus on the discretionary accruals which is reported in column one of Panel A of Table 2 (annual sample) and column one of Panel A of Table 3 (quarterly sample). Since both samples reveal the same pattern, I focus on the annual sample (Table 2). In Case 1 where the pre-managed earnings are below zero, the mean (0.039) and median (0.040) of *DACC* are significantly positive ($p<.0001$). In Case 2, the border-line case, the median of *DACC* is slightly positive (0.006) and the mean is not significant. In Case 3 where the pre-managed earnings are unequivocally positive, the mean (-0.041) and median (-0.022) of *DACC* are significantly negative. The t-tests and Wilcoxon tests across cases indicate that the mean/median of *DACC* in Case 1 is significantly more positive than that in both Cases 2 and 3, and firms in Case 3 report the most negative mean/median of *DACC* which are significantly lower than those in the other two cases. Further, the percentage of positive *DACC* (64%) in Case 1 is the highest among all three cases while only one third of the firms in Case 3 have reported positive *DACC*. The quarterly sample of *DACC* (reported in Panel A of Table 3) displays the same pattern and similar significance levels.

Taking together, the findings about *DACC* from univariate tests suggests that discretionary accruals generally behave as expected when partitioning the sample to different cases based on their pre-managed earnings relative to the earnings threshold. The significant positive *DACC* in Case 1 and comparable in magnitude but negative *DACC* in Case 3 are consistent with managers manipulating earnings through discretionary accruals in a symmetric way: reporting more income-increasing discretionary accruals when pre-managed earnings are below the earnings target and reporting more income-decreasing discretionary accruals when pre-managed earnings are above the target.

The abnormal R&D spending based on annual and quarterly samples are reported in the last column of Panel A of Tables 2 and 3, respectively. *ab_RD* is not symmetrically distributed around positive and negative per-managed earnings as is *DACC*. *Ab_RD* is significantly negative in both Cases 1 and 2, and in both cases significantly smaller (effectively negative) than case 3, but there is no significant difference between Cases 1 and 2. In Case 1, we cannot distinguish the economic and manipulation interpretation since the significant negative *ab_RD* observed in annual and quarterly samples is consistent with the predictions from both interpretations. In Case 3, the mean of annual abnormal R&D (0.004) is insignificantly different from zero, consistent with both economic and manipulation interpretations. While the positive mean of quarterly *ab_RD* seems to lend support to the economic interpretation, the median of annual and quarterly *ab_RD* are significantly negative, contrary to the economic interpretation. For Case 2, the economic interpretation predicts abnormal R&D that is less negative than Case 1, but the manipulation interpretation predicts more cutting in R&D than Case 1 because of greater incentive to do so. The fact that Case 1 and Case 2 are both negative and insignificantly different from each other seems to suggest that both the economic and manipulation interpretations apply. In short, the univariate tests indicate that firms with poor performance (i.e., in Cases 1 and to a lesser degree Case 2) cut their R&D spending aggressively for either economic reasons or manipulation purposes, but firms with good performance (i.e., in Case 3) do not overspend on R&D investment. Since it is not practically possible to distinguish the economic from the manipulation interpretation on cutting R&D, the univariate evidence of managers manipulating earnings through cutting R&D is less clear than them doing so through discretionary accruals.

5.3. Multivariate Tests – Analysis on Equations (1) and (2)

As discussed in Section 3.2, I run two stage least square (2SLS) regressions of *DACC* (or *ab_RD*) on dummy variables for the earnings' cases (D_1 and D_2), *ab_RD* (or *DACC*), and the interaction of D_1 and D_2 with *ab_RD* (or *DACC*), along with appropriate control variables for each regression. Table 4 and Table 5 report the results of 2SLS regressions based on the annual and quarterly sample, respectively. In both tables, Case 3 with unequivocally positive earnings is the base case and with the coefficient for the intercept and the coefficient for *ab_RD* (or *DACC*) corresponding directly to the positive earnings case. To get the intercept for cases 1 and 2, sum the intercept and the coefficient on the case dummy. For the influence of *ab_RD* (or *DACC*) for cases 1 and 2 sum the slope of *ab_RD* (or *DACC*) and the appropriate interaction coefficient. F-tests provided below the regression results provide the respective significance levels for Cases 1 and 2.

My discussion below combines inferences from the annual and quarterly tests presented in Tables 4 and 5, respectively. I focus first on the regression of *DACC* then turn to the regression of *ab_RD*. The first column of Tables 4 and 5 shows the regression results when annual and quarterly *DACC* is the dependent variable. Since the regression results based on the annual and quarterly sample are similar, I focus on annual *DACC* (Table 4). The intercept for Case 3 is negative (-0.015) and marginally significant (p=0.103); insignificant for Case 2 (see the F-test on *Intercept + D2*); and significantly positive for Case 1 (0.045, p<.0001, F-test on *Intercept + D1*). Consistent with the univariate results firms with the most negative earnings (Case 1) having the greatest incentive to report aggressively income-increasing accruals, and this incentive declines with the increase in earnings performance.

The influence on *DACC* of *ab_RD* is provided by the coefficients on *ab_RD* (for Case 3), *ab_Rd + D2*ab_RD* (for Case 2), and *ab_RD + D1*ab_RD* (for Case 1). All three coefficients are positive, but are insignificant for Cases 1 and 2 and only marginally significant for Case 3. As discussed in Section 3.1, the manipulation interpretation predicts zero *ab_RD* in Case 3 but a stronger incentive to manipulate through abnormal R&D in Cases 1 and 2. If discretionary accruals and abnormal R&D are alternative tools to manage earnings in these cases, then one would expect to see a relationship between them. The insignificant coefficients on *ab_RD* for Cases 1 and 2, however, suggest that manipulation through discretionary accruals does not depend on the level of abnormal R&D. The results from the regression of quarterly DACC (column one of Table 5) are generally similar to Table 4. The significantly negative intercept (-0.026) for Case 3 is consistent with the univariate results that managers report more income-decreasing accruals when the current earnings target is met; thereby, saving for the future. The significantly positive intercept (F-test of *Intercept + D1* = 0.012) for Case 1 indicates that firms report more income-increasing accruals when pre-managed earnings cannot meet the earnings target. In the quarterly case, I again do not find any significant coefficient for *ab_RD* across the three cases. The abnormal R&D decision does not appear to affect *DACC*.

Turning next to the regression of abnormal R&D (*ab_RD*) based on the annual sample (column two of Table 4). The intercept for Case 3 is insignificant, consistent with both the economic and the manipulation interpretations. It suggests that managers do not over-invest in R&D just because they have sufficient resources. The F-tests on the intercept for Case 1 and Case 2 are both significantly negative, suggesting that managers do cut R&D, whether for economic reasons or for manipulation purposes. The more negative coefficient for Case 1 than for Case 2 favors the economic interpretation.

With respect to the influence of *DACC* on *ab_RD*, the loading on *DACC* for Case 1 is given by the F-test on *DACC + D1*DACC*; for Case 2 is *DACC + D2&DACC*; and for Case 3 is simply the coefficient of *DACC*. I find the coefficient on *DACC* is significantly positive for all three cases. This can be interpreted as both *DACC* and *ab_RD* being used as substitutive earnings management tools. Within each case, for firms with higher levels of *DACC*, *ab_RD* tends to be greater or less negative, perhaps because firms are left with more leeway to spend on R&D without missing the earnings target.

In the regression of quarterly *ab_RD* (second column of Table 5) the intercepts for the three cases still show monotonic increases from Case 1 to Case 3, although we do not observe a significant cut in R&D for Case 1 as in the annual regression. The F-test of the *Intercept + D2* has a significantly positive coefficient, whereas the manipulation interpretation predicts that Case 2 is the case where managers have the greatest incentive to cut R&D (i.e., negative *ab_RD*). The lack of a negative intercept in case 2 favors the economic interpretation over the manipulation interpretation. As in the annual regression, the coefficient for *DACC* is significantly positive in each case, consistent with *DACC* influencing *ab_RD* as a substitute with respect to earnings management.

Collectively, the regression results suggest that all else equal firms in Case 1 report significantly positive discretionary accruals while firms in Case 3 report significantly negative discretionary accruals, consistent with *DACC* being used symmetrically around the positive and negative earnings relative to the earnings target. There seems to be an asymmetry in the main effect of the earnings classification on *ab_RD* as represented by the intercept and the dummies. The annual regression (also the quarterly regression) of abnormal R&D suggests that Case 1 firms report the most negative *ab_RD*, followed by Case 2 firms, while firms in Case 3 simply report normal R&D spending (that is, zero abnormal R&D). The quarterly regression of abnormal R&D agrees with the annual regression with respect to the order of the three cases, Case 1 is most negative (least positive) while Case 3 is most positive (least negative) but there is not significantly negative abnormal R&D for the poor performance cases (Cases 1 and 2), contrary to both interpretations.

Both annual and quarterly regressions of *DACC* on *ab_RD* suggest that *ab_RD* has no influence on *DACC*. In contrast, *DACC* has a consistently positive and significant influence on *ab_RD*. The regression of *ab_RD* features positive coefficients for *DACC* indicating a substitutive effect of *DACC* on the level of *ab_RD*. This is consistent with Zang (2005) who argues *DACC* and *ab_RD* are substitutes. However, my findings of significant coefficients on *DACC* in the regression of *ab_RD* but not the reverse, contradict Zang's (2005) contention that the R&D spending decision precedes the decision to make more or less discretionary accruals. It appears that the level of discretionary accruals has an influence on R&D spending but the level of abnormal R&D does not affect discretionary accruals. I provide more evidence on the timing and mutual influence issues in the quarterly regressions presented below.

5.4. Multivariate Tests – Analysis on Equations (3) and (4)

I introduce the lags of *ab_RD* and *DACC* to the quarterly regression (see Equations (3) and (4)) to see if the quarterly pattern sheds light on the timing of *ab_RD* and *DACC* decisions relative to each other. If one precedes the other, in regressions of one on the other, we expect to see the lag(s) of the independent variable having significant coefficients. As discussed in Section 3.2, we examine the timing issue in a window of one fiscal year. So in Panel A of Table 6 I set the current quarter to be the fourth fiscal quarter and thus ensure that all of the three lagged quarters are in the same fiscal year as the current quarter. The regression results of all of the pooled quarters, where the lagged and contemporary measures may be in different fiscal years, are also provided (in Panel B of Table 6). The results for the fourth quarter (Panel A) and all quarters (Panel B) are similar. I focus first on the regression of *DACC* and then the regression of *ab_RD* with reference to both panels.

In the regression of *DACC*, the intercepts (significantly negative in both panels) and F-test on *Intercept* + *D* (significantly positive in Panel B but insignificant in Panel A) indicate that managers report negative discretionary accruals in the case of good performance (Case 3) and are more likely to report positive discretionary accruals when meeting the current earnings target is at risk (Cases 1 and 2).[71]

With respect to the influence on *DACC* of contemporary and lagged *ab_R*, consistent with Table 5, contemporary *ab_RD* has an insignificant coefficient in all cases (Cases 1 and 2 given by the F-test on *ab_RD* + *D**ab_RD*). Further, none of the first to third lags of *ab_RD* have significant coefficients irrespective of the cases across both Panels A and B. These results indicate that there is no influence on *DACC* from either contemporary or lagged *ab_RD*, and accordingly, the decision to alter R&D spending does not precede the decision to use discretionary accruals with respect to income manipulation.

Finally, I examine whether *ab_RD* is influenced by *DACC* in quarters prior to the current quarter. The coefficient of contemporary *DACC* continues to be significantly positive for both Case 3 and the *combined* Cases 1 and 2, consistent with Table 5. Most importantly, with respect to the timing issue, while the coefficients for lagged *DACC* are not significant for Case 3, the first two lags are significantly positive in the *combined* Cases 1 and 2. This means that the *DACC* in the two prior quarters has the same substitutive influence on *ab_RD* as does contemporary *DACC*,[72] and that firms appear to begin adjusting their accruals in advance to substitute for anticipated changes in their R&D spending when pre-managed earnings are negative. As discussed earlier negative pre-managed earnings is the case when adjusting R&D spending is most viable as an earnings management tool because the firm can't store excessive R&D spending for the future.

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[71] The earlier results from Table 5 without the lags indicate that Case 1 has the predicted strong positive discretionary accruals. Combining Cases 1 and 2 to allow a tractable investigation of the quarterly lags appears to conceal this result in Panel A, although it remains present in Panel B.
[72] While the third lag is negative, it is not sufficient to outweigh the first two lags, so that the net result remains positive.

Overall, the findings in this section confirm that neither contemporary nor previous R&D spending decisions affect discretionary accruals. In contrast, contemporary discretionary accrual decisions do influence abnormal R&D spending, and both contemporary and previous discretionary accruals influence abnormal R&D spending when pre-managed earnings are negative. These findings that discretionary accruals can precede and influence abnormal R&D spending run counter to the contention presented in Zang (2005).

*5.5.*Surrounding SOX - Univariate Tests

I re-run the univariate tests for the pre-SOX period (1989-2000) and the post-SOX period (2004-2005) separately to see if there is any change after the passage of SOX. Panel A (B) of Table 7 reports the mean/median of annual *DACC* and *ab_RD* in the pre- (post-) SOX period, and Panel C compares *DACC* and *ab_RD* in pre-SOX and post-SOX for each case. Panels D-F of Table 7 repeat Panels A-C based on a quarterly sample. The results based on the annual and quarterly samples are similar. My discussion below mainly focuses on the annual sample (i.e., Panels A-C) with reference to quarterly results when they are different. Within each period (Panels A and B of Table 7), we see a similar pattern of discretionary accruals and abnormal R&D across cases, consistent with what was reported in Panel A of Tables 2 and 3.

Examining the discretionary accruals first, for both time periods *DACC* is significantly positive in Case 1, small but significantly positive in Case 2, whereas significantly negative in Case 3. The tests of comparison among cases indicate that Case 1 is significantly more positive than the other two cases and Case 3 is significantly more negative than the other cases. This result suggests that the manipulation toward the earnings target through discretionary accruals still exits in the post-SOX period. Comparing the level of *DACC* in pre-SOX and post-SOX periods (Panel C of Table 7) reveals that DACC is less positive in the post-SOX period for Case 1 and it is less negative for Case 3. The differences, however, are not significant in the annual sample, but are significant in the quarterly sample approximately a 20 to 25% reduction in the use of discretionary accruals to increase income in Case 1 and approximately a 11 to 17% reduction in the use of discretionary accruals to decrease income in Case 3. Across the annual and quarterly tests there is, therefore, only limited evidence of a reduction in the use of discretionary accruals following SOX. This result suggests that facing incentives to manage earnings upward (Case 1) or downward (Case 3) firms remain likely to report income-increasing accruals for Case 1 and income-decreasing accruals for Case 3 in the post-SOX period, but they do so to a lesser degree, perhaps because of the stricter rules of financial reporting imposed by SOX. This finding is consistent with Cohen et al (2007) who find that the income-increasing accruals decline and the income-decreasing accruals increase subsequent to the SOX. It is also consistent with Bartov and Cohen (2007) who find a significant decline in accruals management subsequent to SOX. Both studies emphasize the relative decline; however, my findings indicate that manipulation through discretionary accruals while smaller still remain substantial.

Corresponding results from univariate tests for *ab_RD* are reported in the second column of Panel A-F of Table 7. The results based on annual (Panel A-C) and quarterly (Panel D-F) samples are quite similar. My discussion again combines the results from the annual and quarterly samples. Within each sample period (pre- and post- SOX periods), we observe significantly negative mean and median abnormal R&D for poor performance cases (Cases 1 and 2), consistent with both the economic and manipulation interpretations. The sign and significance level of mean/median for *ab_RD* in Case 3 are not stable. But it is clear that the level of abnormal R&D in Case 3 is significantly higher than *ab_RD* in both Cases 1 and 2 where *ab_RD* are not significantly different. More importantly, the comparison between the level of *ab_RD* in pre-SOX versus post-SOX period (Panels C and F of Table 7) reveals that *ab_RD* is less negative in most of the cases after SOX but the differences are not statistically significant except for the median of *ab_RD* in Case 3. This suggests that R&D spending is *not* used more extensively to manage earnings subsequent to SOX. The single significant difference of less negative abnormal R&D occurs in Case 3 where the manipulation interpretation should not apply since excessive R&D spending can not be stored. Overall, the findings documented here do not support the contention that earnings management through cutting R&D has increased subsequent to SOX. Although managers claim they tend to resort to real earnings management under the pressure of the SOX as surveyed by Graham et al (2005), my evidence indicates that they do not do so through R&D spending adjustments.[73] This finding is also contrary to Cohen et al (2007) who claim that while accruals management has declined real earnings management has increased following SOX including through R&D spending.

In short, the univariate tests regarding the effects of SOX on accrual and real earnings management provide evidence that managers manage earnings through accruals less aggressively in the post-SOX period compared to the pre-SOX period, but I do not find evidence that earnings management through cutting R&D has increased after SOX, and thus do not support the notion that managers switched from accrual-based manipulation to real earnings management (cutting R&D investment) after SOX. My results are more consistent with Bartov and Cohen (2007) who argue that there has been a significant decline in accruals management, but real earnings management has not changed in the post-SOX period.

5.6. Surrounding SOX - Multivariate Tests

In this section, I rerun the annual and quarterly 2SLS regression of *DACC* and *ab_RD* by introducing a dummy variable *SOX* (=1, if in post-SOX period) to see if there is any change after SOX. To keep the model concise, I again combine Cases 1 and 2 by using one dummy variable *D*. Table 8 presents the regressions results followed by F-tests on the coefficients in the post-SOX period and the difference across periods (i.e., post-SOX minus pre-SOX), based on annual (Panel A) and quarterly (Panel B) samples. The results for annual and quarterly regressions are similar. I discuss them together with focusing first on the regression of *DACC* then *ab_RD*.

In the annual regression of *DACC*, the coefficient on *SOX* and *D*SOX* are both insignificant indicating no difference in the tendency of firms to make either positive or negative discretionary accruals in the pre-versus post-SOX periods. In the quarterly regression of *DACC*, the coefficient on *SOX* is insignificant indicating no difference, but the coefficient on *D*SOX* is marginally negative indicating a mild decline in positive discretionary accruals when pre-managed earnings are negative. Again, for both annual and quarterly samples there is no influence of *ab_RD* on *DACC* in either the pre-SOX period (see T-Stat on b_4 and F-test 4) or the post-SOX period (see F-tests 5 and 6).

[73] They may use spending in other areas, such as selling or advertising.

In the annual regression of *ab_RD*, the coefficient on *SOX* and *D*SOX* are both insignificant indicating no difference in the tendency of firms to change abnormal R&D spending patterns in the pre-versus post-SOX periods. In the quarterly regression of *ab_RD*, the coefficient on *SOX* is insignificant indicating no difference, but the coefficient on *D*SOX* is marginally positive indicating mildly less negative abnormal R&D spending when pre-managed earnings are negative; however, there is generally less abnormally negative R&D spending in the quarterly case. Again, for both annual and quarterly samples there is a significant substitutive influence of *DACC* on *ab_RD* in both the pre-SOX period (see T-Stat on b_4 and F-test 4) and the post-SOX period (see F-tests 5 and 6).

Collectively, the regression results documented in this section suggest that SOX had little influence on either discretionary accruals or on abnormal R&D spending, nor does it appear to have a significant influence on the substitution relationship evident from the previous analysis. The univariate analysis; however, did indicate a decline in the use of discretionary accruals to manage earnings in the quarterly, but not the annual sample. However, I do not find evidence that real earnings management through cutting R&D has increased following SOX, nor do I find a greater substitution of real earnings management through cutting R&D for discretionary accruals. The interaction between discretionary accruals and abnormal R&D has not changed in the post-SOX period. That is, while the level of abnormal R&D does not affect the decision on discretionary accruals, the level of discretionary accruals seems to influence the R&D decision as a substitute, again contrary to Zang's (2005) argument that *ab_RD* precedes *DACC*.

VI Conclusion

There is a vast body of literature on earnings management. Most earlier works focus on accrual-based earnings management, with more and more attention to the other type of earnings management through real activities such as cutting R&D spending, advertising expenses, overproduction, etc. However, most extant studies examine only one aspect and assume the other is exogenous. My study is inspired by Field et al (2001) who remind researchers in this area that examining only one accounting choice at a time may "obscure the overall effect of" the multiple accounting choices. I examine discretionary accruals and abnormal R&D spending at the same time under the assumption that managers have discretion on both and try to discern whether they use these two separately or together in order to meet the earnings target.

In particular, I provide responses to four research questions. The first question examines discretionary accruals and abnormal R&D separately in different contingent earnings cases. The results suggest that accruals are managed symmetrically: more positive discretionary accruals when pre-managed earnings are below the earnings target and more negative discretionary accruals when pre-managed earnings are above the target. In contrast, my results are supportive of annually, but not quarterly, measured abnormal R&D being asymmetrically distributed with significantly negative abnormal R&D associated with negative pre-managed earnings, but positive pre-managed earnings not giving rise to consistently positive abnormal R&D spending. I find comparable significantly negative abnormal R&D both for firms with negative pre-managed earnings for which R&D spending cuts alone are clearly insufficient to achieve the earnings target and for cases in which cutting R&D spending can have a more material impact on the earnings shortfall. This result is consistent with a manipulation perspective, especially for the group of firms for which R& D spending is more material; however, I cannot rule out an economic interpretation since firms with poor performance may significantly cut R&D for either funding reasons or lack of economic opportunity.

The second and third related research questions are whether the relation between discretionary accruals and abnormal R&D is substitutive or complementary, and if so, what is the direction of the influence and is there a relative timing difference of the decisions. The results suggest that there is a substitutive relationship between these two, consistent with Zang (2005). However, unlike Zang (2005), I find that the discretionary accrual decision influences the R&D spending decision, but that the reverse does not hold. Further, examining the quarterly pattern of both abnormal R&D spending and discretionary accruals indicates that the discretionary accrual decisions influence both contemporaneous and subsequent abnormal R&D spending as a substitute.

The fourth and last research question is about the effect of SOX on the levels of discretionary accruals and abnormal R&D spending and on the relation between these two. I find some support in univariate tests, but not multivariate tests, that SOX diminishes, but does not eliminate, the use of discretionary accruals in earnings management. SOX does not appear to have influenced the substitution of abnormal R&D spending for discretionary accruals, as I find no evidence of the increased use of abnormal R&D spending to replace discretionary accruals. This finding is consistent with Bartov and Cohen (2007), but does not support the conclusion from Graham et al's (2005) survey that managers tend to switch from accruals management to real earnings management, at least with respect to abnormal R&D spending.

This study focused primarily on the management of annual earnings, but also on quarterly earnings, and accordingly, used a positive/negative earnings target that is applicable to both circumstances. A limitation of this study is using zero as the earnings target may have left out firms who manage earnings to alternate targets. Another income objective – meet/beat analysts' forecast has attracted more attention recently, but meet/beat is typically done relative to quarterly forecasts. Further work could examine earnings management in a purely quarterly context with respect to meeting or beating an earnings target.

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Appendix 4-A. Variable Definitions

Variable	Definition and Measurement
	Proxies for earnings management in main analyses
DACC_Ann	Signed *annual* performance-adjusted discretionary accruals. The difference between a firm's discretionary accruals estimated from *annual* modified Jones model and the median discretionary accruals of other firms in the same industry-ROA decile.
DACC_Qtr	Signed *quarterly* performance-adjusted discretionary accruals. The difference between a firm's discretionary accruals estimated from *quarterly* modified Jones model and the median discretionary accruals of other firms in the same industry-ROA decile.
abRD_Ann	Residuals from the *annual* R&D estimation model
abRD_Qtr	Residuals from the *quarterly* R&D estimation model
	Variables used in the estimation models for normal level of accruals and R&D
TACC	Total accruals = Earnings before extraordinary items – Cash flow from operating
TA	Total Assets
ΔREV	Year-to year or quarter-to-quarter change in sales revenues
ΔAR	Year-to year or quarter-to-quarter change in account receivables
PPE	Property, plant and equipment
RD	R&D spending in current year or quarter
CFO	Cash flow from operating activities, before R&D and working capital spending
TobinsQ	(Market Value of Equity + Book Value of Preferred Stock + Long-term Debt + Short-term Debt) / (Book Value of Equity + Book Value of Preferred Stock + Long-term Debt + Short-term Debt)
CX	Capital expenditure
	Income objective cases
Case1	Earnings before discretionary accruals and R&D spending is negative: EBT+RD-DACC < 0;
Case2	Earnings before discretionary accruals and R&D spending is positive but smaller than expected R&D spending: 0 < EBT+RD-DACC < E(RD)
Case3	Earnings before discretionary accruals and R&D spending is greater than expected R&D spending: EBT+RD-DACC > E(RD)
EBT	Earnings before tax: (Data18 + Data16, for annual data; Data8 + Data6, for quarterly data)
E(RD)	Expected R&D spending, from the estimation models
	Control variables used in the multivariate tests
lgTA	Log transformation of average total assets.
ΔNI	Change in earnings before extraordinary items.
M/B	Market-to-Book ratio: market value of equity / book value of equity
Big4	= 1, if the auditor is a Big-4 company; = 0, otherwise.
GDP-growth	U.S. GDP growth rate
MktRet	Annual return of U.S. stock exchanges

Appendix 4-A. Variable Definitions (continued)

Variable	Definition and Measurement
	Indicator variables used in the multivariate tests
D1	= 1, if Case1 = 1; = 0, otherwise
D2	= 1, if Case2 = 1; = 0, otherwise
D	Combination of Case1 and Case2. = 1, if Case1 = 1 or Case2 = 1; = 0, otherwise.
SOX	= 1, if a firm-year observation is for post-SOX period (2004); = 0, otherwise.

Appendix 4-B. Estimation of Discretionary Accruals (*DACC*) and Abnormal R&D (*ab_RD*)

a). Discretionary Accruals

I estimate annual and quarterly normal level of accruals based on annual and quarterly Jones and modified Jones model (Dechow, Sloan and Sweeney 1995).

In the case of annual estimation, I run the following cross-sectional regressions for each year and Fama-French (1997) industry:

Jones Model: $$\frac{TACC_{ijt}}{TA_{ijt-1}} = \frac{\beta_0}{TA_{ijt-1}} + \beta_1 \frac{\Delta REV_{ijt}}{TA_{ijt-1}} + \beta_2 \frac{PPE_{ijt}}{TA_{ijt-1}} + \varepsilon \qquad \text{(A1)}$$

Modified Jones: $$\frac{TACC_{ijt}}{TA_{ijt-1}} = \frac{\beta_0}{TA_{ijt-1}} + \beta_1 \frac{(\Delta REV_{ijt} - \Delta AR_{ijt})}{TA_{ijt-1}} + \beta_2 \frac{PPE_{ijt}}{TA_{ijt-1}} + \varepsilon \qquad \text{(A2)}$$

where $TACC_{ijt}$ denotes the total accruals for firm i in industry j and year t, and it is computed as the difference between net income before extraordinary items (Data123) and cash flow from operating activities after adjusting extraordinary items (Data308 – Data124); ΔREV_{ijt} is the one year change in net revenues (change in Data12); ΔAR_{ijt} is the one year change in accounts receivables (Data302); PPE_{ijt} is gross property, plant and equipment (Data7). All variables are scaled by total assets at the end of last year's TA_{ijt-1} (Data6). To deal with the effect of outliers, I winsorize total accruals and all independent variables at the 1st and 99th percentiles prior to estimating normal accruals. The residuals from Equation (1) and (2) are denoted as *DA_ann* and *DAMJ_ann*, referring to the annual unadjusted discretionary accruals based on Jones model and Modified Jones model respectively. I then adjust the performance following Francis, LaFond, Olsson and Schipper (2005, Appendix A) and Cahan and Zhang (2006).[74] In particular, I partition the sample of firms with sufficient data to calculate unadjusted discretionary accruals, for each Fama-French industry, into deciles based on contemporary return on assets (ROA). The performance-adjusted discretionary accruals are calculated as the difference between firm i's unadjusted discretionary accruals and the median unadjusted discretionary accruals for firm i's industry-ROA decile where firm i is

[74] Dechow et al 2003, Kothari et al 2005 find evidence that the discretionary accruals estimated from Jones or modified Jones model for firms with high growth and good performance are overestimated and therefore it is necessary to match performance.

excluded from the median calculation. Corresponding to *DA_ann* and *DAMJ_ann*, the performance-adjusted discretionary accruals are denoted as *DAadj_ann* and *DAMJadj_ann*.

Following Barua, Legoria, and Moffitt (2006), I also estimate quarterly normal level of accruals by running following regressions for each year-quarter and each Fama-French industry:

Quarterly Jones: $$\frac{TACC_{ijq}}{TA_{ijq-1}} = \frac{\beta_0}{TA_{ijq-1}} + \beta_1 \frac{\Delta REV_{ijq}}{TA_{ijq-1}} + \beta_2 \frac{PPE_{ijq}}{TA_{ijq-1}} + \varepsilon \qquad \text{(Q1)}$$

Quarterly Modified Jones: $$\frac{TACC_{ijq}}{TA_{ijq-1}} = \frac{\beta_0}{TA_{ijq-1}} + \beta_1 \frac{(\Delta REV_{ijq} - \Delta AR_{ijq})}{TA_{ijq-1}} + \beta_2 \frac{PPE_{ijq}}{TA_{ijq-1}} + \varepsilon \qquad \text{(Q2)}$$

where $TACC_{ijq}$ denotes the total accruals for firm *i* in industry *j* and year-quarter *q*, and it is computed as the difference between net income before extraordinary items (Data8) and cash flow from operating activities after adjusting extraordinary items (Data108 – Data78); ΔREV_{ijt} is the one quarter change in net revenues (change in Data2); ΔAR_{ijt} is the one quarterchange in accounts receivables (Data37);[75] PPE_{ijt} is gross property, plant and equipment (Data118). All variables are scaled by total assets at the end of last quarter TA_{ijq-1} (Data44). Again total accruals and all independent variables are winsorized at the 1st and 99th percentiles prior to estimating normal accruals. The residuals from Equation (3) and (4) are denoted as *DA_qtr* and *DAMJ_qtr*, referring to quarterly unadjusted discretionary accruals based on Jones model and Modified Jones model respectively. Following the procedure as discussed above, I adjust the performance for quarterly estimated discretionary accruals which are denoted as *DAadj_qtr* and *DAMJadj_qtr*, corresponding to *DA_qtr* and *DAMJ_qtr*. To compare with annual discretionary accruals, I sum up all four quarter discretionary accruals and define them as Σ *DA_qtr*, Σ *DAMJ_qtr* Σ *DAadj_qtr*, and Σ *DAMJadj*.

b). Abnormal R&D

[75] For change in sales revenue and change in account receivables, I tried to use both one quarter change and the difference between current quarter and last year same quarter to control for potential effect of seasonality. But the later does not seem to contribute to the estimation and to keep the regressions simple, I leave it out and use the same regression as Barua et al (2006).

Similar to Zang (2005) and Gunny (2005), I slightly modified the model Berger (1993) to estimate the normal level of annual R&D spending. The following regression (5) is estimated cross-sectionally for each industry-year with at least 15 observations:

$$\frac{RD_t}{TA_{t-1}} = \alpha_0 + \alpha_1 \frac{RD_{t-1}}{TA_{t-1}} + \alpha_2 \frac{CFO_{t-1}}{TA_{t-1}} + \alpha_3 \frac{\Delta CFO_t}{TA_{t-1}} + \alpha_4 TobinsQ + \alpha_5 \frac{CX_t}{TA_{t-1}}$$

where RD_t and RD_{t-1} refer to the actual R&D spending in current and last fiscal year (Data46). Cash flow from operating activities (CFO) is decomposed to CFO_{t-1} and ΔCFO_t because these two components have opposite correlation with R&D spending and in the regression they show significantly different coefficients. CFO (Data308) controls for the finance constraint faced by the firms and therefore is adjusted by adding back R&D spending (Data46) and change in working capital ((Data4 – Data1) – (Data5 – Data34)). Tobins'Q is computed as market value of equity and debts (Data199*Data25 + Data130 + Data9 + Data34) over book value of equity and debts (Data60 + Data130 + Data9 + Data34). CX_t is capital expenditure (Data128) in current year.

The residuals from above equation (5) are annual abnormal R&D, denoted as abRD_ann.

For quarterly estimation of R&D spending, I suspect that there is a seasonality, that is, current quarter's R&D spending is related to R&D spending in last year same quarter. The following regression (6) is estimated cross-sectionally for each industry-year-quarter with at least 15 observations:

$$\frac{RD_q}{TA_{q-1}} = \alpha_0 + \alpha_1 \frac{RD_{q-1}}{TA_{q-1}} + \alpha_2 \frac{RD_{q-4}}{TA_{q-1}} + \alpha_3 \frac{CFO_{q-1}}{TA_{q-1}} + \alpha_4 \frac{\Delta CFO_q}{TA_{q-1}} + \alpha_5 TobinsQ + \alpha_6 \frac{CX_q}{TA_{q-1}}$$

The definitions of variables used in Equation (6) are similar to those in Equation (5) except on a quarterly basis instead of annual. RD_q, RD_{q-1} and RD_{q-4} stand for R&D spending (Data4) in current quarter, last quarter, and same quarter of last year. Cash flow from operating activities (CFO) is decomposed to CFO_{q-1} (Data108)[76] and ΔCFO_q (difference between current quarter and last quarter).[77] Similar to the discussion in annual estimation, *CFO* is adjusted by adding back contemporary R&D spending and change in

[76] Data108 of quarterly Compustat data reports the year-to-date operating cash flow figures. I adjusted it to get the quarterly amount.

[77] I also tried to include CFO_{q-4} and ΔCFO_q ($=CFO_q - CFO_{q-4}$) to take care of the seasonality effect. But they are not significant and do not contribute to adjusted R^2. So I exclude them in the regression.

working capital ((data40-data36) - (data49-data45)). Tobins'Q is computed as market value of equity and debts (data14*data61 + data55 + data51 + data45) over book value of equity and debts (data59 + data55 + data51 + data45). CX_t is capital expenditure (Data90) in current quarter.

The residuals from above equation (6) are annual abnormal R&D, denoted as *abRD_qtr*. To facilitate the comparison of annual and quarterly estimated abnormal R&D, I denote abnormal R&D estimated based on quarterly estimation model in each fiscal quarter as *abRD_q1*, *abRD_q2*, *abRD_q3*, and *abRD_q4*.

Appendix 4-C. Compare Annually and Quarterly Estimated *DACC* (and *ab_RD*)

Panel A. Distribution of Annual and Quarterly Estimated *DACC* and *ab_RD*

Mean of Annual and Quarterly Discretionary Accruals and Abnormal R&D

	Annual	Q1	Q2	Q3	Q4	Σ Qtrs	Mean Difference [1]	
DA	0.266	0.039	0.054	0.076	0.190	0.360	DA_ann - ΣDA_qtr	-0.093 ***
DAMJ	0.274	0.043	0.044	0.072	0.183	0.342	DAMJ_ann - ΣDAMJ_qtr	-0.068 ***
DAadj	-0.003	0.001	-0.001	-0.001	-0.001	-0.001	DAadj_ann - ΣDAadj_qtr	-0.001
DAMJadj	-0.004	0.001	0.001	0.000	0.000	0.001	DAMJadj_ann - ΣDAMJadj_qtr	-0.005 ***
ab_RD	-0.004	0.000	0.000	0.000	0.000	-0.001	abRD_ann - ΣabRD_qtr	-0.003 ***

Median of Annual and Quarterly Discretionary Accruals and Abnormal R&D

	Annual	Q1	Q2	Q3	Q4	Σ Qtrs	Median Difference [2]	
DA	0.247	0.039	0.050	0.078	0.201	0.352	DA_ann - ΣDA_qtr	-0.087 ***
DAMJ	0.254	0.043	0.041	0.073	0.197	0.334	DAMJ_ann - ΣDAMJ_qtr	-0.060 ***
DAadj	0.000	0.000	0.000	0.000	0.000	-0.003	DAadj_ann - ΣDAadj_qtr	0.003 ***
DAMJadj	0.000	0.000	0.000	0.000	0.000	-0.004	DAMJadj_ann - ΣDAMJadj_qtr	0.003 **
ab_RD	-0.004	-0.001	-0.001	-0.001	-0.001	-0.003	abRD_ann - ΣabRD_qtr	-0.001 ***

[1] The numbers indicate the magnitude of difference in the mean of annual measures and that of sum of quarterly measures. ***, **, and * indicate the mean difference is different from zero at 1%, 5%, and 10%, respectively, based on t-tests.

[2] The numbers indicate the magnitude of difference in the median of annual measures and that of sum of quarterly measures. ***, **, and * indicate the median difference is different from zero at 1%, 5%, and 10%, respectively, based on Wilcoxon signed test.

Panel B. Correlations of Annual and Quarterly Estimated *DACC* and *ab_RD*

	Pearson	**Spearman**
Corr (DA_ann, ΣDA_qtr)	0.615	0.646
Corr (DAMJ_ann, ΣDAMJ_qtr)	0.612	0.660
Corr (DAadj_ann, ΣDAadj_qtr)	0.707	0.787
Corr (DAMJadj_ann, ΣDAMJadj_qtr)	0.694	0.769
Corr (ab_RD(annual), Σab_RD(qtrly))	0.696	0.653

Note: All the correlation coefficients shown in above table are significant at 1%.

Table 4-1. Descriptive Statistics (Annual Data)

	N	25th Pctl	Mean	Median	75th Pctl	Std Dev
Overall						
DACC	16,328	-0.061	-0.004	0.000	0.061	0.202
ab_RD	16,328	-0.035	-0.004	-0.004	0.022	0.114
R&D	16,328	2.364	69.836	7.834	24.982	371.073
EBT	16,312	-0.288	-0.158	-0.022	0.109	0.485
TA	16,328	17.665	720.426	59.947	240.098	2924.920
lgTA	16,328	2.872	4.271	4.093	5.481	1.991
M/B	15,517	1.553	4.932	2.770	5.244	7.530
CFO	16,328	-0.169	-0.077	0.022	0.123	0.359
CX	16,328	0.017	0.056	0.036	0.069	0.064
Case = 1						
DACC	6,047	-0.032	0.040	0.040	0.137	0.263
ab_RD	6,047	-0.053	-0.009	-0.007	0.030	0.143
R&D	6,047	1.402	19.153	4.161	11.668	138.061
EBT	6,031	-0.663	-0.525	-0.363	-0.181	0.568
TA	6,047	8.161	174.730	22.731	69.733	1113.250
lgTA	6,047	2.099	3.264	3.124	4.245	1.642
M/B	5,413	1.391	6.507	3.116	6.792	10.400
CFO	6,047	-0.497	-0.360	-0.236	-0.085	0.416
CX	6,047	0.010	0.048	0.025	0.056	0.067
Case = 2						
DACC	3,039	-0.043	-0.004	0.006	0.064	0.194
ab_RD	3,039	-0.048	-0.011	-0.009	0.020	0.126
R&D	3,039	3.380	58.708	10.262	28.041	270.157
EBT	3,039	-0.175	-0.116	-0.062	0.020	0.305
TA	3,039	22.133	570.149	59.515	184.056	2620.120
lgTA	3,039	3.097	4.239	4.086	5.215	1.768
M/B	2,936	1.387	4.161	2.366	4.574	6.064
CFO	3,039	-0.089	-0.043	-0.009	0.049	0.185
CX	3,039	0.019	0.055	0.035	0.067	0.063
Case = 3						
DACC	7,242	-0.081	-0.041	-0.022	0.014	0.125
ab_RD	7,242	-0.021	0.004	-0.001	0.019	0.073
R&D	7,242	3.748	116.827	12.880	42.600	509.443
EBT	7,242	0.048	0.129	0.115	0.204	0.164
TA	7,242	43.600	1239.140	145.031	551.930	3853.290
lgTA	7,242	3.775	5.127	4.977	6.313	1.947
M/B	7,168	1.715	4.058	2.764	4.687	4.809
CFO	7,242	0.076	0.146	0.130	0.202	0.121
CX	7,242	0.024	0.062	0.045	0.079	0.061

Note: For definition and measurement of variables, refer to Appendix A. All variables, except for *DACC and ab_RD*, are winsorized at the 1st and 99th percentiles of their distributions. Variable *CFO* and *CX* are deflated by last year total assets.

Table 4-2. Univariate Tests for Annual Sample

Panel A. Mean/Median of annual *DACC* and *ab_RD* partitioned by cases

Cases	*DACC_ann* Mean	*DACC_ann* Median	*DACC_ann* % of Positive	*abRD_ann* Mean	*abRD_ann* Median	*abRD_ann* % of Positive
1: EBT + RD - DACC < 0	0.040	0.040	64%	-0.009	-0.007	44%
N=6,047	***	***	***	***	***	***
2: 0 < EBT + RD - DACC < E(RI	-0.004	0.006	54%	-0.011	-0.009	42%
N=3,039	n.s.	***	***	***	***	***
3: EBT + RD - DACC > E(RD)	-0.041	-0.022	33%	0.004	-0.001	49%
N=7,242	***	***	***	n.s.	**	**
Cross-Case Tests:	**Mean[a]**	**Median[b]**		**Mean[a]**	**Median[b]**	
Case 2 - Case 1	-0.044	-0.034		-0.002	-0.002	
	(-9.03)***	(-13.72)***		(-0.78)	(-1.67)*	
Case 2 - Case 3	0.037	0.028		-0.015	-0.008	
	(9.65)***	(21.27)***		(-5.97)***	(-10.18)***	
Case 1- Case 3	0.081	0.062		-0.012	-0.006	
	(21.97)***	(38.34)***		(-6.06)***	(-8.89)***	

[a] The t-stats of the t-test comparing the mean of two cases are reported, followed by the significance level based on two-tailed p-values.

[b] The z-scores of Wilcoxon sign test comparing the median of two cases are reported, followed by the significance level based on two-tailed p-values.

***, **, * represent significantly different from 0 at less than 1%, 5%, and 10% level respectively (two-tailed).

Table 4-3. Univariate Tests for Quarterly Sample

Panel A. Mean/Median of quarterly *DACC* and *ab_RD* partitioned by cases

	DACC_qtr			*abRD_qtr*		
Cases	**Mean**	**Median**	**% of Positive**	**Mean**	**Median**	**% of Positive**
1: EBT + RD - DACC < 0	0.0217	0.0181	67%	-0.0010	-0.0014	43%
N=24,761	***	***	***	***	***	***
2: 0 < EBT + RD - DACC < E(RD	0.0023	0.0028	55%	-0.0007	-0.0012	43%
N=10,893	***	***	***	***	***	***
3: EBT + RD - DACC > E(RD)	-0.0186	-0.0097	29%	0.0007	-0.0007	44%
N=29,327	***	***	***	***	***	**
Cross-Case Tests:	**Mean**[a]	**Median**[b]		**Mean**[a]	**Median**[b]	
Case 2 - Case 1	-0.019	-0.015		0.0003	0.0002	
	(-29.29)***	(-34.74)***		(1.28)	(2.38)***	
Case 2 - Case 3	0.021	0.012		-0.001	-0.001	
	(40.27)***	(49.95)***		(-5.73)***	(-7.58)***	
Case 1 - Case 3	0.040	0.028		-0.002	-0.001	
	(73.93)***	(96.17)***		(-9.98)***	(-12.78)***	

[a] The t-stats of the t-test comparing the mean of two cases are reported, followed by the significance level based on two-tailed p-values.

[b] The z-scores of Wilcoxon sign test comparing the median of two cases are reported, followed by the significance level based on two-tailed p-values.

***, **, * represent significantly different from 0 at less than 1%, 5%, and 10% level respectively (two-tailed).

Table 4-4. Regressions of annual *DACC* and *ab_RD*

2SLS Regressions:

$$DACC\_ann = \alpha_0 + \alpha_1 ab\_RD + \alpha_2 D_1 + \alpha_3 D_2 + \alpha_4 D_1 \times ab\_RD + \alpha_5 D_2 \times ab\_RD$$
$$+\alpha_6 \lg TA + \alpha_7 \Delta NI + \alpha_8 MB + \alpha_9 CFO + \alpha_{10} Big4$$

$$abRD\_ann = \beta_0 + \beta_1 DACC + \beta_2 D_1 + \beta_3 D_2 + \beta_4 D_1 \times DACC + \beta_5 D_2 \times DACC$$
$$+\beta_6 \lg TA + \beta_7 \Delta NI + \beta_8 GDP\_growth + \beta_9 MktRet$$

		DV = *DACC_ann*				DV = *abRD_ann*		
		Coef.	**T-Stat**	**P-value**		**Coef.**	**T-Stat**	**P-value**
Intercept	***b₀***	-0.015	-1.63	0.103		0.008	1.17	0.244
D1	b_1	0.060	12.28	<.0001		-0.051	-10.07	<.0001
D2	b_2	0.024	5.10	<.0001		-0.032	-6.67	<.0001
ab_RD	b_3	0.704	1.94	0.052				
DACC	b_4					0.935	14.58	<.0001
D1*ab_RD	b_5	-0.270	-11.40	<.0001				
D2*ab_RD	b_6	-0.431	-13.80	<.0001				
D1*DACC	b_7					-0.101	-6.87	<.0001
D2*DACC	b_8					-0.159	-6.82	<.0001
Log(TA)		-0.002	-1.12	0.264		0.004	4.06	<.0001
ΔNI		0.003	2.21	0.027		-0.005	-5.96	<.0001
M/B		0.000	-2.21	0.027				
CFO		-0.038	-1.82	0.068				
Big4		0.000	0.04	0.966				
GDP_growth						-0.248	-1.71	0.087
MktRet						0.003	0.26	0.799
Adj_R^2		0.084				0.029		
N		11,612				11,612		
F-test:		**Magnitude**	**F-value**		**F-test:**	**Magnitude**	**F-value**	
1. $b_0 + b_1$		0.045	23.27	***	**1. $b_0 + b_1$**	-0.043	36.67	***
2. $b_0 + b_2$		0.008	0.71	n.s.	**2. $b_0 + b_2$**	-0.024	10.20	***
3. $b_3 + b_5$		0.434	1.44	n.s.	**3. $b_3 + b_7$**	0.834	168.91	***
4. $b_3 + b_6$		0.273	0.57	n.s.	**4. $b_3 + b_8$**	0.776	122.37	***

Table 4-5. Regressions of *DACC_qtr* and *abRD_qtr*

2SLS Regressions:

$$DACC\_qtr = \alpha_0 + \alpha_1 ab\_RD + \alpha_2 D_1 + \alpha_3 D_2 + \alpha_4 D_1 \times ab\_RD + \alpha_5 D_2 \times ab\_RD + \alpha_6 \lg TA + \alpha_7 \Delta NI + \alpha_8 MB + \alpha_9 CFO$$

$$abRD\_qtr = \beta_0 + \beta_1 DACC + \beta_2 D_1 + \beta_3 D_2 + \beta_4 D_1 \times DACC + \beta_5 D_2 \times DACC + \beta_6 \lg TA + \beta_7 \Delta NI + \beta_8 GDP\_growth + \beta_9 MktRet$$

		DV = *DACC_qtr*				DV = *abRD_qtr*		
		Coef.	T-Stat	P-value		Coef.	T-Stat	P-value
Intercept	*b₀*	-0.026	-10.88	<.0001		0.003	8.63	<.0001
D1	*b₁*	0.038	18.10	<.0001		-0.003	-13.24	<.0001
D2	*b₂*	0.018	8.04	<.0001		-0.002	-7.30	<.0001
ab_RD	*b₃*	8.172	1.05	0.294				
DACC	*b₄*					0.140	15.84	<.0001
*D1*ab_RD*	*b₅*	-0.277	-4.84	<.0001				
*D2*ab_RD*	*b₆*	-0.412	-5.01	<.0001				
*D1*DACC*	*b₇*					-0.034	-13.82	<.0001
*D2*DACC*	*b₈*					-0.093	-18.35	<.0001
Log(TA)		0.003	2.94	0.003		0.000	-6.61	<.0001
ΔNI		0.010	1.29	0.196		-0.001	-9.67	<.0001
M/B		0.000	-1.10	0.272				
CFO		0.010	0.30	0.762				
GDP_growth						-0.006	-0.79	0.428
MktRet						0.000	-0.86	0.391
Adj_R^2		0.014				0.020		
N		48,894				48,894		
F-test:		**Magnitude**	**F-value**		**F-test:**	**Magnitude**	**F-value**	
1. $b_0 + b_1$		0.012	24.83	***	**1. $b_0 + b_1$**	0.000	0.23	n.s.
2. $b_0 + b_2$		-0.008	9.67	***	**2. $b_0 + b_2$**	0.001	10.76	***
3. $b_3 + b_5$		7.894	1.03	n.s.	**3. $b_3 + b_7$**	0.106	139.54	***
4. $b_3 + b_6$		7.759	0.99	n.s.	**4. $b_3 + b_8$**	0.048	21.04	***

Table 4-6. Regressions of Quarterly *DACC* and *ab_RD* with their lags

$$DACC = \alpha_0 + \alpha_1 D + \alpha_2 ab\_RD + \alpha_3 D \times ab\_RD + \alpha_4 lag(ab\_RD) + \alpha_5 D \times lag(ab\_RD)$$
$$+ \alpha_6 lag2(ab\_RD) + \alpha_7 D \times lag2(ab\_RD) + \alpha_8 lag3(ab\_RD) + \alpha_9 D \times lag3(ab\_RD)$$
$$+ \alpha_{10} lag(DACC) + \alpha_{11} D \times lag(DACC) + \alpha_{12} lag2(DACC) + \alpha_{13} D \times lag2(DACC)$$
$$+ \alpha_{14} lag3(DACC) + \alpha_{15} D \times lag3(DACC) + \alpha_{16} \lg TA + \alpha_{17} \Delta NI + \alpha_{18} MB + \alpha_{19} CFO$$

$$ab\_RD = \alpha_0 + \alpha_1 D + \alpha_2 DACC + \alpha_3 D \times DACC + \alpha_4 lag(ab\_RD) + \alpha_5 D \times lag(ab\_RD)$$
$$+ \alpha_6 lag2(ab\_RD) + \alpha_7 D \times lag2(ab\_RD) + \alpha_8 lag3(ab\_RD) + \alpha_9 D \times lag3(ab\_RD)$$
$$+ \alpha_{10} lag(DACC) + \alpha_{11} D \times lag(DACC) + \alpha_{12} lag2(DACC) + \alpha_{13} D \times lag2(DACC)$$
$$+ \alpha_{14} lag3(DACC) + \alpha_{15} D \times lag3(DACC) + \alpha_{16} \lg TA + \alpha_{17} \Delta NI + \alpha_{18} GDP\_growth + \alpha_{19} MktRet$$

Panel A. Define 4th quarter as the current quarter

		DV = *DACC*				DV = *ab_RD*		
		Coef.	**T-Stat**	**P-value**		**Coef.**	**T-Stat**	**P-value**
Intercept	b_0	-0.030	-3.81	0.000		0.003	3.58	0.000
D	b_1	0.037	6.26	<.0001		-0.002	-4.62	<.0001
ab_RD (Quarter 4)	b_2	-13.101	-0.63	0.528				
D*ab_RD	b_3	-0.279	-1.90	0.058				
DACC (Quarter 4)	b_4					0.126	6.51	<.0001
D*DACC	b_5					-0.032	-7.83	<.0001
lag1(ab_RD)	b_6	-1.906	-0.69	0.487		-0.098	-3.69	0.000
D*lag1(ab_RD)	b_7	0.114	0.32	0.752		-0.031	-1.05	0.294
lag2(ab_RD)	b_8	0.960	0.59	0.555		0.049	2.27	0.023
D*lag2(ab_RD)	b_9	0.086	0.27	0.784		0.048	1.88	0.060
lag3(ab_RD)	b_{10}	1.350	0.64	0.524		0.075	3.70	0.000
D*lag3(ab_RD)	b_{11}	-0.031	-0.10	0.917		0.043	1.79	0.073
lag1(DACC)	b_{12}	0.069	0.33	0.738		-0.009	-1.22	0.223
D*lag1(DACC)	b_{13}	0.104	0.98	0.330		0.025	2.89	0.004
lag2(DACC)	b_{14}	0.032	0.17	0.863		-0.003	-0.41	0.681
D*lag2(DACC)	b_{15}	0.158	1.47	0.141		0.015	1.69	0.091
lag3(DACC)	b_{16}	-0.244	-1.01	0.312		-0.006	-0.78	0.436
D*lag3(DACC)	b_{17}	0.160	1.50	0.135		-0.006	-0.71	0.477
Log(TA)		0.000	0.06	0.950		0.000	-3.31	0.001
ΔNI		-0.038	-0.44	0.661		-0.006	-9.72	<.0001
M/B		0.000	0.06	0.956				
CFO		-0.056	-0.86	0.390				
GDP_growth						-0.007	-0.40	0.686
MktRet						-0.001	-0.84	0.399
Adj_R²		0.005				0.041		
N		12,013				12,013		
F-test:		**Magnitude**	**F-value**		**F-test:**	**Magnitude**	**F-value**	
1. $b_0 + b_1$		0.007	0.80	n.s.	**1.** $b_0 + b_1$	0.001	0.84	n.s.
2. $b_2 + b_3$		-13.380	0.42	n.s.	**2.** $b_2 + b_3$	0.094	23.18	***
3. $b_6 + b_7$		-1.792	0.43	n.s.	**3.** $b_{12} + b_{13}$	0.016	11.19	***
4. $b_8 + b_9$		1.046	0.42	n.s.	**4.** $b_{14} + b_{15}$	0.012	5.35	**
5. $b_{10} + b_{11}$		1.319	0.39	n.s.	**5.** $b_{16} + b_{17}$	-0.012	5.67	**

Panel B. Pool all quarters

		DV = *DACC*			DV = *ab_RD*		
		Coef.	T-Stat	P-value	Coef.	T-Stat	P-value
Intercept	b_0	-0.025	-12.29	<.0001	0.003	8.24	<.0001
D	b_1	0.029	19.62	<.0001	-0.003	-11.56	<.0001
ab_RD (current qtr)	b_2	6.685	0.96	0.337			
*D*ab_RD*	b_3	-0.359	-8.99	<.0001			
DACC (current qtr)	b_4				0.122	13.99	<.0001
*D*DACC*	b_5				-0.048	-22.61	<.0001
lag1(ab_RD)	b_6	0.823	0.90	0.370	-0.020	-1.79	0.073
*D*lag1(ab_RD)*	b_7	-0.033	-0.39	0.697	-0.133	-10.99	<.0001
lag2(ab_RD)	b_8	-0.608	-1.04	0.297	0.079	8.81	<.0001
*D*lag2(ab_RD)*	b_9	0.058	0.79	0.428	0.015	1.40	0.162
lag3(ab_RD)	b_{10}	-0.741	-1.00	0.319	0.094	10.62	<.0001
*D*lag3(ab_RD)*	b_{11}	0.079	1.10	0.271	0.019	1.84	0.066
lag1(DACC)	b_{12}	-0.077	-1.58	0.114	-0.005	-1.65	0.098
*D*lag1(DACC)*	b_{13}	0.066	2.62	0.009	0.016	4.36	<.0001
lag2(DACC)	b_{14}	-0.061	-1.49	0.135	-0.003	-0.98	0.329
*D*lag2(DACC)*	b_{15}	0.081	3.26	0.001	0.009	2.60	0.009
lag3(DACC)	b_{16}	0.006	0.19	0.847	-0.005	-1.53	0.126
*D*lag3(DACC)*	b_{17}	0.064	2.56	0.010	-0.001	-0.36	0.716
Log(TA)		0.002	2.81	0.005	0.000	-6.30	<.0001
ΔNI		0.009	1.22	0.222	-0.001	-9.65	<.0001
M/B		0.000	-1.05	0.294			
CFO		-0.008	-0.36	0.718			
GDP_growth					-0.005	-0.66	0.511
MktRet					0.000	-0.79	0.430
Adj_R^2		0.018			0.051		
N		48,894			48,894		

F-test:	Magnitude	F-value		F-test:	Magnitude	F-value	
1. $b_0 + b_1$	0.004	5.72	***	1. $b_0 + b_1$	0.001	2.48	*
2. $b_2 + b_3$	6.326	0.82	n.s.	2. $b_2 + b_3$	0.074	70.67	***
3. $b_6 + b_7$	0.791	0.74	n.s.	3. $b_{12} + b_{13}$	0.011	28.11	***
4. $b_8 + b_9$	-0.550	0.90	n.s.	4. $b_{14} + b_{15}$	0.006	9.70	***
5. $b_{10} + b_{11}$	-0.661	0.80	n.s.	5. $b_{16} + b_{17}$	-0.006	7.90	***

Table 4-7. Univariate tests of *DACC* and *ab_RD* Surrounding SOX

Panel A. Mean and Median of *DACC_ann* and *abRD_ann* in Pre-SOX Period

Cases	*DACC_ann* Mean	*DACC_ann* Median	*DACC_ann* % of Positive	*abRD_ann* Mean	*abRD_ann* Median	*abRD_ann* % of Positive
1: EBT + RD - DACC < 0	0.0434	0.0410	64%	-0.0123	-0.0079	43%
N=3,286	***	***	***	***	***	***
2: 0 < EBT + RD - DACC < E(RD)	0.0025	0.0113	55%	-0.0183	-0.0137	39%
N=1,780	n.s.	***	***	***	***	***
3: EBT + RD - DACC > E(RD)	-0.0408	-0.0222	34%	0.0018	-0.0027	46%
N=4,565	***	***	***	n.s.	***	***
Cross-Case Tests:	**Mean[a]**	**Median[b]**		**Mean[a]**	**Median[b]**	
Case 2 - Case 1	-0.041	-0.030		-0.006	-0.006	
	(-6.19)***	(-9.16)***		(1.36)	(-2.89)***	
Case 2 - Case 3	0.043	0.034		-0.020	-0.011	
	(8.89)***	(17.08)***		(-5.67)***	(-9.54)***	
Case 1 - Case 3	0.084	0.063		-0.014	-0.005	
	(16.44)***	(28.79)***		(-4.64)***	(-6.03)***	

Panel B. Mean and Median of *DACC_ann* and *abRD_ann* in Post-SOX Period

Cases	*DACC_ann* Mean	*DACC_ann* Median	*DACC_ann* % of Positive	*abRD_ann* Mean	*abRD_ann* Median	*abRD_ann* % of Positive
1: EBT + RD - DACC < 0	0.0308	0.0415	66%	-0.0105	-0.0128	39%
N=872	***	***	***	***	***	***
2: 0 < EBT + RD - DACC < E(RD)	-0.0160	0.0094	58%	-0.0091	-0.0095	38%
N=500	n.s.	***	***	***	***	***
3: EBT + RD - DACC > E(RD)	-0.0380	-0.0166	33%	0.0057	0.0025	55%
N=1,206	***	***	***	n.s.	***	***
Cross-Case Tests:	**Mean[a]**	**Median[b]**		**Mean[a]**	**Median[b]**	
Case 2 - Case 1	-0.047	-0.032		0.001	0.003	
	(-3.15)***	(-5.83)***		(0.20)	(0.86)	
Case 2 - Case 3	0.022	0.026		-0.015	-0.012	
	(1.91)**	(9.36)***		(-2.67)***	(-7.68)***	
Case 1 - Case 3	0.069	0.058		-0.016	-0.015	
	(6.22)***	(15.27)***		(-3.21)***	(-8.40)***	

Panel C. Compare Mean/Median of Annual *DACC* and *ab_RD* (Post – Pre)

Cases	*DACC_ann* Mean[a]	*DACC_ann* Median[b]	*abRD_ann* Mean[a]	*abRD_ann* Median[b]
1: EBT + RD - DACC < 0	-0.013	0.000	0.002	-0.005
	(-1.11)	(0.55)	(0.34)	(1.27)
2: 0 < EBT + RD - DACC < E(RD)	-0.018	-0.002	0.009	0.004
	(-1.58)	(-0.17)	(1.48)	(1.46)
3: EBT + RD - DACC > E(RD)	0.003	0.006	0.004	0.005
	(0.59)	(2.01)**	(1.85)*	(5.89)***

Panel D. Mean and Median of *DACC_qtr* and *abRD_qtr* in Pre-SOX Period

Cases	*DACC_qtr* Mean	*DACC_qtr* Median	*DACC_qtr* % of Positive	*abRD_qtr* Mean	*abRD_qtr* Median	*abRD_qtr* % of Positive
1: EBT + RD - DACC < 0	0.0251	0.0208	67%	-0.0011	-0.0017	42%
N=13.577	***	***	***	***	***	***
2: 0 < EBT + RD - DACC < E(RD)	0.0039	0.0046	57%	-0.0008	-0.0016	42%
N=6.243	***	***	***	***	***	***
3: EBT + RD - DACC > E(RD)	-0.0184	-0.0095	30%	0.0007	-0.0009	43%
N=18.509	***	***	***	***	***	***
Cross-Case Tests:	**Mean**[a]	**Median**[b]		**Mean**[a]	**Median**[b]	
Case 2 vs. Case 1	-0.021	-0.016		0.000	0.000	
	(-23.16)***	(-25.55)***		(0.67)	(1.22)	
Case 2 vs. Case 3	0.022	0.014		-0.002	-0.001	
	(31.05)***	(39.78)***		(-5.67)***	(-6.71)***	
Case 1 vs. Case 3	0.043	0.030		-0.002	-0.001	
	(59.48)***	(74.71)***		(-6.87)***	(-9.96)***	

Panel E. Mean and Median of *DACC_qtr* and *abRD_qtr* in Post-SOX Period

Cases	*DACC_qtr* Mean	*DACC_qtr* Median	*DACC_qtr* % of Positive	*abRD_qtr* Mean	*abRD_qtr* Median	*abRD_qtr* % of Positive
1: EBT + RD - DACC < 0	0.0188	0.0164	67%	-0.0008	-0.0014	42%
N=3.674	***	***	***	***	***	***
2: 0 < EBT + RD - DACC < E(RD	0.0036	0.0045	55%	-0.0009	-0.0014	41%
N=1.761	***	***	***	***	***	***
3: EBT + RD - DACC > E(RD)	-0.0163	-0.0079	29%	0.0006	-0.0006	43%
N=4.823	***	***	***	***	***	***
Cross-Case Tests:	**Mean**[a]	**Median**[b]		**Mean**[a]	**Median**[b]	
Case 2 vs. Case 1	-0.015	-0.012		0.000	0.000	
	(-9.83)***	(-12.72)***		(-0.11)	(0.53)	
Case 2 vs. Case 3	0.020	0.012		-0.001	-0.001	
	(17.57)***	(21.69)***		(-.287)***	(-5.39)***	
Case 1 vs. Case 3	0.035	0.024		-0.001	-0.001	
	(26.05)***	(37.48)***		(-3.30)***	(-6.60)***	

Panel F. Compare Mean /Median of Quarterly *DACC* and *ab_RD* (Post – Pre)

Cases	*DACC_qtr* Mean[a]	*DACC_qtr* Median[b]	*abRD_qtr* Mean[a]	*abRD_qtr* Median[b]
1: EBT + RD - DACC < 0	-0.006	-0.004	0.000	0.000
	(-4.56)***	(-4.69)***	(0.59)	(1.42)
2: 0 < EBT + RD - DACC < E(RD)	0.000	0.000	0.000	0.000
	(-0.24)	(-1.41)	(-0.12)	(0.96)
3: EBT + RD - DACC > E(RD)	0.002	0.002	0.000	0.000
	(3.05)***	(3.70)***	(0.33)	(4.24)***

Table 4-8. Regressions of *DACC* and *ab_RD* Surrounding SOX

Panel A. 2SLS Regressions of *DACC_ann* and *abRD_ann*

		DV = *DACC_ann*			DV = *abRD_ann*		
		Coef.	**T-Stat**	**P-value**	**Coef.**	**T-Stat**	**P-value**
Intercept	b_0	-0.039	-4.54	<.0001	0.010	1.87	0.061
D	b_1	0.041	8.81	<.0001	-0.046	-11.39	<.0001
SOX	b_2	-0.002	-0.33	0.744	0.008	1.53	0.126
*D*SOX*	b_3	-0.012	-1.48	0.140	0.006	0.87	0.386
ab_RD	b_4	0.044	0.11	0.910			
*D*ab_RD*	b_5	-0.213	-10.07	<.0001			
*SOX*ab_RD*	b_6	-0.287	-3.49	0.001			
*D*SOX*ab_RD*	b_7	0.056	0.60	0.548			
DACC	b_8				0.561	13.84	<.0001
*D*DACC*	b_9				-0.096	-7.41	<.0001
*SOX*DACC*	b_{10}				-0.038	-1.37	0.171
*D*SOX*DACC*	b_{11}				0.023	0.62	0.537
Log(TA)		0.003	1.86	0.064	0.000	-0.07	0.941
ΔNI		0.086	4.34	<.0001	-0.094	-21.61	<.0001
M/B		0.000	-5.88	<.0001			
CFO		-0.116	-7.01	<.0001			
Big4		-0.001	-0.07	0.944			
MktRet					0.033	2.85	0.004
Adj_R^2		0.156			0.071		
N		8,551			8,551		

F-test:	**Magnitude**	**F-value**		**F-test:**	**Magnitude**	**F-value**	
1. $b_0 + b_1$	-0.003	0.11		**1.** $b_0 + b_1$	-0.036	58.78	***
2. $b_0 + b_2$	-0.041	16.13	***	**2.** $b_0 + b_2$	0.018	7.19	***
3. $b_0 + b_1 + b_2 + b_3$	-0.011	1.31		**3.** $b_0 + b_1 + b_2 + b_3$	-0.022	13.26	***
4. $b_4 + b_5$	-0.169	0.19		**4.** $b_8 + b_9$	0.465	130.82	***
5. $b_4 + b_6$	-0.242	0.37		**5.** $b_8 + b_{10}$	0.523	116.03	***
6. $b_4 + b_5 + b_6 + b_7$	-0.399	1.03		**6.** $b_8 + b_9 + b_{10} + b_{11}$	0.450	100.29	***

Panel B. 2SLS Regressions of *DACC_qtr* and *abRD_qtr*

		DV = *DACC_qtr*			DV = *abRD_qtr*		
		Coef.	T-Stat	P-value	Coef.	T-Stat	P-value
Intercept	b_0	-0.028	-9.03	<.0001	0.003	8.15	<.0001
D	b_1	0.032	18.90	<.0001	-0.004	-12.98	<.0001
SOX	b_2	0.001	0.57	0.569	0.000	-0.70	0.485
*D*SOX*	b_3	-0.006	-2.10	0.036	0.001	2.33	0.020
ab_RD	b_4	5.299	0.68	0.499			
*D*ab_RD*	b_5	-0.033	-4.57	<.0001			
*SOX*ab_RD*	b_6	-0.508	-3.74	0.000			
*D*SOX*ab_RD*	b_7	0.386	2.38	0.017			
DACC	b_8				0.120	12.42	<.0001
*D*DACC*	b_9				-0.006	-8.03	<.0001
*SOX*DACC*	b_{10}				-0.067	-8.00	<.0001
*D*SOX*DACC*	b_{11}				0.048	4.72	<.0001
Log(TA)		0.003	2.23	0.026	0.000	-6.94	<.0001
ΔNI		0.123	1.06	0.288	-0.019	-29.28	<.0001
M/B		0.000	-0.84	0.399			
CFO		-0.019	-0.73	0.465			
MktRet					0.001	0.70	0.486
Adj_R^2		0.030			0.034		
N		34,767			34,767		

F-test:	Magnitude	F-value		F-test:	Magnitude	F-value	
1. $b_0 + b_1$	0.005	2.36		1. $b_0 + b_1$	-0.001	3.74	**
2. $b_0 + b_2$	-0.027	62.26	***	2. $b_0 + b_2$	0.003	32.76	***
3. $b_0 + b_1 + b_2 + b_3$	-0.001	0.03		3. $b_0 + b_1 + b_2 + b_3$	0.000	0.55	
4. $b_4 + b_5$	5.267	0.45	**	4. $b_8 + b_9$	0.113	139.51	***
5. $b_4 + b_6$	4.792	0.37		5. $b_8 + b_{10}$	0.053	17.80	***
6. $b_4 + b_5 + b_6 + b_7$	5.146	0.43		6. $b_8 + b_9 + b_{10} + b_{11}$	0.094	72.75	***