Audit Quality and Accrual Reliability:
Evidence from the Pre- and Post-Sarbanes-Oxley Periods

Abstract: This study examines three research questions. First, did accrual reliability improve in the post-SOX period? Second, do companies receiving higher-quality audits report accruals that are more reliable? Third, did the degree of SOX-related improvement in accrual reliability vary across companies with disparate audit quality? We first demonstrate that accrual reliability increased significantly in the post-SOX period. We next use three metrics for audit quality: audit firm industry specialization, audit-firm independence, and client-specific audit-firm litigation/reputation risk. We find evidence that accrual reliability is positively associated with each of our audit quality metrics. Finally, we find evidence that in the post-SOX period, subsamples of companies experienced more improvement in accrual reliability than others. Specifically, companies audited by non-specialist auditors, those audited by lower-independence auditors, and those that represent higher litigation/reputation risk to their auditor experienced the greatest improvement in accrual reliability in the post-SOX period.

JEL Classification Code: K22, M41, M49

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I. INTRODUCTION

A series of events occurred in the period after 2001 that potentially had the effect of improving the reliability of reported financial information. Following the "dot-com" bust, a number of high-profile audit failures (e.g., Enron and WorldCom), the prosecution and subsequent failure of Arthur Anderson, and the passage of landmark regulatory legislation in the form of the Sarbanes-Oxley Act of 2002 (hereafter, SOX) created both *de facto* and *de jure* changes in the environment in which companies report and audit firms audit. In this study, we address three research questions. First, did the reliability of financial reports (specifically, accruals) improve in the post-2001 period (hereafter, the post-SOX period)? Second, are higher quality audits associated with more reliable accruals? Third, if SOX era reforms altered accrual reliability, how is this related to disparate audit quality?

The first question, dealing with the effects of SOX, is somewhat controversial with divided views among the public, corporate management, auditors, and government leaders. Business leaders have been outspoken in their criticism of SOX, asserting that compliance added significant costs for minimal benefits. Many have been quick to dismiss SOX as unnecessary and overly burdensome, even going so far as to deem it "quack corporate governance" (Romano 2005).

Academic research provides evidence that compensation packages rely less on performance-based compensation in the post-SOX era. Additionally, there are reduced levels of abnormal accruals and a reduced propensity to manage earnings to meet or beat analysts' forecasts in the post-SOX period. However, no study has directly examined potential improvements in accrual reliability in the post-SOX period.

In answering the second question, we extend prior studies that investigate the influence of audit quality on management's financial reporting decisions by examining the effect of audit quality on accrual reliability. The third question provides additional insight by examining interactions between any SOX-related improvements in reliability and audit quality.

We construct a sample of 30,788 audit-client companies over the period 1990 through 2004, with the post-SOX period comprising the final three years of the sample period. We first examine the reliability of accruals in the pre- and post-SOX periods by comparing accrual persistence in each period, with controls for a variety of non-SOX drivers of accrual persistence. We find that accrual persistence is significantly higher in the post-SOX period. This finding is consistent with a SOX-related increase in accrual reliability.

We then partition the entire sample of audit-client companies into high- and low-audit-quality groups using three separate audit-quality variables; we base these variables on audit-firm industry specialization, audit-firm independence, and client litigation and reputation risk, respectively. We compare accrual persistence across each of these partitions. Over the entire sample period, we find that accrual persistence is significantly positively associated with each of the three audit-quality metrics. In the pre-SOX period, we find that industry specialization and portfolio concentration have a significant positive effect on accrual persistence, but audit litigation and reputation risk does not.

Finally, we test whether the post-SOX improvement in accrual persistence differs for our audit-quality groups. We expect significantly greater SOX-related improvement in accrual persistence for the low-specialization, low-independence, and high litigation/reputation risk groups, compared to their counterparts. We base these expectations on the intended effects of the various SOX-era reforms as well as the general reporting environment in the post-SOX period. As expected, we find that the post-SOX improvement is significantly greater for the low independence and high reputation/litigation risk sub-samples when compared to the high independence and low reputation/litigation risk groups, respectively. Contrary to our expectations, the greater improvement found in the low industry-specialization group was not statistically significant.

This study contributes to the SOX and audit-quality literatures in a number of ways. First, we demonstrate a link between SOX-era reforms and higher accrual reliability. Second, we demonstrate a link between audit quality and accrual reliability using three metrics, two of which have not been used for this purpose in prior research: audit-firm industry specialization and client litigation and reputation risk, respectively. The third metric, measuring audit-firm independence, was used by Chambers and Payne (2008) to investigate the influence of audit quality on accrual reliability and resulting differences in accrual mispricing for firms with disparate audit quality. Prior studies have linked audit quality, defined using similar measures as ours, to the variance or magnitude of total accruals and discretionary accruals as well as to analysts' rankings of disclosure quality, reduced instances of financial statement fraud, increased investor response to reported earnings, and reduced levels of financial statement restatements. Third, we provide evidence that SOX-related improvements in accrual reliability differs across the sample's audit quality partitions. The greatest SOX-related improvements occur for companies audited by non-specialist auditors, by auditors with less independence pre-SOX, and by companies with greater litigation/reputation risk to their audit firm.

We organize the paper as follows. Section II contains background discussion and hypothesis development. Section III contains the sample selection process and reports descriptive statistics. Section IV contains research design and results for tests of the effect of the post-SOX period on accrual reliability. Section V contains research design and results for the tests of the effect of audit quality on accrual reliability and tests of whether SOX-related improvement in reliability depends on audit quality. Section VI contains additional and sensitivity analyses and section VII contains concluding comments.

II. BACKGROUND AND HYPOTHESIS DEVELOPMENT

The Sarbanes-Oxley Act of 2002

Congress passed the Sarbanes-Oxley Act (SOX) on April 25, 2002 by near unanimous votes in both the US Senate and House of Representatives. This legislation was in response to a series of financial scandals (e.g., Enron, WorldCom, and the demise of Arthur Andersen) that aroused investors' concerns regarding the reliability of financial reporting. These events occurred subsequent to the dot-com bust in the financial markets and during an economic recession in the US. This regulatory response by Congress is strikingly similar to its reaction to the stock market crash of 1929 and the subsequent economic depression; leading to the passage of the arguably highly successful Securities Act of 1933 and the Securities Exchange Act of 1934.[1]

The Sarbanes-Oxley Act was intended to restore confidence in financial reporting. SOX provides managers incentives to report financial results that truly reflect their company's underlying economic performance (e.g., the Title III, SEC 302 CEO certification requirement). SOX also contains a number of provisions intended to improve the quality of auditing. A primary purpose of SOX is to improve auditor independence and audit quality by means of an

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[1]The delayed response to Hurricane Katrina by government agencies at all levels, and the related public outcry that government was not responsive to citizens in their moment of greatest need, provides an example of the motivation for elected representatives to act swiftly in the presence of an impending financial crisis.

altered auditor-client relationship. The ultimate aim is to increase the reliability of reported financial statements.

Specific provisions intended to impact audit quality include the creation of the Public Company Accounting Oversight Board (PCAOB) to oversee the audits of, and related auditing standards for, publicly traded companies. The creation of the PCAOB was a response to concerns that the Auditing Standards Board (ASB) had been "captured" (in a Stigler (1971) sense) by professionals in the financial reporting community, thereby reducing the ASB's ability to respond quickly and demonstrably to current regulatory needs (although empirical evidence of this is limited, see Puro 1984, 1985).

SOX addressed concerns regarding auditor independence by prohibiting most auditor provided non-audit services. While extant research provides conflicting evidence of the impact of non-audit services on auditor independence (e.g., Frankel et al. 2002; Ashbaugh et al. 2003), it can be argued that these studies investigate independence "in fact." Other studies indicate that investors (Lowe & Pany 1995) and CPAs (Lindberg & Beck 2004) perceive auditor provided non-audit services as reducing the "appearance" of auditor independence.[2] Additional provisions in SOX under Title II and Title III create a much closer relationship between the auditor and the audit committee (required to consist of independent board members) potentially allowing auditors to achieve greater independence from management.

Title III and Title VII of SOX provide additional incentives for clients to cooperate with auditors by requiring that management certify that their financial statements are free of material misstatements with stipulated monetary and criminal penalties for false representations in this

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[2] Coffee (2006) argues that much of the extant research into the effect of non-audit service fees on auditor independence was flawed in that the studies assumed that the absence of non-audit service fees indicated an absence of the economic incentives that lead to impaired independence. Coffee argues that both existing and potential non-audit service fees provide such an economic incentive.

regard. This may align management and auditor incentives to produce financial statements that are free from material misstatements leading to a more reliable presentation of performance to investors. Title IV of SOX, specifically section 404, requires management to report on, and auditors to attest to, the adequacy of a company's system of internal controls.[3]

Initial evidence suggests that SOX has influenced financial markets and management's decision-making. Some early studies find that investors reacted positively (negatively) to initial information indicating the likely passage (defeat) of SOX (Jain & Rezaee 2006; Li et al. 2006). On the other hand, Zhang (2007) finds evidence of negative stock market reactions to key SOX-related legislative events, indicating investors' assessment that SOX represents greater costs than benefits and Engle et al. (2007) find evidence of increased going-private decisions that they interpret as evidence of high SOX-related costs. However, Luez (2007) urges caution in interpreting the results of these two papers as definitive evidence of the costliness of SOX. In any case, evidence on the market's reaction to SOX is mixed and the question of investors' evaluation of SOX is at this point unresolved.

In the post-SOX period, company Boards of Directors modified managements' compensation packages to move toward more fixed (as opposed to performance-based) compensation and managers reduced R&D and capital expenditures in an attempt to reduce the volatility of future earnings (Cohen et al. 2005). Post-SOX financial statements reflect reduced absolute levels of abnormal accruals (Lobo & Zhou 2006; Cohen et al. 2007), with a corresponding increase in real earnings management activities that are perceived as less opportunistic (Cohen et al. 2007). This was accompanied by a reduced propensity of reported

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[3] Section 404 was effective for financial statements issued after November 15, 2004 for large SEC registrants ("accelerated filers with market value exceeding $75 million). However, as a practical matter companies and auditors started the process of implementation soon after the passage of SOX.

earnings to just meet or beat analysts' forecasts (Bartov & Cohen 2006), potentially indicating companies are less likely to engage in opportunistic earnings management.

In addition to these intentional regulatory changes, implementation of SOX resulted in potentially unintended effects that may also improve audit quality. From 2001 to 2004, audit fees increased 104% for companies in the S&P 500 and the proportion of total audit-firm revenues derived from audit services increased from 41% to 82% (Ciesielski & Weirich 2006), as non-audit service fees declined rapidly during this period. As auditors perform additional SOX-related audit procedures, audit firms are now spending more time on, and collecting additional revenues from, financial statement audits. This increase in audit fees provides an improved return on investments in technology and training to improve audit services, making such investments more likely.

We investigate the influence of SOX era reforms on financial reporting reliability by examining the reliability of reported accruals. While errors and misstatements may occur in any part of the financial reports of a company, they are more likely to arise from the accrual and deferral process (hereafter referred to as simply accruals). Accruals are less certain than cash transactions that involve verifiable amounts. In addition, accruals are potentially subject to intentional manipulation to achieve a variety of earnings management goals[4].

Summarizing, the passage of the Sarbanes-Oxley Act led to dramatic changes to existing audit and financial reporting regulations, with the intention of improving the reliability of audited financial statements and the quality of auditing services. While many question the benefits of SOX, existing research indicates that SOX has affected managerial decision-making in general, and more specifically with regard to financial statement presentation decisions. Therefore, we

[4] See Healy and Wahlen (1999) for an extensive discussion of managements' incentives to manage earnings by manipulating accruals and by other means.

expect the reliability of accruals to improve in the post-SOX period when compared to the period before the implementation of SOX. Stated formally:

H1: The reliability of accruals will be significantly greater in the post-SOX period compared to the pre-SOX period.

Audit quality and accrual reliability

Many of the provisions of SOX are intended to improve the quality of financial statement audits. In addition, the auditing environment appears to have changed dramatically during the same period that SOX was enacted and implemented (McConnell and Banks 2003; Koehn and Del Vecchio 2004). Therefore, it seems reasonable that relative audit quality will influence the degree to which the events surrounding and following enactment of SOX affected accrual reliability. In this section, we discuss the role of the financial statement audit and define three constructs designed to characterize different aspects of audit quality, and discuss how these constructs should affect accrual reliability in general, and the change in accrual reliability in the post-SOX period.

Management prepares financial statements that are subject to an audit examination before issuance. The role of the audit, among other things, is to verify and ensure the reliability of financial reporting.[5] Research supports the auditor's ability to influence managements' accounting choices (Antle & Nalebuff 1991; Dye 1991; Gibbins et al. 2001) thereby affecting the final presentation of financial statement balances and increasing the perceived reliability of reported accounting numbers (Elliott & Jacobson 1998; Ryan et al. 2001).[6]

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[5] FASB Concepts Statement 2 (FASB 1980) describes the two primary foundations of quality financial reporting: relevance and reliability. By definition, the role of the auditor is most associated with the qualitative characteristic of reliability. SFAC No. 2 defines reliability as the quality of information that assures that information is reasonably free from error or bias and faithfully represents what it purports to represent.

[6] Auditing services are demanded to reduce contracting costs between investors and management (e.g., Jensen & Meckling 1976). As part of the auditor's role in influencing the reliability of reported accounting numbers, the auditor's opinion identifies

Ideally, a skilled and independent audit firm is able to identify accounting misstatements and exert pressure on the client to correct those misstatements and report reliable financial information (DeAngelo 1981). As a practical matter, the achievement of this ideal depends on characteristics of the audit firm that affect its ability to identify misstatements and to exercise its influence over the client. For example, an audit firm that has built a reputation as an industry leader may have a greater ability to both identify client misstatements and to exert influence over a client to correct those misstatements (Dechow & Schrand 2004).[7] On the other hand, an audit firm that depends a great deal on the client's business may lack independence and be less willing to exert influence over client reporting choices (Reynolds & Francis 2001; Casterella et al. 2004). In this way, audit firm characteristics may be positively or negatively associated with audit quality. In the following discussion, we use three constructs from prior research to capture the potentially conflicting attributes of auditor specialization and independence: industry specialization, auditor independence, and client specific litigation and reputation risk.

Industry specialization

Audit firms have recently increased their emphasis on industry specialization in response to the growing importance placed on understanding their clients' industry by professional auditing standards (e.g., AICPA 2006).[8] Companies within an industry are similar in regards to production, financing, and general economic characteristics; in addition, they are often quite

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material departures from generally accepted accounting principles to allow investors to assess the reliability of management's estimates and representations presented in the financial statements (FASB 1978; Ghosh & Moon 2005). The audit process is a critical component of the financial system's integrity (Olson 2006).

[7] This intuition follows DeAngelo (1981) who shows that audit firm size is a representative proxy for audit quality.

[8] A search of the Handbook of International Auditing, Assurance, and Ethic Pronouncements (IFAC 2007) for "industry" produced 151 references to settings where auditors should consider industry characteristics during the planning, conduct, and reporting from an audit examination. For example, "The establishment of the overall audit strategy involves: …Determining the characteristics of the engagement that define its scope, such as the financial reporting framework used, [and the] **industry-specific** (emphasis added) reporting requirements …." (IFAC 2007).

different from other industries (e.g., financial institutions vs. manufacturing companies). Investment in industry-specific knowledge potentially gives auditors the ability to provide higher quality auditing services (Klein & Leffler 1981; Novak 1998; Hogan & Jeter 1999; Solomon *et al.* 1999; USGAO 2003). Economies of scale in the production of audit services (Casterella et al. 2004) allow investment in improved audit technologies (Dopuch & Simunic 1980, 1982). Specialized auditors appear to have a more developed understanding of accounting practices and industry trends (Maletta & Wright 1996), an increased ability to identify problems within financial statements (Bonner & Lewis 1990; Ashton 1991), an improved ability to recognize industry-specific errors (Wright & Wright 1997), and more certainty in their assessment of audit evidence and the application of financial accounting processes (Taylor 2000). Industry specialists are more effective when working in their area of specialization (Moroney 2007).

Research also provides evidence that specialized auditors are associated with improved client disclosure quality (Dunn & Mayhew 2004), reduced instances of financial statement fraud (Carcello & Nagy 2004), increased investor response to reported earnings (e.g., Balsam et al. 2003), lower levels of discretionary accruals (e.g., Balsam et al. 2003; Krishnan 2003), and reduced levels of financial statement restatements (Stanley & DeZoort 2007). Big N firms[9] organize along industry lines and invest significant resources to develop industry expertise (Solomon et al. 1999).

Investments by audit firms in industry-specialized knowledge are unobservable.[10] However, industry-specific audit-market share is observable and possibly correlated with

[9] Big N is used to represent the largest international accounting firms. In the time period for our study this has changed from six firms in 1989; Pricewaterhouse, Arthur Andersen, Ernst & Young, Deloitte, Coopers and Lybrand, and KPMG to four firms in the post SOX period; Pricewaterhousecoopers, Deloitte, KMPG, and Ernst & Young.

[10] We do not examine firms' self-disclosed specializations because they are not highly correlated with their actual practice and are likely influenced by other factors (Dunn & Mayhew 2004).

significant investment in industry-specific knowledge (e.g., Gramling & Stone 2001; Neal & Riley 2004). Following DeAngelo (1981), we assume that audit firms have incentives to maintain high levels of audit quality as the number and relative size of their clients in a particular industry increases. In particular, maintaining the technical competence to detect industry specific misstatements. We therefore expect that the reliability of accruals will be positively associated with audit-firm industry specialization, measured by market share within the client's industry.

We first investigate the relationship between audit firm specialization and accrual reliability without considering SOX-era reforms. Stated formally:

> H2a: Reported accruals audited by industry-specialists will have higher reliability compared to reported accruals of companies audited by non-specialist audit firms

We next investigate the influence of audit firm specialization on accrual reliability in the pre-SOX period to establish the relationship before the SOX era reforms. Stated formally:

> H2b: During the pre-SOX period, reported accruals audited by industry-specialists will have higher reliability compared to reported accruals of companies audited by non-specialist audit firms

As previously discussed, the SOX era reforms had dramatic effects on the auditing marketplace. The provisions of SOX were intended to improve the quality of all audits. However, we expect this effect to be greater for audits performed by non-specialist audit firms.[11] We investigate this question using three separate hypotheses. The first two hypotheses examine the influence of SOX era reforms on the reliability of accruals associated with audits performed by specialized and non-specialized auditors. We then test if the improvement is greater for non-specialized auditors. Stated formally:

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[11] If H2b holds, this indicates that specialized audit firm are associated with higher levels of accrual reliability pre-SOX. If SOX encourages all firms to reach the same audit quality level, non-specialized firms will have more room for improvement.

H2c: The reliability of accruals reported by companies audited by non-specialist audit firms will significantly increase in the post-SOX period

H2d: The reliability of accruals reported by companies audited by specialist audit firms will significantly increase in the post-SOX period

H2e: Reported accruals audited by non-specialized audit firms will have a greater increase in reliability from the pre-SOX to the post-SOX periods than those audited by industry-specialist audit firms.

Auditor independence

While an audit firm may gain valuable industry-specific expertise when specializing in a particular industry, significant reliance on one industry for audit revenues may reduce the firm's independence. DeAngelo (1981) theorizes that audit quality has two components, the competence to detect misstatements (we proxy with auditor specialization) and the willingness to report them (auditor independence). If a particular client or industry represents a large proportion of an audit firm's total revenue, the audit firm may be less willing to exert influence on client reporting choices. For auditors with a significant proportion of audit revenues from one industry, we suggest that auditor independence is potentially impaired and auditor willingness to correct misstatements is diminished. In this setting, the audit firm's desire to retain a dominant position in an industry that represents a significant economic base for the firm, along with the desire to maintain the return from the related investment in industry specific knowledge, leads to reduced auditor independence (AICPA 1978, 1994; Reynolds & Francis 2001). Therefore, we use a measure of the relative proportion of a firm's audit fees earned from a particular industry (hereafter, portfolio concentration) as an indicator of auditor independence.[12] Note that this does

[12] Chambers and Payne (2008) use the same metric.

not reduce the competence of the auditor, just their willingness to adjust financial reports for misstatements.

There are several reasons to suggest that this industry-level proxy is related to client-specific independence and audit reporting decisions. Specifically, audit firms will aggressively protect their revenue stream for every client in a high revenue industry. First, industry specialists are more efficient when working in specialization (Wright and Wright 1997; Solomon et al. 1999; Low 2004; Cairney and Young 2006). Firms seek additional clients in industries in which existing clients have similar operations (Cairney and Young 2006) suggestive of auditor specialization providing a cost-based competitive advantage by spreading the costs of developing expertise over more clients. Therefore, clients in industries that are significant revenue source for the firm are also potentially the most profitable clients from a fee realization standpoint.[13]

Second, Stein et al. (1994) find that auditors in practice clearly identify the presence of industry differences and the benefits of auditor specialization. Specifically, they note that the impact of risk measurement on audit production varies across industries. This assessment influences the audit team's composition regarding the experience levels utilized. Therefore, staff utilization is not costless to transfer between industries. A loss of any client in an industry significant to a firm can cause inefficiencies in audit production stemming from reassignment of audit team members to (potentially less profitable) clients outside the industry. Significant client loss in key industries for the firm could require a material adjustment to the partner and staff composition of the local office.

Lastly, prior to the implementation of SOX, non-audit services to audit clients represented a significant current and potential revenue source for audit firms. In 2001, the last

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[13] This might be particularly related to small clients where Casterella et al. (2004) document a Big 6 industry specialization audit fee premium that is not present for larger clients.

year before the implementation of SOX, the ratio of non-audit services fees to audit fees for the population of publicly traded companies on Audit Analytics (n= 8,199) was greater than 2 to 1. The significant revenue from these audit clients represents a strong economic incentive to reduce conflicts with audit clients when reporting disagreements arise. This incentive would tend to impair audit-firm independence with respect to these high non-audit service fee clients.

In addition, Coffee (2006) suggests that audit clients that do not currently purchase non-audit services represent fertile ground for marketing of such services. Clients from specialized industries provide the best opportunity for this sort of revenue growth; audit firms' "cross-selling" emphases are more effective in client industries that represent significant revenue sources, as the specialization developed in these industries will allow more non-audit services to be proposed (Lim and Tan 2008).

Consequently, audit independence may become impaired due to the economic incentives inherent in audit clients' currently paying high non-audit service fees and the potential for additional audit and non-audit service fees from audit clients that do not currently contract for non-audit services. The need to cultivate a positive relationship with clients to maintain or increase audit and non-audit services could affect auditor behavior and impair independence as audit partners were increasingly rewarded for new revenue generation and penalized for failure to produce new revenue from existing clients (Zeff 2003). A final constraint on auditor independence is the concern that audit fees were often "low-balled" to gain access to more lucrative and profitable non-audit service fees, even from seemingly small clients (Parker 2002).[14]

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[14] Another risk is that other clients in the industry might alter their perceptions of the audit firm's expertise as other clients change auditors, leading to additional client losses or reduced fees on existing clients. For this reason, we believe that audit firms

For all of these reasons, we assert that while the loss of one particular client in a significant industry may be insignificant in and of itself, this loss eliminates not only existing client revenues, but the availability of additional new revenues from the provision of additional services. Client loss can reduce the efficiency of audit production as resources are redirected to less profitable alternative uses and lead to the loss of very profitable non-audit service fees (Simunic 1984).

Firms with significant portfolio concentration are likely to have the competence to identify general and industry-specific misstatements.[15] However, impaired independence due to the economic pressures of maintaining industry portfolio concentration may reduce the firm's ability or willingness to influence the client to correct the misstatements. Therefore, we expect accruals reported by companies audited by firms with relatively greater independence (low portfolio concentration) will have higher reliability compared to accruals reported by companies audited by firms with relatively lower independence (high portfolio concentration). We test this expectation by first examining the relationship between audit firm independence and accrual reliability without considering the SOX era reforms. Stated formally:

H3a: Reported accruals audited by audit firms with low portfolio concentration (i.e., greater independence) will have higher reliability compared to reported accruals of companies audited by audit firms with higher levels of portfolio concentration (i.e., less independence).[16]

We next consider the differential influence of audit firm portfolio concentration in the pre- and post-SOX periods. As mentioned earlier, many of the provisions of SOX were directed

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will want to protect their standing in an industry in which they have a significant presence by protecting their relationship with each individual client in that industry to eliminate potential contagion effects to their portfolio concentration.

[15] Neal and Riley (2004) recommend examining both relative audit-market share and portfolio concentration as metrics for industry specialization; the appropriate application of each is not easy to determine and the metrics are not highly correlated (see Krishnan 2001) Our measures of audit-market share (*SPEC*) and portfolio concentration (*IND*) have a correlation of -0.19 (Table 2).

[16] This hypothesis replicates a similar one in Chambers and Payne (2008) for which they find strong support.

toward improving audit quality by increasing auditor independence, specifically the ban on non-audit services and the implementation of a direct communication channel with the audit committee allowing auditors to bypass management in their discussions of potentially contentious financial reporting and control issues. In the post-SOX era, the audit committee hires the audit firm, not company management or the Board of Directors. Therefore, the effect of SOX may be to improve the independence of audit firms, regardless of the level of portfolio concentration. As with H2, we investigate this question using separate hypotheses. The next hypothesis investigates the relationship between accrual reliability and audit firm portfolio concentration in the pre-SOX era.

H3b: During the pre-SOX period, reported accruals audited by audit firms with low portfolio concentration (i.e., greater independence) will have higher reliability compared to reported accruals of companies audited by audit firms with higher levels of portfolio concentration (i.e., less independence).

The next two hypotheses examine the influence of SOX era reforms on the reliability of accruals associated with audits performed by audit firms with low and high levels of portfolio concentration. We then test if the improvement is greater for auditors with high portfolio concentration.[17] Stated formally:

H3c: The reliability of accruals reported by companies audited by audit firms with high portfolio concentration will significantly increase in the post-SOX period

H3d: The reliability of accruals reported by companies audited by audit firms with low portfolio concentration significantly increase in the post-SOX period

H3e: Reported accruals audited by audit firms with high portfolio concentration will have a greater increase in reliability from the pre-SOX to the post-SOX periods than those audited by audit firms with low portfolio concentration.

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[17] If H3b holds, this indicates that audit firms with high portfolio concentration are associated with lower levels of accrual reliability pre-SOX. If SOX encourages all firms to reach the same audit quality level, these firms will have more room for improvement.

Auditor litigation and reputation risk

Reynolds and Francis (2001) find that litigation and reputation risk attenuates the independence risk from portfolio concentration as specialist auditors are more likely to be concerned about reputation losses and litigation exposure (Lim and Tan 2008).[18] Large clients for an audit-firm office can create economic dependence that is not diversifiable by having more clients in other firm offices. However, a large client can also pose substantial litigation and reputation risk. An incentive of audit partners is to maximize audit firm office profitability (Reynolds and Francis 2001) considering both the revenue and potential costs represented by a client. An audit failure on a large publicly visible client can lead to significant reputation loss. Additionally, litigation costs are greater for larger clients (e.g., Bonner et al. 1998; Lys and Watts 1994). Reynolds and Francis (2001) find evidence that reputation protection and litigation concerns outweigh other economic incentives, leading to more conservative auditor decision for an audit-firm office's largest clients.

As noted previously, if SOX era reforms influenced financial reporting behavior, we expect to see an overall increase in accrual reliability (H1). Here we investigate accrual reliability considering the client's effect on an audit firm's litigation and reputation risk. Not considering the SOX era reforms, we expect accruals reported by companies that pose a significant litigation and/or reputation risk to their auditor will have higher reliability compared to accruals reported by companies that pose relatively less litigation and/or reputation risk to their auditor. Stated formally:

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[18] Reynolds and Francis (2001) use a city-specific (as opposed to a national) measure to proxy for portfolio concentration. We follow their research design in our examination of the influence of litigation and reputation risk on auditor behavior.

H4a: Accruals reported by companies that pose a significant litigation and/or reputation risk to their auditor will have higher reliability compared to accruals reported by companies that pose relatively less litigation and/or reputation risk to their auditor

We next consider the differential influence of audit firm litigation risk and reputation concerns on accrual reliability in the pre- and post-SOX periods. Here we expect the public outcry for justice from the losses created by the financial scandals that lead to the passage of SOX (e.g., ENRON) and the significant losses from lawsuits stemming from these cases, as well as the lengthy jail sentences imposed upon management involved in the deception, and the demise of Arthur Andersen to significantly increase the salience of the litigation risk and reputation concerns for management and auditors, post SOX. We expect SOX to improve the quality of all audits (H1), but expect this effect to be greater for audits of clients that represent more reputation and litigation risk for the audit firm. We first investigate the influence of reputation and litigation risk on accrual reliability in the pre-SOX period to establish the relationship before the SOX era reforms. Reynolds and Francis' (2001) use data from one year in the pre-SOX era. Based on their results that litigation and reputation risk encourage more conservative auditor decisions and financial reporting, we expect the relationship predicted in H4a to hold in the pre-SOX period. Stated formally:

H4b: During the pre-SOX period, accruals reported by companies that pose a significant litigation and/or reputation risk to their auditor will have higher reliability compared to accruals reported by companies that pose relatively less litigation and/or reputation risk to their auditor

The next three hypotheses examine the influence of SOX era reforms on the reliability of accruals associated with audits performed by audit firms for clients with lower and higher levels of litigation and reputation risks. We then test if the improvement from SOX era reforms is greater for auditors with greater levels of litigation and reputation risk. We expect that SOX era reforms improved the quality of all audits. However, we expect this effect to be greater for audits performed on clients that create significant litigation or reputation risk for their auditor.

Stated formally:

H4c: The reliability of accruals reported by companies that pose a significant litigation and/or reputation risk to their auditor will significantly increase in the post-SOX period

H4d: The reliability of accruals reported by companies that pose relatively less litigation and/or reputation risk to their auditor will significantly increase in the post-SOX period

H4e: Accruals reported by companies that pose a significant litigation and/or reputation risk to their auditor will have a greater increase in reliability from the pre-SOX to the post-SOX periods than those that pose relatively less litigation risk to their auditor

Measuring Accrual Reliability

The reliability of accruals is not directly observable. However, our hypothesis tests do not require a direct measure of accrual reliability. They only require a comparison of the relative reliability of accruals across groups of sample companies and across time. Two prominent studies have implemented empirical proxies for measuring the relative reliability of accruals. Dechow and Dichev (2002) measure the reliability (they use the term "quality") of accruals using a time series regression of total accruals on current, lagging, and leading cash flows. Unfortunately, this methodology is not compatible with comparisons of accrual reliability across time. Richardson et al. (2005) measure the relative reliability of accruals by estimating earnings-persistence regression coefficients and comparing their magnitude; we use this empirical proxy to test our hypotheses.[19] Following Richardson et al. (2005), Chambers and Payne (2008) use accrual persistence as their measure of accrual reliability when examining differences in accrual

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[19] Please see the appendix for a more detailed discussion of Richardson et al. (2005) and their analytical motivation for using relative accrual persistence as a measure of relative accrual reliability.

mispricing due to reliability differences arising from disparate audit quality. By comparing accruals coefficients across subsets of companies based on audit quality and time, we test for differences in accrual reliability due to audit quality and SOX.

Other determinants of accrual persistence

In order to construct an unambiguous test of relative accrual reliability using accrual persistence coefficients, it will be important to control for other determinants of accrual persistence that may systematically differ across groups of companies and across time. Dechow and Dichev (2002) discuss a number of company-specific characteristics that are likely to be associated with accrual persistence, but unrelated to the effect of SOX or the role of auditors in detecting reporting errors and misstatements. First, companies with longer operating cycles are more likely to have lower accrual persistence. Longer operating cycles indicate greater uncertainty and greater use of approximations and estimations in accruals. Second, smaller companies are more likely to have lower accrual persistence compared to larger companies. Larger companies have more stable and diversified operations and therefore more persistent accruals. Third, companies with greater sales volatility are likely to have lower accrual persistence. Volatile sales may indicate a more volatile operating environment that forces a greater use of approximations and estimations in accruals. Fourth, and for the same reasons, companies with greater cash flow volatility are likely to have lower accrual persistence. Finally, companies reporting losses are likely experiencing a severe negative shock in their operating environment. Accruals made in response to these conditions likely involve lower accrual persistence. Dechow and Dichev (2002) find evidence that each of these characteristics, to varying degrees, is associated with accrual quality.[20] In addition to the characteristics suggested by Dechow and Dichev, we expect that a company's relative riskiness may affect the persistence of their accruals. Therefore, we will also control for book-to-market ratio as a general measure of company-specific risk (Fama and French 1993). Since each of these company-specific characteristics may have an effect on accrual persistence and may differ systematically across groups of sample firms and across time, we control for these characteristics in our tests of differential accrual persistence.

III. DATA AND SAMPLE SELECTION

We first obtain data from the 2006 Compustat database over the data years 1989 through 2004.[21] All NYSE/AMEX/NASDAQ companies with available industry information (Compustat item "DNUM"), audit-firm information (Compustat item 149), total assets (item 6), and company location in these data years are included in the calculation of audit-firm industry specialization, auditor independence, and auditor litigation and reputation risk. Because actual audit fee data has limited availability for the pre-SOX period, we use the client company-year's total assets to proxy for audit revenue (Simunic 1980).[22] We calculate the square root of total

[20] Dechow and Dichev (2002) identify three additional variables that affect accrual quality: accrual volatility, earnings volatility, and accrual magnitude. We do not control for these variables because, unlike the variables we adopt, they measure characteristics of accruals themselves rather than non-accrual characteristics that might affect accruals persistence. Including these three variables would inappropriately control for the hypothesized relations; this would amount to "throwing the baby out with the bathwater."

[21] We limit ourselves to the period after 1989 because it is likely that industry specialization will be less useful as a proxy for audit quality in years earlier than 1989. Significant audit firm investment in industry-specific knowledge was not as common before that time (Emerson 1993; Hogan and Jeter 1999).

[22] As a specification check of our use of total assets as a proxy for audit fees, we calculated the correlation between total assets and actual audit fees for sample company-years with available data (primarily those observations in the post-SOX period). We find that total assets and actual audit fees are highly correlated (Pearson correlation equal to 0.70 and Spearman correlation equal to 0.78).

assets by industry, by auditor, by auditor within industries, and by auditor within Metropolitan Statistical Area (MSA).[23]

We then form three dichotomous variables (*SPEC*, *IND*, and *LITRISK*) designed to measure our three audit quality constructs: audit-firm industry specialization, audit-firm independence, and audit-firm litigation and reputational risk, respectively. We construct *SPEC* by first calculating the audit firm's share of the company-year's two-digit SIC industry (e.g., Audit Firm A collected 26% of the total audit fees paid by companies in two-digit SIC industry 50 in 1999). Following Palmrose (1986, p 104), we define industry specialists as audit firms that have a market share of at least 120 percent of an equal division of market share among the Big N firms existing at that time. Specifically, when the audit firm's market share is greater than 1/6*1.2 (20%) for 1989-1997, 1/5*1.2 (25%) for 1998-2001, or 1/4*1.2 (30%) for 2002-2005, *SPEC* is coded one, and zero otherwise. This method has the advantage that it controls for the consolidation of the Big N firms from six in 1989 to four in 2002.

We construct *IND* by first calculating audit-firm portfolio concentration, equal to the proportion of the audit firm's total audit revenue derived from the company-year's two-digit SIC industry (e.g., 14% of Audit Firm A's audit revenues are earned in the two-digit SIC industry 50 in 1999). Prior studies indicate that audit fees paid to an auditor are a reliable measure for auditor reliance, or economic dependence, on a client or particular industry (Simunic 1984; Reynolds & Francis 2001; Chung & Kallapur 2003). In addition, as discussed in section 2, portfolio concentration should indicate the audit-firm's reliance on higher-than-average non-audit-services revenue from these clients and the potential for further marketing of such services.

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[23] A Metropolitan Statistical Area (MSA), as defined by the US Census Bureau, is a metropolitan area that comprises a single economic region. We match company-specific zip codes from Compustat to a taxonomy relating MSAs to zip codes provided by the US Census Bureau to identify each sample company's MSA (the taxonomy is located at http://www.census.gov/population/estimates/metro-city/99mfips.txt).

We define a high independence audit firm as one that has portfolio concentration less than 3/(number of two-digit SIC industry codes used in analysis) (for 1989-1997, 59; 1998-2001, 56; and 2002-2005, 51).[24] *IND* is coded one when portfolio concentration is less than the benchmark; otherwise, *IND* is coded zero, indicating potentially impaired independence.[25]

Finally, we construct *LITRISK* by calculating the relative within-office client size. We calculate this based on the sample company's audit fees, as a proportion of audit firm's total audit revenue from clients within the company's MSA. This measure is very similar to the measure hand collected by Reynolds and Francis (2001) designed to measure both within-office client influence as well as auditor litigation and reputation risk. When that proportion is in the top quintile of the sample, *LITRISK* is coded one; otherwise it is coded zero.

In order to ensure that the relationship between audit firm and client-company is well established at the beginning of the fiscal year, we assign each company-year the *SPEC*, *IND*, and *LITRISK* metrics calculated for that company's auditor in the prior fiscal year.[26]

We then screen sample company-years for required financial statement data in the prior, current and subsequent years. We base the earnings and accruals variables used in this study on

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[24] Using 3/(# of SIC industries) reduces the number of high portfolio concentration observations. Prior research's use of 1/(# of SIC industries) is unlikely to capture a significant client as a client industry's fees would only have to be greater than $1/59^{th}$ of the firm's fees (for example in the 1989-1997 time period), thereby creating a high percentage of observations identified as having concentrated portfolios as noted by Neal and Riley (2004), 67 percent for our sample. Using the higher cutoff classifies only 25 percent of our sample as high portfolio concentration firms.

[25] As a specification check, we examined the ratio of non-audit-service fees to audit fees for sample firms where such data is available from Audit Analytics. This data is available for some of our sample for the years 2000 through 2004. We find that low *IND* companies pay significantly greater non-audit-service fees to their auditors than high *IND* companies, as expected. In 2000, low (high) *IND* companies paid 1.47 (1.05) times their audit fees in non-audit-service fees to their audit firm (this difference is statistically significant, $t = 3.74$). In 2001, low (high) *IND* companies paid 1.12 (0.91) times their audit fees in non-audit-service fees to their audit firm (this difference is also statistically significant, $t = 3.13$). The difference becomes insignificant as the provisions of SOX are implemented prohibiting non-audit-service fees from audit clients (the ratio of non-audit-service fees to audit fees drops to 0.24 and 0.27 for low and high *IND* companies, respectively in 2004).

[26] This lagging procedure requires eliminating the first year of data (1989) and any company-years that changed auditors. While this procedure introduces potential classification errors that may affect our results, their effect should tend to work against finding evidence consistent with our hypotheses. We believe that the benefits of the lagging outweigh the potential costs. When we re-estimate the main results in the paper using contemporaneous classifications, we find no differences in our inferences (with statistical tests being slightly weaker).

Richardson et al. (2005). *Earnings* is equal to income before extraordinary items (Compustat item 18), scaled by average total assets (item 6). Total accruals (*TACC*) is equal to the change in total assets (item 6), minus the change in cash and short-term investments (item 1), plus the change in short-term investments (item 193), minus the changes in total liabilities (item 181) and preferred stock (item 130), all scaled by average total assets (item 6). Cash flows (*CF*) is equal to *Earnings*, less *TACC*.[27]

We define six variables designed to control for company-specific characteristics that may affect accrual persistence. *OPCYCLE* is the sample company's operating cycle, in days. Following Dechow and Dichev (2002), *OPCYCLE* is calculated as follows:

$$OPCYCLE = \left[\frac{(AR_t + AR_{t-1})/2}{Sales/360}\right] + \left[\frac{(Inv_t + Inv_{t-1})/2}{COGS/360}\right] \quad (1)$$

Where *AR* is accounts receivable (Compustat item 151), *Inv* is inventory (item 3), and *COGS* is cost of goods sold (item 41). *SIZE* is equal to the square root of total assets (this measure of company size is aligned with our proxy for audit fees) . $|\Delta Sales|$ is the absolute value of the change in sales (item 12) scaled by average total assets (item 6); this is designed to measure volatility in sales. $|\Delta CF|$ is equal to the absolute value of the change in *CF*; this variable is designed to measure the volatility of cash flows. *LOSS* is a dummy variable coded one if *Earnings* is less than zero and coded zero otherwise. *BM* is equal to book-to-market ratio at fiscal-year-end. Overall, our data requirements yield a sample of 30,788 company-years, representing 5,205 companies, over the fifteen-year period 1990 through 2004. Yearly subsamples range from 1,575 in 1990 to 2,535 in 1997.

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[27] Richardson et al. (2005) use data item 178 as their measure of earnings. We choose data item 18 because it is a better match to their measure of total accruals. Using a more inclusive measure of earnings will allow more intuitive interpretations of regression coefficients.

Table 1, panel A contains distributional statistics for the study variables. The median firm's earnings represent 3.4 percent of total assets, while median total accruals equal 3.6 percent of assets. Mean *Earnings* are slightly negative, reflecting the skewing effects of extreme negative observations. The mean *SPEC* of 0.263 indicates that 26.3 percent of the sample companies are audited by industry specialists. In the same way, the mean *IND* of 0.749 indicates that 74.9 percent of sample companies are audited by firms with unimpaired independence. Finally, the mean *LITRISK* of 0.203 indicates that 20.3 percent of sample companies are identified as companies that represent high auditor litigation or reputational risk.

Table 1, panel B contains variable medians calculated in the pre- and post-SOX period. *Earnings* are nearly identical in the pre- and post-SOX periods. However, median *CF* and *TACC* are somewhat lower in the post-SOX years (t-statistics of -4.25 and -4.79, respectively).[28] Each of the median control variables are significantly different in the post-SOX period.[29]

Table 2 contains Spearman correlations between selected study variables, along with p-values in parentheses. The correlations between the financial statement variables and the audit quality variables are reported below the diagonal. Most of the correlations are statistically significant but very low. The correlations between *Earnings* in period t+1 and both *CF* and *TACC* are positive, as expected. Consistent with prior research and with the role of accruals, the correlation between *CF* and *TACC* is significantly negative. The audit quality variables are not highly correlated with each other or with the financial statement variables. The correlations

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[28] The t-statistics and medians reported in this table are generated by randomly assigning the sample companies into 100 equal groups. The reported medians are the average of the group medians and the t-statistics are based on the standard errors across the groups. This method is analogous to the Fama-MacBeth method for generating t-statistics across yearly regression coefficients.

[29] We do not report median *LOSS*, *SPEC*, *IND*, and *LITRISK* because they are the same in both periods. However, a comparison of means reveals that LOSS equals one for 29.9 percent of the sample pre-SOX and 35.9 percent post-SOX. SPEC equals one for 27.4 percent of the sample pre-SOX and 20.7 percent post-SOX. IND equals one for 74.0 percent of the sample pre-SOX and 79.1 percent post-SOX. Finally, LITRISK equals one for 20.4 percent of the sample pre-SOX and 19.3 percent post-SOX.

between *IND* and both *SPEC* and *LITRISK* are negative. This is not surprising since larger firms would tend to be classified as high *SPEC* and *LITRISK*, but low *IND*.

Correlations between the financial statement variables and the control variables are reported above the diagonal. Not surprisingly, *LOSS* is negatively correlated with one-year-ahead *Earnings*, *CF*, and *TACC*. *LOSS* is also negatively correlated with *SIZE*. Cash flow volatility ($|\Delta CF|$) is negatively correlated with *CF* and positively correlated with *LOSS*. *SIZE* is negatively correlated with both cash flow and sales volatility, which confirms our intuition that larger firms will have less volatile economic environments.

IV. TESTS OF THE EFFECT OF SOX ON ACCRUAL RELIABILITY

Research design

We test H1 by estimating a regression of one-year-ahead *Earnings* on current *CF* and *TACC*, with separate coefficients estimated pre-SOX and post-SOX. We then compare the pre- and post-SOX accrual persistence coefficients. We expect the persistence of accruals will be greater in the post-SOX period.

$$Earnings_{t+1} = \alpha_0 + D_{pre}\left(\alpha_1^{pre} CF_t + \alpha_2^{pre} TACC_t\right) + D_{post}\left(\alpha_1^{post} CF_t + \alpha_2^{post} TACC_t\right) + \sum_{k=1}^{6} \alpha_{k+2}(Control_k * TACC_t) + \varepsilon \quad (2)$$

The dummy variable D_{pre} is equal to one if the year equals 1990 through 2001, and zero otherwise. Similarly, D_{post} is equal to one if the year equals 2002 through 2004, and zero otherwise. As described in the previous section, accrual persistence can differ between firms due to economic factors that may systematically differ in the pre- and post-SOX periods. Therefore, we include six control variables that interact with *TACC* to control for non-SOX-related persistence differences.[30] Based on Dechow and Dichev (2002), we would expect the coefficient on the SIZE interaction to be positive, while the other five control-variable coefficients would be negative. However, because a number of these control variables are correlated with one another, these univariate predictions may not hold; therefore, no formal predictions are made about the direction or magnitude of the control-variable coefficients.

The *CF* coefficients ($\alpha_1^{pre}$and α_1^{post}) measure the persistence of cash flows with respect to one-year-ahead *Earnings*. Similarly, the *TACC* coefficients ($\alpha_2^{pre}$and α_2^{post}) measure the persistence of accruals. H1 will be supported if $\alpha_2^{post} > \alpha_2^{pre}$. In addition, based on the results of Sloan (1996) and Richardson et al. (2005), we expect the *TACC* coefficients to be significantly lower than the *CF* coefficients. This will be consistent their findings that the reliability of total accruals is lower than the reliability of cash flows.

Results

Table 3 reports the results from estimating regression (2). The table reports two versions of this regression; the first set of results excludes the control variables while the second set includes them. The post-SOX accrual coefficient (α_2^{post}) is significantly greater than the pre-SOX coefficient(α_2^{pre}) in both the uncontrolled and controlled versions of the regression (t-statistics of 1.80 and 2.03, respectively).[31] This finding supports H1; the reliability of accruals

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[30] We convert the six control variables to fractional ranks before interacting them with TACC. Using fractional ranks (that range from zero to one) allow interpretation of the interaction coefficients as incremental persistence coefficients.

[31] The study sample may contain up to 15 company-year observations from a single company. Correlations between these observations violate independence assumptions of OLS. In addition, the sample is significantly heteroskedastic ($\chi^2 = 406.19$, $p < 0.0001$). Therefore, the t-statistics reported in Table 3, and the rest of the study, are corrected for both heteroskedasticity and for lack of within-company independence in the study sample. These Huber-White t-statistics are calculated based on Diggle et al. (1994).

improved in the post-SOX period, compared to the pre-SOX period, after controlling for other sources of differential persistence.[32]

We next examine the efficacy of our control variables. In the uncontrolled regression, in both the pre- and post-SOX periods, the coefficient on *TACC* is significantly smaller than the *CF* coefficient (t-statistics of 3.04 and 4.03, respectively). This is consistent with the results in prior studies, particularly Sloan (1996) and Richardson et al. (2005). This difference disappears when we add the control variables to the regression. This is not surprising because these variables are controlling for the economic factors that cause the persistence of accruals to be lower than that of cash flows. Five of the six control variables have statistically significant coefficients; only *OPCYCLE* interaction has an insignificant coefficient. For the most part the coefficients have the expected sign; the exceptions are the *SIZE* and |*ΔCF*| interactions.

V. AUDIT QUALITY, ACCRUAL RELIABILITY, AND THE EFFECT OF SOX

Descriptive statistics

Table 4 reports comparative medians across the audit quality measures. Panel A compares variable medians between low and high *SPEC* subsamples. All of the differences are statistically significant. However, not all the differences are large enough to be considered economically significant. Median *Earnings*, *TACC, BM,* |*ΔSales*|*, and OPCYCLE* are relatively

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[32] Interestingly, the cash flow coefficient is also significantly greater in the post-SOX period compared to the pre-SOX period. This implies that economic conditions in the post-SOX period caused cash flow persistence to increase. When control variables are interacted with *CF* and added to the regression to control for these economic effects, the difference between the pre- and post-SOX *CF* coefficients is no longer statistically significant. However, H1 is still supported after the *CF* controls are added.

similar for each subsample. However, the differences in median *CF*, |*ΔCF*|, and *SIZE* are both statistically and economically significant.

Panel B reports similar comparative medians across the *IND* subsamples. Once again, all of the differences are statistically significant. The differences in median *Earnings*, *CF*, *TACC*, and |*ΔSales*| appear to also be large enough to be considered economically significant. Finally, Panel C reports median differences across the *LITRISK* partition. These differences all appear to be both statistically and economically significant. High *LITRISK* companies have higher *Earnings* and *CF*, and lower *TACC*. They have higher book-to-market risk, lower cash flow and sales volatility, shorter operating cycles, and are significantly larger. The significant differences in the control variable medians in each of the panels demonstrate the importance of controlling for these economic drivers of accrual persistence when comparing accrual persistence across audit quality groups.

Research design

In order to examine how audit quality affects accrual reliability, we estimate the following regression.

$$Earnings_{t+1} = \beta_0 + \beta_1 CF_t + \beta_2 TACC_t + \beta_3 \left(AQ^j_{t-1} * TACC_t\right) + \sum_{k=1}^{6} \beta_{k+3} (Control_k * TACC_t) + \varepsilon \quad (3)$$

AQ^j represents one of the three audit-quality measures discussed above: *SPEC*, *IND*, or *LITRISK*. Therefore, we estimate regression (3) three times, once for each of the three measures.[33] The coefficient on the interaction of AQ^j with *TACC* (β_3) measures the incremental accrual persistence for the high-*SPEC*, *IND*, or *LITRISK*, compared to the respective low group. β_3 will

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[33] We also estimated a combined regression that simultaneously estimates all three audit-quality interactions. The inferences from the combined regression are the same as those from the individual regressions reported in the paper.

be significantly positive if the high-*SPEC*, *IND*, or *LITRISK* group has higher accrual reliability. We test H2a, H3a, and H4a by comparing β_3 with zero in each of the three estimations of regression (3).

We then estimate the following regression to measure the effect of each audit quality metric on accrual reliability separately in the pre- and post-SOX periods.

$$Earnings_{t+1} = \gamma_0 + D_{pre}\left(\gamma_1^{pre} CF_t + \gamma_2^{pre} TACC_t + \gamma_3^{pre}\left[AQ_{t-1}^{j} * TACC_t\right]\right) + D_{post}\left(\gamma_1^{post} CF_t + \gamma_2^{post} TACC_t + \gamma_3^{post}\left[AQ_{t-1}^{j} * TACC_t\right]\right) + \sum_{k=1}^{6} \gamma_{k+3}(Control_k * TACC_t) + \varepsilon \quad (4)$$

Regression (4) repeats the tests for incremental persistence due to higher audit quality, making separate estimates for the pre- and post-SOX periods. The coefficients on the interactions of AQ^j with *TACC* (γ_3^{pre} and γ_3^{post}) measure the pre- and post-SOX, respectively, incremental accrual persistence for the high-*SPEC*, *IND*, or *LITRISK* group, compared to the low group. We test H2b, H3b, and H4b by comparing γ_3^{pre} to zero.

The coefficients on *TACC* (γ_2^{pre} and γ_2^{post}) can be interpreted as accrual persistence for the low-*SPEC*, *IND*, or *LITRISK* group. We test H2c, H3c, and H4c by comparing γ_2^{post} to γ_2^{pre}. The coefficient sums ($\gamma_2^{pre} + \gamma_3^{pre}$) and ($\gamma_2^{post} + \gamma_3^{post}$) measure total accrual persistence for the respective high group. We test H2d, H3d, and H4d by comparing ($\gamma_2^{post} + \gamma_3^{post}$) with ($\gamma_2^{pre} + \gamma_3^{pre}$). Finally, we test H2e, H3e, and H4e by comparing the difference in the improvement in accrual reliability, due to SOX, between the low and high audit-quality groups; specifically, we test $\gamma_2^{post} - \gamma_2^{pre} = (\gamma_2^{post} + \gamma_3^{post}) - (\gamma_2^{pre} + \gamma_3^{pre})$.

Results

Tests of H2a through H2e

Table 5, Panel A reports the results from estimating regressions (3) and (4) using *SPEC* as the audit-quality measure. H2a predicts that β_3 will be significantly positive. That is, that high-*SPEC* companies (i.e., those companies audited by industry-specialist audit firms) will have significantly higher accrual persistence over the entire study period. We find that β_3 is significantly positive (0.048, t-statistic = 2.21), supporting H2a. H2b predicts that γ_3^{pre} will be significantly positive. We find that this is true (0.054, t-statistic = 2.33) indicating support for H2b.

Although we make no hypothesis regarding γ_3^{post} (measuring the incremental effect of industry specialization on accrual persistence in the post-SOX period), it is interesting that this coefficient is insignificantly different from zero (0.013, t-statistic = 0.26). This finding is consistent with industry specialization being less predictive of higher audit quality in the post-SOX period. Since it is doubtful that in the post-SOX period industry specialization has lost its beneficial effects, the most likely reason for the insignificant γ_3^{post} is a SOX-related improvement in the quality of audits for low-*SPEC* companies that "closes the gap" between low- and high-*SPEC* companies. We will gain insight into this possible explanation by testing H2c through H2e.

We test H2c by comparing the pre- and post-SOX accrual persistence estimates for the low-*SPEC* companies to see if the post-SOX persistence coefficient is significantly greater than the pre-SOX coefficient ($\gamma_2^{pre} < \gamma_2^{post}$). We find, consistent with this hypothesis, that the post-SOX accrual persistence for low-*SPEC* companies is significantly greater than in the pre-SOX period (difference of 0.105, t-statistic = 2.30). However, our test of H2d, that the SOX-related change in accrual persistence for the high-*SPEC* group will also significantly increase, is not supported (0.064, t-statistic = 1.06). Finally, we test H2e by comparing the SOX-related improvement in accrual persistence for low- and high-*SPEC* groups; in other words, $\gamma_2^{post} - \gamma_2^{pre} > (\gamma_2^{post} + \gamma_3^{post}) - (\gamma_2^{pre} + \gamma_3^{pre})$. We find that the improvement for the low-*SPEC* group is greater than for the high-*SPEC* group, but the difference is not statistically significant (0.041, t-statistic = 0.76). Therefore, we find no significant support for H2e.

Summarizing our results with respect to our *SPEC* partition, we find support for H2a and H2b, that high-*SPEC* companies report accruals with significantly greater persistence overall and during the pre-SOX period. These results are consistent with our expectations that high-*SPEC* companies report more reliable accruals compared to low-*SPEC* companies. We also find support for H2c that the low-*SPEC* group experienced a significant increase in accrual persistence in the post-SOX period. This result is consistent with a significant increase in accrual reliability, in the post-SOX period, for the low-*SPEC* companies. However, we find no support for either H2d or H2e. Accruals reported by high-*SPEC* companies did not have increased persistence in the post-SOX period. Surprisingly, the relative improvement of the two groups are not significantly different (H2e). These latter results are generally consistent with the improvement in low-*SPEC* company accruals "closing the reliability gap" with the high-*SPEC* companies in the post-SOX period.

Tests of H3a through H3e

Table 5, Panel B reports the results of estimating regressions (3) and (4) using *IND* as the audit-quality measure. H3a predicts that β_3 will be significantly positive. That is, high-*IND* companies (i.e., those companies audited by relatively independent audit firms) will have significantly higher accrual persistence over the entire study period. We find that β_3 is positive and statistically significant (0.087, t-statistic = 3.90), supporting H3a.[34] H3b predicts a similar finding in the pre-SOX period; in other words, γ_3^{pre} will be positive and statistically significant. We find that γ_3^{pre} is significantly positive (0.099, t-statistic = 3.89), supporting H3b. These two results indicate that high-*IND* companies report accruals that are more reliable than those of the low-*IND* companies over the entire study period and in the pre-SOX period.

Once again we also find that γ_3^{post} is not significantly positive (0.003, t-statistic = 0.08). Although we make no predictions for this coefficient, the insignificant coefficient is consistent with there being no significant difference between the accrual reliability of low- and high-*IND* companies in the post-SOX period. Such a null result may be due to a SOX-related increase in the accrual reliability of the low-*IND* companies that closes the gap that existed between low- and high-*IND* companies in the pre-SOX period.

H3c predicts that the accrual persistence of the low-*IND* companies will significantly increase in the post-SOX period. Consistent with H3c, we find a significant difference between γ_2^{post} and γ_2^{pre} (0.157, t-statistic = 3.16). However, we find only marginal support for H3d. The high-*IND* increase in accrual persistence in the post-SOX period is equal to 0.061 (t-statistic = 1.26, p = 0.104). This result is consistent with only modest improvement in accrual reliability for the high-*IND* group in the post-SOX period. Finally, H3e predicts that the SOX-related improvement in accrual persistence will be significantly greater for the low-*IND* group compared to the high-*IND* group. We find support for H3e, with the low-*IND* increase in persistence being 0.096 (t-statistic = 2.01) greater than the high-*IND* increase in persistence.

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[34] Our findings for H3a mirror those in Chambers and Payne (2008) where they find significant differences in accrual reliability for groups of companies with auditors having high or low portfolio concentration in the company's industry.

In summary, we find significant evidence supporting H3a and H3b. This is consistent with high-*IND* companies reporting significantly more reliable accruals overall, consistent with Chambers and Payne (2008), and in the pre-SOX period, not examined by Chambers and Payne (2008). We also find support for H3c, consistent with a significant improvement in accrual reliability in the post-SOX period for the low-*IND* group. We find only marginal support for H3d, but significant support for H3e. These results are consistent with only modest SOX-related improvement in accrual reliability for the high-*IND* group and with significantly greater improvement for the low-*IND* group. Once again, these results are consistent with the improvement in low-*IND* accrual reliability "closing the reliability gap" that existed between the low- and high-*IND* groups in the pre-SOX period.

Tests of H4a and H4b

Table 5, Panel C reports the results of estimating regressions (3) and (4) using *LITRISK* as the audit-quality measure. H4a predicts that β_3 will be significantly positive. That is, high-*LITRISK* companies (i.e., those companies that represent a high level of litigation and reputational risk to their audit firm) will have significantly higher accrual persistence over the entire study period. H4b predicts a similar finding for the pre-SOX period; that is, γ_3^{pre} will be significantly positive. These predictions are based on Reynolds and Francis (2001) who argue that when a client represents a large part of the audit revenues of an audit-firm *office*, the audit firm will face a set of incentives that may have countervailing effects on audit quality. The large client may be able to exert influence on the audit firm due to their importance to that office. This may reduce the quality of their audit. On the other hand, the client's size and importance represent a disproportionate risk to the audit firm's reputation should an audit failure and resulting litigation occur. Therefore, the audit firm has an incentive to deliver a higher-quality audit to these clients. Which of these countervailing incentives will dominate is a question tested empirically. Reynolds and Francis (2001) find that for their sample the litigation and reputational risk incentives dominated and that audit firms performed a higher-quality audit on these clients. We base H4a on their findings. However, it is possible that for our sample, the relative strength of these two countervailing incentives may differ and we may not find support for H4a and H4b.

We find that H4a is marginally supported, with β_3 positive and marginally significant (0.032, t-statistic = 1.47, p = 0.07). However, H4b is not supported, with γ_3^{pre} positive but statistically insignificant (0.026, t-statistic = 1.10). This indicates that high-*LITRISK* companies report accruals that are slightly more reliable over the entire study period but insignificantly more reliable in the pre-SOX period. The insignificant test of H4b appears to be inconsistent with the findings of Reynolds and Francis (2001). They find that the effect of litigation and reputational risk dominates the potential for impaired independence for high-*LITRISK* companies, resulting in higher-quality audits for these clients. However, their sample included a single fiscal-year, 1996. By contrast, our sample covers many more firms over a much longer period. In an attempt to understand why our results are inconsistent with those reported by Reynolds and Francis (2001), we re-estimated regression (3) year-by-year over the pre-SOX period 1990 through 2001. We find that high-*LITRISK* firms have significantly higher accrual persistence in only three of the twelve years examined; one of those years was 1996, the year examined by Reynolds and Francis (2001).[35] Therefore, our results are consistent with Reynolds

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[35] The three years with significant γ_3 coeffient are 1990 (0.123, t-statistic = 1.62), 1996 (0.084, t-statistic = 1.90), and 1999 (0.196, t-statistic = 2.12).

and Francis (2001) when examined in the same year as their study, but are inconsistent over the entire pre-SOX period.

H4c predicts that accruals reported by low-*LITRISK* companies will have significantly greater persistence in the post-SOX period than in the pre-SOX period; that is, γ_3^{post} will be significantly more positive than γ_3^{pre}. Consistent with H4c, we find significantly greater persistence in the post-SOX period for the low-*LITRISK* group (difference of 0.086, t-statistic = 1.88). H4d predicts a similar result for the high-*LITRISK* group; that is ($\gamma_2^{post} + \gamma_3^{post}$) will be significantly greater than ($\gamma_2^{pre} + \gamma_3^{pre}$). We find the difference between the post- and pre-SOX coefficient sum is significant (0.147, t-statistic = 3.40), supporting H4d. Finally, H4e predicts that the pre- to post-SOX increase in accrual persistence for the high-*LITRISK* group will be significantly greater than for the low-*LITRISK* group. We find evidence marginally consistent with H4e (difference of 0.061, t-statistic = 1.58, p = 0.057).

In summary, we find marginally significant support for H4a and no support for H4b. This result is inconsistent with prior research (Reynolds and Francis 2001). However, when H4b is tested in year-by-year regressions, it is supported in 1996, the year covered by that study. We find significant support for H4c and H4d, and marginally significant support for H4e. These results are consistent with both low- and high-*LITRISK* companies reporting significantly more reliable accruals in the post-SOX period with the greatest improvement for the high-*LITRISK* group.

Overall, the results from estimating regressions (3) and (4) provide consistent evidence that the three measures of audit quality, *SPEC*, *IND*, and *LITRISK* are positively correlated with accrual reliability. In addition, the improvement in the reliability of accruals in the post-SOX period occurs disproportionately in the low-*SPEC*, low-*IND*, and high-*LITRISK* groups, as predicted. These results are consistent with the intentions stated in SOX of improving the quality of audits and increasing the reliability of financial reporting.

VI. ADDITIONAL ANALYSIS

Alternate test of audit quality metrics

The results of tests of H2a, H3a, and H4a provide evidence that higher quality audits result in more reliable accruals. As additional analysis, we also examine the effect of our audit quality metrics on accrual quality as defined by Dechow and Dichev (2002) (hereafter D&D). They measure accrual quality based on the standard deviation of residuals from a regression of current accruals on current, prior and future cash flows. Using our measure of total accruals (*TACC*) and cash flows (*Earnings – TACC*), we estimate D&D residuals for a subset of companies with at least eight years of continuous data.[36] We estimate residuals separately for companies in the high- and low-*SPEC*, *IND*, and *LITRISK* groups. We expect that the standard deviation of residuals should be significantly lower for the high groups. Consistent with our expectation, the standard deviation of residuals for the high-*SPEC* group is significantly smaller than for the low-*SPEC* group (0.067 versus 0.081, F-statistic = 1.44, $p < 0.0001$). Similarly, the standard deviation of residuals for the high-*IND* group was significantly smaller than for the low-*IND* group (0.076 versus 0.082, F-statistic = 1.17, $p < 0.0001$). Finally, the standard deviation of residuals for the high-*LITRISK* group is significantly smaller than for the low-*LITRISK* group (0.048 versus 0.085, F-statistic = 3.09, $p < 0.0001$). These results provide support for the use of *SPEC, IND,* and *LITRISK* as proxies for audit quality.

[36] This requirement resulted in a subsample of 18,603 company-years.

Sensitivity analysis

The choice of the cutoffs for the dichotomous variables *SPEC*, *IND*, and *LITRISK* are based either on prior research (e.g., Palmrose 1986) or on cutoffs that provide a reasonable partitioning. However, it is possible that the results reported in Tables 3 and 5 are sensitive to the choice of these cutoffs. To check for this possibility, we re-run the main analyses replacing *SPEC*, *IND*, and *LITRISK* with continuous fractional ranks that range between zero and one. In all cases, the inferences from regressions using these alternate variables are consistent with those reported in the paper.

We also re-estimate regressions (2), (3), and (4) while including the main effects for all interactions. In most cases the inferences reported in the paper are unchanged. The exceptions are the test of H4a in regression (3) and the test of H4e in regression (4); in both these cases the statistical significance of the tests were reduced and no longer reject the hypotheses.

It is possible that our results could occur because of a change in the composition of total accruals rather than because of our hypothesized relations. For example, in the pre-SOX period total accruals could be composed of relatively more working-capital accruals and less long-term accruals while the opposite is true in the post-SOX period. Such a change in relative composition of total accruals could cause an apparent change in the reliability of total accruals that is unrelated to SOX. We determine the extent to which this affects our results by re-estimating equation (2) and (4) on accruals disaggregated into three components: Working capital accruals, non-current operating accruals, and financial accruals. Disaggregating accruals in this way should control for changes in the relative composition of total accruals. We find support for all of our hypotheses in one or another of the components depending on which audit-quality metric is being considered. For example, H2b is supported for non-current operating accruals but not for the other two components. H3b is supported for non-current accruals and financial accruals but not for working capital accruals. H4d, on the other hand, is supported for all three components. We obviously have no predictions in our study of which components of accruals will be more affected by audit quality or SOX. However, finding support for all of our SOX-related hypotheses for at least one component provides evidence that differential accrual composition is not driving our results.

VII. CONCLUSION

In this study we answer three research questions. First, did the reliability of accruals improve in the post-SOX period? We find significant evidence consistent with an improvement in accrual reliability in the post-SOX period. Second, is audit quality associated with higher accrual reliability? We partition the sample into low- and high-audit-quality groups based on three separate constructs of audit quality: audit-firm industry specialization, audit-firm independence, and client-specific litigation and reputation risk. We find a significant association between the first two constructs and accrual reliability and a marginally significant association for the third construct. Third, does the extent of post-SOX improvement in accrual reliability differ between audit-quality groups? Finally, we find evidence that in the post-SOX period, subsamples of companies experienced more improvement in accrual reliability than others. Specifically, companies audited by non-specialist auditors, those audited by lower-independence auditors, and those that represent higher litigation/reputation risk to their auditor experienced the greatest improvement in accrual reliability in the post-SOX period. These results indicate that the SOX-related improvement in accrual reliability is highly related to the three audit quality metrics.

Two potential limitations to the study should be kept in mind when considering our results. First, due to lack of actual audit fee data over both the pre- and post-SOX periods, we use total assets as a proxy for audit fees. While this and prior studies have demonstrated a high correlation between audit fees and total assets, it is possible that our proxy measures audit fees with error. Second, since there has been only a short time period since implementation of SOX, our post-SOX results may not reflect the long-term effects of the post-SOX environment. Future studies can evaluate the generalizability of our results when more years of post-SOX data become available.

APPENDIX

Richardson et al. (2005) propose an errors-in-variables model that implies a greater downward bias on persistence coefficients when accruals are more unreliable. They begin with a simple mean-reverting earnings process,

$$E_{t+1}^{*} = \gamma E_{t}^{*} + \varepsilon_{t+1} \tag{A1}$$

where $0 < \gamma < 1$ and E^* represents true underlying earnings. Disaggregating earnings into accruals and cash flows results in the following:

$$E_{t+1}^{*} = \gamma C_{t} + \gamma A_{t}^{*} + \varepsilon_{t+1} \tag{A2}$$

where C is actual cash flows and A^* is the unobservable "perfect foresight" accrual associated with E^*. A^* can be thought of as a perfectly reliability measure of accruals. Richardson et al. (2005) then define the observable counterparts of E^* and A^* as reported earnings and accruals, E and A. Reported accruals, A, differs from the unobservable A^* by an error term, e.

$$A = A^{*} + e \tag{A3}$$

The error term embodies the degree of unreliability in A. Because C is observable, E differs from E^* by the same error term. When they replace E^* and A^* with their observable counterparts, the resulting equation suffers from the classic errors-in-variables problem with two explanatory variables where one is measured with error:

$$E_{t+1} = \gamma_{C} C_{t} + \gamma_{A} A_{t} + \omega_{t+1} \text{ where } \omega_{t+1} = \varepsilon_{t+1} + e_{t+1} - \gamma e_{t} \tag{A4}$$

The new error term, ω_{t+1}, is correlated with A_t because both vary with e_t. Consequently, the coefficients on C and A will be biased toward zero, with the bias increasing in the total measurement error in A (Richardson et al. 2005). Likewise, the bias is negatively associated with accrual reliability.

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Table 1
Descriptive Statistics

Panel A: Distributional Statistics

Variable	Mean	Standard Deviation	1st Percentile	1st Quartile	Median	3rd Quartile	99th Percentile
$Earnings_{t+1}$	-0.024	0.231	-0.937	-0.036	0.034	0.078	0.267
$TACC_t$	0.054	0.249	-0.522	-0.025	0.036	0.116	0.802
CF_t	-0.073	0.312	-1.208	-0.092	-0.004	0.038	0.327
SPEC	0.263	0.440	0	0	0	1	1
IND	0.749	0.434	0	0	1	1	1
LITRISK	0.203	0.402	0	0	0	0	1
Control Variables:							
OPCYCLE	154.479	2219.645	0.000	66.933	109.874	165.922	490.005
$SIZE_t$	24.565	33.949	1.984	6.866	12.861	27.029	170.370
$\lvert \Delta Sales \rvert$	0.172	0.260	0.001	0.038	0.098	0.214	1.095
$\lvert \Delta CF \rvert$	0.191	0.365	0.001	0.029	0.084	0.216	1.509
LOSS	0.309	0.462	0	0	0	1	1
BM	0.668	0.685	0.044	0.282	0.502	0.845	3.062

Panel B: Distributional Statistics Pre- and Post-Sarbanes-Oxley

Variable	**Pre-SOX Median (1990 – 2001)**	**Post-SOX Median (2002 – 2004)**	**Difference**	***t*-statistic**
$Earnings_{t+1}$	0.034	0.033	-0.001	-0.42
CF	-0.003	-0.010	-0.006	-4.25
TACC	0.037	0.029	-0.008	-4.79
BM	0.507	0.487	-0.019	-2.67
$\lvert \Delta CF \rvert$	0.083	0.092	0.009	3.59
$\lvert \Delta Sales \rvert$	0.102	0.081	-0.022	-10.91
OPCYCLE	112.550	98.041	-14.510	-10.10
SIZE	11.917	18.631	6.713	21.93

Notes for Table 1

The t-statistics in Panel B are calculated by randomly dividing the total sample into 100 equal groups. The medians for each group are then averaged across the groups. T-statistics are based on the cross-group standard errors. This method is analogous to the Fama-MacBeth cross-year calculation of regression coefficient t-statistics.

AVASSET	= Average total assets (item 6) over year t.
Earnings	= Income before extraordinary items (item 18), scaled by *AVASSET*.
TACC	= Total accruals, scaled by *AVASSET*. Total accruals are equal to the change in total assets (item 6), minus the change in cash and short-term investments (item 1), plus the change in short-term investments (item 193), minus the changes in total liabilities (item 181) and preferred stock (item 130).
CF	= Cash flows; *Earnings – TACC*
SPEC	= When the audit firm's share of the company-year's two-digit SIC industry is greater than 1/6*1.2 (20%) for 1989-1997, 1/5*1.2 (25%) for 1998-2001, or 1/4*1.2 (30%) for 2002-2005 *SPEC* is coded one, zero otherwise.
IND	= When the proportion of the audit firm's total audit revenue derived from the company-year's two-digit SIC industry is less than 3/ (number of two-digit SIC industry codes used in analysis) (for 1989-1997, 59; 1998-2001, 56; and 2002-2005, 51) *IND* is coded one, zero otherwise.
LITRISK	= When the company's audit fees, as a percentage of the audit firm's total audit revenue from clients within the company's Metropolitan Statistical Area (MSA) is in the top quintile of the study sample, *LITRISK* is coded one, zero otherwise.
BM	= Book-to-market ratio
LOSS	= Dummy variable coded one if *Earnings* is less than zero, coded zero otherwise.
$\lvert \Delta CF \rvert$	= Absolute value of the change in *CF*
$\lvert \Delta Sales \rvert$	= Absolute value of the change in sales (item 12) scaled by average total assets (item 6).
OPCYCLE	= Operating cycle in days; $\left[\frac{(AR_t+AR_{t-1})/2}{Sales/360}\right]+\left[\frac{(Inv_t+Inv_{t-1})/2}{COGS/360}\right]$
AR	= Accounts receivable (item 151)
Inv	= Inventory (item 3)
Sales	= Sales (item 12)
COGS	= Cost of goods sold (item 41)
SIZE	= Square root of total assets.

Table 2
Spearman Correlations

		CF	***TACC***	***BM***	***LOSS***	***|ΔCF|***	***|ΔSales|***	***OPCYCLE***	***SIZE***	
		0.336 (0.000)	0.217 (0.000)	-0.193 (0.000)	-0.539 (0.000)	-0.181 (0.000)	-0.014 (0.013)	0.020 (0.000)	0.221 (0.000)	***Earnings$_{t+1}$***
			-0.544 (0.000)	0.123 (0.000)	-0.336 (0.000)	-0.289 (0.000)	-0.098 (0.000)	0.030 (0.000)	0.252 (0.000)	***CF***
				-0.223 (0.000)	-0.331 (0.000)	0.119 (0.000)	0.071 (0.000)	-0.036 (0.000)	0.012 (0.042)	***TACC***
CF	0.336 (0.000)				0.002 (0.668)	-0.249 (0.000)	-0.058 (0.000)	0.045 (0.000)	0.025 (0.000)	***BM***
TACC	0.217 (0.000)	-0.544 (0.000)				0.256 (0.000)	0.055 (0.000)	0.002 (0.668)	-0.303 (0.000)	***LOSS***
SPEC	0.028 (0.000)	0.049 (0.000)	-0.007 (0.198)				0.172 (0.000)	-0.031 (0.000)	-0.266 (0.000)	***|ΔCF|***
IND	0.064 (0.000)	0.022 (0.000)	0.024 (0.000)	-0.194 (0.000)				0.041 (0.000)	-0.236 (0.000)	***|ΔSales|***
LITRISK	0.081 (0.000)	0.136 (0.000)	-0.044 (0.000)	0.080 (0.000)	-0.049 (0.000)				-0.120 (0.000)	***OPCYCLE***
	Earnings$_{t+1}$	***CF***	***TACC***	***SPEC***	***IND***					

Notes for Table 2

Correlation p-values reported in parentheses.

AVASSET	=	Average total assets (item 6) over year t.
Earnings	=	Income before extraordinary items (item 18), scaled by *AVASSET*.
TACC	=	Total accruals, scaled by *AVASSET*. Total accruals are equal to the change in total assets (item 6), minus the change in cash and short-term investments (item 1), plus the change in short-term investments (item 193), minus the changes in total liabilities (item 181) and preferred stock (item 130).
CF	=	Cash flows; *Earnings – TACC*
SPEC	=	When the audit firm's share of the company-year's two-digit SIC industry is greater than 1/6*1.2 (20%) for 1989-1997, 1/5*1.2 (25%) for 1998-2001, or 1/4*1.2 (30%) for 2002-2005 *SPEC* is coded one, zero otherwise.
IND	=	When the proportion of the audit firm's total audit revenue derived from the company-year's two-digit SIC industry is less than 3/ (number of two-digit SIC industry codes used in analysis) (for 1989-1997, 59; 1998-2001, 56; and 2002-2005, 51) *IND* is coded one, zero otherwise.
LITRISK	=	When the company's audit fees, as a percentage of the audit firm's total audit revenue from clients within the company's Metropolitan Statistical Area (MSA) is in the top quintile of the study sample, *LITRISK* is coded one, zero otherwise.
BM	=	Book-to-market ratio
LOSS	=	Dummy variable coded one if *Earnings* is less than zero, coded zero otherwise.
$\lvert \Delta CF \rvert$	=	Absolute value of the change in *CF*
$\lvert \Delta Sales \rvert$	=	Absolute value of the change in sales (item 12) scaled by average total assets (item 6).
OPCYCLE	=	Operating cycle in days; $\left[\frac{(AR_t+AR_{t-1})/2}{Sales/360}\right]+\left[\frac{(Inv_t+Inv_{t-1})/2}{COGS/360}\right]$
AR	=	Accounts receivable (item 151)
Inv	=	Inventory (item 3)
Sales	=	Sales (item 12)
COGS	=	Cost of goods sold (item 41)
SIZE	=	Square root of total assets.

Table 3

Regressions of one-year-ahead earnings on current cash flow and accruals, with separate coefficients for pre- and post-SOX periods

$$Earnings_{t+1} = \alpha_0 + D_{pre}\left(\alpha_1^{pre} CF_t + \alpha_2^{pre} TACC_t\right) + D_{post}\left(\alpha_1^{post} CF_t + \alpha_2^{post} TACC_t\right) + \sum_{k=1}^{6} \alpha_{k+2}(Control_k * TACC_t) + \varepsilon \quad (2)$$

Variable	Estimated Coefficients	t-statistics	Estimated Coefficients	t-statistics
Intercept	-0.008	-5.52	-0.010	-6.95
Pre-Sox:				
CF	0.641	17.34	0.644	16.82
TACC	0.581	17.28	0.663	12.30
Post-Sox:				
CF	0.744	24.56	0.754	26.57
TACC	0.665	20.51	0.754	12.41
Controls				
*OPCYCLE*TACC*			-0.028	-0.87
*SIZE*TACC*			-0.105	-2.12
*|ΔSales|*TACC*			-0.144	-5.10
*|ΔCF|*TACC*			0.196	4.24
*LOSS*TACC*			-0.138	-5.94
*BM*TACC*			-0.068	-1.88
Adjusted R2	0.45		0.46	
Hypothesis test:				
H1: $\alpha_2^{post} > \alpha_2^{pre}$	**0.084**	**1.80****	**0.091**	**2.03****
Other statistical tests:				
$\alpha_1^{pre} > \alpha_2^{pre}$	0.060	3.04	-0.020	-0.30
$\alpha_1^{post} > \alpha_2^{post}$	0.079	4.03	0.000	0.01

Notes for Table 3

Huber-White *t*-statistics calculated as described in Diggle et al. (1994)

***	Significant at greater than 0.01; one-tail test
**	Significant at greater than 0.05; one tail test

AVASSET	= Average total assets (item 6) over year t.
Earnings	= Income before extraordinary items (item 18), scaled by *AVASSET*.
TACC	= Total accruals, scaled by *AVASSET*. Total accruals are equal to the change in total assets (item 6), minus the change in cash and short-term investments (item 1), plus the change in short-term investments (item 193), minus the changes in total liabilities (item 181) and preferred stock (item 130).
CF	= Cash flows; *Earnings* – *TACC*
D_{pre}	= Equals one if year equals 1990 through 2001; zero otherwise.
D_{post}	= Equals one if year equals 2002 through 2004; zero otherwise.
BM	= Book-to-market ratio
LOSS	= Dummy variable coded one if *Earnings* is less than zero, coded zero otherwise.
$\|\Delta CF\|$	= Absolute value of the change in *CF*
$\|\Delta Sales\|$	= Absolute value of the change in sales (item 12) scaled by average total assets (item 6).
OPCYCLE	= Operating cycle in days; $\left[\frac{(AR_t+AR_{t-1})/2}{Sales/360}\right]+\left[\frac{(Inv_t+Inv_{t-1})/2}{COGS/360}\right]$
AR	= Accounts receivable (item 151)
Inv	= Inventory (item 3)
Sales	= Sales (item 12)
COGS	= Cost of goods sold (item 41)
SIZE	= Square root of total assets.

Table 4
Variable medians partitioned by audit quality metrics

Panel A: Partitioned by SPEC

Variable	**SPEC = 0**	**SPEC = 1**	**Difference**	***t*-statistic**
$Earnings_{t+1}$	0.032	0.036	0.004	4.01
CF	-0.007	0.002	0.008	8.95
TACC	0.037	0.033	-0.004	-2.93
BM	0.485	0.561	0.076	11.84
$\|\Delta CF\|$	0.091	0.069	-0.023	-12.52
$\|\Delta Sales\|$	0.103	0.086	-0.016	-9.08
OPCYCLE	112.932	101.998	-10.934	-11.13
SIZE	11.786	17.090	5.304	18.65

Panel B: Partitioned by IND

Variable	**IND = 0**	**IND = 1**	**Difference**	***t*-statistic**
$Earnings_{t+1}$	0.028	0.036	0.008	6.81
CF	-0.007	-0.004	0.003	2.36
TACC	0.030	0.038	0.008	5.74
BM	0.478	0.511	0.033	5.24
$\|\Delta CF\|$	0.094	0.082	-0.012	-5.36
$\|\Delta Sales\|$	0.086	0.102	0.016	7.52
OPCYCLE	102.364	112.383	10.020	8.00
SIZE	14.149	12.626	-1.523	-6.43

Panel C: Partitioned by LITRISK

Variable	LITRISK = 0	LITRISK = 1	Difference	*t*-statistic
$Earnings_{t+1}$	0.031	0.041	0.010	12.32
CF	-0.010	0.012	0.022	26.67
TACC	0.040	0.027	-0.013	-10.16
BM	0.484	0.575	0.091	12.84
$\|\Delta CF\|$	0.096	0.052	-0.044	-25.60
$\|\Delta Sales\|$	0.105	0.076	-0.029	-15.32
OPCYCLE	114.956	93.042	-21.914	-21.21
SIZE	10.827	30.451	19.624	39.28

The t-statistics are calculated by randomly dividing the total sample into 100 equal groups. The medians for each group are then averaged across the groups. T-statistics are based on the cross-group standard errors. This method is analogous to the Fama-MacBeth cross-year calculation of regression coefficient t-statistics.

AVASSET = Average total assets (item 6) over year t.

Earnings = Income before extraordinary items (item 18), scaled by *AVASSET*.

TACC = Total accruals, scaled by *AVASSET*. Total accruals are equal to the change in total assets (item 6), minus the change in cash and short-term investments (item 1), plus the change in short-term investments (item 193), minus the changes in total liabilities (item 181) and preferred stock (item 130).

SPEC = When the audit firm's share of the company-year's two-digit SIC industry is greater than 1/6*1.2 (20%) for 1989-1997, 1/5*1.2 (25%) for 1998-2001, or 1/4*1.2 (30%) for 2002-2005 *SPEC* is coded one, zero otherwise.

IND = When the proportion of the audit firm's total audit revenue derived from the company-year's two-digit SIC industry is less than 3/ (number of two-digit SIC industry codes used in analysis) (for 1989-1997, 59; 1998-2001, 56; and 2002-2005, 51) *IND* is coded one, zero otherwise.

LITRISK = When the company's audit fees, as a percentage of the audit firm's total audit revenue from clients within the company's Metropolitan Statistical Area (MSA) is in the top quintile of the study sample, *LITRISK* is coded one, zero otherwise.

CF = Cash flows; *Earnings – TACC*

BM = Book-to-market ratio

LOSS = Dummy variable coded one if *Earnings* is less than zero, coded zero otherwise.

$|\Delta CF|$ = Absolute value of the change in *CF*

$|\Delta Sales|$ = Absolute value of the change in sales (item 12) scaled by average total assets (item 6).

OPCYCLE = Operating cycle in days; $\left[\frac{(AR_t+AR_{t-1})/2}{Sales/360}\right]+\left[\frac{(Inv_t+Inv_{t-1})/2}{COGS/360}\right]$

AR = Accounts receivable (item 151)

Inv = Inventory (item 3)

Sales = Sales (item 12)

COGS = Cost of goods sold (item 41)

SIZE = Square root of total assets.

Table 5
Regressions of one-year-ahead earnings on current cash flow and accruals, with interactions by audit-quality metrics

$$Earnings_{t+1} = \beta_0 + \beta_1 CF_t + \beta_2 TACC_t + \beta_3 (AQ_{t-1}^{j} * TACC_t) + \sum_{k=1}^{6} \beta_{k+3} (Control_k * TACC_t) + \varepsilon \quad (3)$$

$$Earnings_{t+1} = \gamma_0 + D_{pre}(\gamma_1^{pre} CF_t + \gamma_2^{pre} TACC_t + \gamma_3^{pre} [AQ_{t-1}^{j} * TACC_t]) + D_{post}(\gamma_1^{post} CF_t + \gamma_2^{post} TACC_t + \gamma_3^{post} [AQ_{t-1}^{j} * TACC_t]) + \sum_{k=1}^{6} \gamma_{k+3} (Control_k * TACC_t) + \varepsilon \quad (4)$$

Panel A: Partitioning on SPEC

Variable (hypothesis test)	Estimated Coefficients	t-statistics	Estimated Coefficients	t-statistics
Intercept	-0.011	-6.61	-0.010	-6.82
CF	0.660	18.91		
TACC	0.684	13.36		
*SPEC*TACC* **(H2a)**	**0.048**	**2.21****		
Pre-Sox:				
CF			0.644	16.81
TACC			0.669	12.80
*SPEC*TACC* **(H2b)**			**0.054**	**2.33****
Post-Sox:				
CF			0.755	26.71
TACC			0.774	12.94
*SPEC*TACC*			*0.013*	*0.26*
Controls				
*OPCYCLE*TACC*	-0.027	-0.84	-0.028	-0.88
*SIZE*TACC*	-0.105	-1.12	-0.111	-2.25
*|ΔCF|*TACC*	0.177	3.87	0.180	4.04
*|ΔSales|*TACC*	-0.149	-5.31	-0.150	-5.35
*LOSS*TACC*	-0.126	-5.76	-0.125	-5.79
*BM*TACC*	-0.090	-2.60	-0.096	-2.76
Adjusted R2	0.46		0.46	
Other hypothesis tests:				
H2c: $\gamma_2^{pre} < \gamma_2^{post}$			**0.105**	**2.30****
H2d: $\gamma_2^{pre} + \gamma_3^{pre} < \gamma_2^{post} + \gamma_3^{post}$			**0.064**	**1.06**
H2e: $\gamma_2^{post} - \gamma_2^{pre} > (\gamma_2^{post} + \gamma_3^{post}) - (\gamma_2^{pre} + \gamma_3^{pre})$			**0.041**	**0.76**

Panel B: Partitioning on IND

Variable (hypothesis test)	Estimated Coefficients	t-statistics	Estimated Coefficients	t-statistics
Intercept	-0.011	-6.67	-0.010	-6.85
CF	0.661	18.97		
TACC	0.617	11.82		
*IND*TACC* **(H3a)**	**0.087**	**3.90*** **		
Pre-Sox:				
CF			0.646	16.86
TACC			0.594	11.08
*IND*TACC* **(H3b)**			**0.099**	**3.89*** **
Post-Sox:				
CF			0.755	26.73
TACC			0.751	12.23
*IND*TACC*			*0.003*	*0.08*
Controls				
*OPCYCLE*TACC*	-0.039	-1.25	-0.038	-1.23
*SIZE*TACC*	-0.083	-1.74	-0.086	-1.81
*|ΔSales|*TACC*	-0.151	-5.36	-0.153	-5.48
*|ΔCF|*TACC*	0.186	4.11	0.191	4.34
*LOSS*TACC*	-0.119	-5.66	-0.117	-5.61
*BM*TACC*	-0.076	-2.24	-0.082	-2.44
Adjusted R2	0.46		0.46	
Other hypothesis tests:				
H3c: $\gamma_2^{pre} < \gamma_2^{post}$			**0.157**	**3.16*** **
H3d: $\gamma_2^{pre} + \gamma_3^{pre} < \gamma_2^{post} + \gamma_3^{post}$			**0.061**	**1.26**
H3e: $\gamma_2^{post} - \gamma_2^{pre} > (\gamma_2^{post} + \gamma_3^{post}) - (\gamma_2^{pre} + \gamma_3^{pre})$			**0.096**	**2.01** **

Panel C: Partitioning on LITRISK

Variable (hypothesis test)	Estimated Coefficients	t-statistics	Estimated Coefficients	t-statistics
Intercept	-0.011	-6.73	-0.011	-6.95
CF	0.659	18.90		
TACC	0.672	12.77		
*LITRISK*TACC* **(H4a)**	**0.032**	**1.47***		
Pre-Sox:				
CF			0.644	16.81
TACC			0.660	12.21
*LITRISK*TACC* **(H4b)**			**0.026**	**1.10**
Post-Sox:				
CF			0.754	26.62
TACC			0.746	12.25
*LITRISK*TACC*			0.087	2.45
Controls				
*OPCYCLE*TACC*	-0.026	-0.80	-0.028	-0.87
*SIZE*TACC*	-0.106	-2.08	-0.113	-2.22
*|ΔSales|*TACC*	-0.143	-5.04	-0.142	-5.05
*|ΔCF|*TACC*	0.196	4.14	0.200	4.34
*LOSS*TACC*	-0.137	-5.87	-0.137	-5.92
*BM*TACC*	-0.063	-1.71	-0.067	-1.83
Adjusted R2	0.46		0.46	
Other hypothesis tests:				
H4c: $\gamma_2^{pre} < \gamma_2^{post}$			**0.086**	**1.88****
H4d: $\gamma_2^{pre} + \gamma_3^{pre} < \gamma_2^{post} + \gamma_3^{post}$			**0.147**	**3.40*****
H4b: $\gamma_2^{post} - \gamma_2^{pre} < (\gamma_2^{post} + \gamma_3^{post}) - (\gamma_2^{pre} + \gamma_3^{pre})$			**0.061**	**1.58***

Notes for Table 5

Huber-White *t*-statistics calculated as described in Diggle et al. (1994)

***	Significant at greater than 0.01; one-tail test
**	Significant at greater than 0.05; one tail test
*	Significant at greater than 0.10; one tail test

AVASSET	= Average total assets (item 6) over year t.
Earnings	= Income before extraordinary items (item 18), scaled by *AVASSET*.
TACC	= Total accruals, scaled by *AVASSET*. Total accruals are equal to the change in total assets (item 6), minus the change in cash and short-term investments (item 1), plus the change in short-term investments (item 193), minus the changes in total liabilities (item 181) and preferred stock (item 130).
CF	= Cash flows; *Earnings – TACC*
D_{pre}	= Equals one if year equals 1990 through 2001; zero otherwise.
D_{post}	= Equals one if year equals 2002 through 2004; zero otherwise.
BM	= Book-to-market ratio
LOSS	= Dummy variable coded one if *Earnings* is less than zero, coded zero otherwise.
$\lvert\Delta CF\rvert$	= Absolute value of the change in *CF*
$\lvert\Delta Sales\rvert$	= Absolute value of the change in sales (item 12) scaled by average total assets (item 6).
OPCYCLE	= Operating cycle in days; $\left[\frac{(AR_t+AR_{t-1})/2}{Sales/360}\right]+\left[\frac{(Inv_t+Inv_{t-1})/2}{COGS/360}\right]$
AR	= Accounts receivable (item 151)
Inv	= Inventory (item 3)
Sales	= Sales (item 12)
COGS	= Cost of goods sold (item 41)
SIZE	= Square root of total assets.