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ORIGINAL RESEARCH

Does the monitoring effect of Big 4 audit firms really prevail? Evidence from managerial expropriation of cash assets

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Abstract
This study pins down the monitoring effect of Big 4 versus non-Big 4 audit firms on shareholder wealth by exploring the dollar equivalent of the reduction in shareholder value arising from managerial expropriation of cash assets. We detect a value discount of $0.12 for a dollar of cash assets held by non-Big 4 clients, while we uncover a value premium of $0.09 for an extra dollar of cash reserves in Big 4 clients. We further observe that second-tier auditors underperform their Big 4 rivals in containing managerial expropriation of corporate liquidity. Moreover, the economic consequences of cash and cash equivalents increase with a switch from a non-Big 4 firm to a Big 4 firm. Our results survive examinations of excessive cash assets, propensity score-matching analysis, a vast array of controls, and alternative valuation models. Collectively, our results suggest that Big 4 auditors tend to play a significantly stronger role vis-à-vis their non-Big 4 rivals in deterring managers from expropriating outside shareholders through cash resources.

Keywords Big 4/non-Big 4 auditor · Cash assets · Monitoring effect · Wealth expropriation

JEL Classification G3 · M4

1 Introduction

The monitoring effect of an audit firm has been well discussed in agency theory (Jensen and Meckling 1976; Watts and Zimmerman 1983). In particular, an audit firm serving as the external monitor of the financial reporting process can reduce agency costs by curbing

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the management's ability to exploit opportunistic financial reporting concealing its expropriation activities. This agency framework suggests that the performance of Big 4 (Big N) vis-à-vis non-Big 4 (non-Big N) audit firms is potentially tied to their monitoring role.[1] While previous empirical research provides valuable insight into the performance of the Big 4 relative to their non-Big 4 rivals, existing evidence about their relative monitoring effect is largely indirect (Becker et al. 1998; Francis et al. 1999; Lennox and Pittman 2010; DeFond et al. 2016). Notably, little is done to differentiate the components of auditor performance. This inquiry gap merits careful research attention because extant literature recognizes that auditor performance can comprise not only the monitoring effect but also the information effect pertaining to adverse selection costs.[2] Moreover, prior empirical proxies (e.g., accounting fraud, discretionary accruals) for auditor performance can capture both effects, thus making it difficult to isolate the monitoring effect from the information effect.[3]

This inference issue can further extend to the underlying mechanisms through which auditors influence shareholder value, a more fundamental question from the perspective of shareholders and value-maximizing firms but a less explored question in prior studies. Specifically, it is unclear whether better stock performance in Big 4 audit clients is driven by the monitoring effect or the information effect of Big 4 auditors (Mitton 2002). It is also difficult to attribute a lower cost of equity capital to an auditor's superior monitoring quality because a firm's cost of equity can be influenced more by its information risk than by its expropriation risk (Easley and O'Hara 2004; Lambert et al. 2007; Lawrence et al. 2011). Further, there is little empirical evidence linking the value implications of Big 4 relative to non-Big 4 audit firms directly to the reduction in managerial expropriation of corporate assets (Fan and Wong 2005; DeFond and Zhang 2014; Myers et al. 2014). Consequently, the monitoring impact of the Big 4 in relation to their non-Big 4 rivals on shareholder value requires a careful examination.

In this study, we attempt to gain a deeper understanding of the monitoring effect of Big 4 versus non-Big 4 audit firms on shareholder wealth by investigating the dollar equivalent of the reduction in shareholder value arising from managerial appropriation of private benefits. Motivated by the self-dealing or tunneling literature, we examine the economic

[1] Similar to Lawrence et al. (2011), we use Big 4 to broadly characterize Big 8, Big 6, Big 5, or Big 4 audit firms across eras.

[2] Distinct from the monitoring effect, the information effect of auditors is also well recognized by the literature. As many researchers point out, an auditor can reduce the adverse selection bias or the lemons problem intrinsic to security issuances because the accounting information audited by a higher-quality firm enables investors to make a more accurate estimate of the issuing firm's value (Titman and Trueman 1986; Slovin et al. 1990; Menon and Williams 1991; Healy and Palepu 2001; La Porta et al. 2006). Consistent with the asymmetric information framework, we refer to the effect of auditors on adverse selection costs in financial markets as the information effect. In contrast, the effect of auditors on agency costs, as discussed above, is referred to as the monitoring effect.

[3] An explanation consistent with the monitoring effect is that a lower incidence of accounting fraud can capture the influence of an audit firm on agency costs because the auditor can prevent the managers from orchestrating fraudulent financial reporting disguising their consumption of private benefits. However, an alternative explanation consistent with the information effect is that a lower probability of accounting fraud can reflect the influence of an audit firm on adverse selection costs since its independent audits can preclude the audit client from manipulating accounting information to sell overpriced equity. The underlying logic is that firms can falsify financial statements to mislead potential investors about the true values of security issues (Dechow et al. 1996; Forsythe et al. 1999; DuCharme et al. 2004; Wang et al. 2010). Similarly, the reduction in earnings management does not necessarily indicate the effect of an audit firm on agency conflicts because discretionary accruals are likely to be a symptom of not only moral hazard but also adverse selection problems (DeFond and Park 1997; Teoh et al. 1998; Lee and Masulis 2009).

consequences of cash assets to explore the tension between the monitoring effect and the information effect of audit firms (Johnson et al. 2000a, b; Pinkowitz et al. 2006; Djankov et al. 2008). We focus on the contribution of cash assets to shareholder wealth for three reasons. First, liquid assets are less vulnerable to information risk but more to expropriation risk than illiquid assets (Stiglitz and Weiss 1981; Myers and Majluf 1984; Myers and Rajan 1998; Louis et al. 2012). Second, the gap between the economic contribution and the face value of cash reserves enables us to estimate the extent of managerial extraction of private benefits from cash and cash equivalents (Pinkowitz et al. 2006; Dittmar and Mahrt-Smith 2007; Fresard and Salva 2010). Third, the economic consequences of cash assets tend to respond asymmetrically to the monitoring effect and the information effect of an audit firm.

On the one hand, the value of cash reserves is expected to improve with the monitoring effect of an audit firm. If one type of auditors (Big 4/non-Big 4) outperforms the other in preventing the management from manipulating accounting information to camouflage its misuse and misappropriation of cash assets, cash resources should contribute more to a firm that engages an auditor of higher monitoring quality. Notably, a dollar of cash holdings should be worth less than a dollar only for a firm whose auditor cannot prevent the managers from siphoning cash reserves from the company in various forms, such as embezzlement, intercorporate loans, transfer pricing, and perquisite consumption (Bertrand et al. 2002; Allen et al. 2005; Coates 2007; Jiang et al. 2010). Consistent with the notion that an auditor failing to perform monitoring functions properly is conducive to managerial expropriation of cash assets, a *Chicago Tribune* story (Jenco 2013) reports that lax auditors enable the management to steal a massive amount of funds through phony invoices.

On the other hand, the value of cash reserves is expected to decrease with the information effect of an audit firm. The rationale is that financial slack is especially valuable when a firm facing severe adverse selection in capital markets cannot afford to finance value-increasing projects with external funds (Almeida et al. 2004; Bates et al. 2009; Denis and Sibilkov 2010; Duchin 2010). It follows that cash assets become less valuable when an audit firm helps to ameliorate adverse selection costs intrinsic to external financing.

Taken together, the economic consequences of corporate cash assets provide a fertile research ground for disentangling the monitoring effect from the information effect of the Big 4 versus non-Big 4 auditors on shareholder wealth. Studying a sample of nearly 50,000 firm-year observations over the period of 1991–2010, we find that a dollar of cash assets contributes only $0.88 to non-Big 4 clients. This represents a discount of 12% from the full value of cash reserves. In contrast, the marginal value of cash holdings ascends to $1.09 for Big 4 clients, representing a premium of 9%. Our results suggest that Big 4 accounting firms tend to outperform their non-Big 4 rivals in combating the private consumption of cash assets. While corporate governance practices can converge with the passage of the Sarbanes–Oxley (SOX) Act, we observe that non-Big 4 firms continue to exhibit inferior performance in deterring managerial expropriation of cash reserves in the post-SOX era.

It seems implausible that all non-Big 4 auditors are homogenous and provide monitoring services of similar quality. In particular, second-tier auditors are more likely to emerge as a viable alternative to Big 4 auditors than do third-tier smaller accounting firms (Hogan and Martin 2009). Hence, we further explore the monitoring intensity of second-tier auditors relative to Big 4 auditors by removing third-tier auditors from our refined analysis. We uncover that a dollar of cash assets is worth only $0.96 for second-tier audit firm clients, whereas the corresponding value approximates $1.12 for Big 4 clients. This evidence suggests that second-tier auditors do not exhibit a monitoring capacity similar to that of their Big 4 rivals for alleviating transfers of corporate cash resources from outside shareholders to the management.

To reinforce the interpretation of our results, we also investigate whether a change in auditor type exerts notable influences on the incremental value of cash holdings. To the extent that there are drastic differences in monitoring quality between auditor types, then a switch from a non-Big 4 auditor to a Big 4 auditor is likely to spark a significant variation in the value of liquid assets. As anticipated, we find that cash and short-term marketable securities contribute more to the average audit client when it switches from a non-Big 4 auditor to a Big 4 auditor than when it switches from a Big 4 firm to a non-Big 4 firm or experiences no change in its auditor type. Accordingly, this ancillary analysis lends further credence to the notion that smaller auditors are likely to be inferior monitoring substitutes for their brand-name rivals.

An important concern is that the appointment of auditors is endogenously determined. For instance, a firm with stronger economic fundamentals seems more likely to attract reputable auditors. To assure a proper inference about our findings, we rely on a propensity score-matching approach to explicitly isolate the effects of auditor type from those of client characteristics on managerial diversion of corporate cash assets (Rosenbaum and Rubin 1983; Dehejia and Wahba 2002). In particular, we perform a logistic regression to account for auditor choice as a function of firm characteristics. To ensure that the treatment sample is as much like the control sample as possible, we select as our control firm (non-Big 4 client) one that is characterized by the minimum distance in its propensity score from the corresponding score for the treatment firm (Big 4 client). Our attribute-based matched results verify that the superior performance of Big 4 vs. non-Big 4 auditors in attenuating managerial expropriation of cash reserves is not attributable to client characteristics.

This study's main contributions are threefold. First, we provide a better understanding of the monitoring quality of the Big 4 vis-à-vis their non-Big 4 rivals by distinguishing the monitoring effect from the information effect. In contrast to many earlier studies that focus on an array of proxies for auditor performance, we shed light on the reduction in shareholder value arising from managerial expropriation of cash assets. In particular, we detect a value discount of 12% for cash and cash equivalents held by non-Big 4 clients, whereas we uncover a value premium of 9% for cash holdings in Big 4 clients. Our results also indicate that the value of cash assets significantly increases with a switch from a non-Big 4 auditor to a Big 4 auditor. Further, the superior monitoring quality of Big 4 firms versus non-Big 4 firms is robust to propensity score-matching analysis and therefore less likely to emanate from differences in client attributes, a crucial issue that often complicates previous inferences.

Second, our study adds to the burgeoning literature that features second-tier accounting firms versus the Big 4. Geiger and Rama (2006) find that both type I and type II reporting error rates in the context of issuing going-concern report modifications are significantly higher for second-tier firms as compared to Big 4 firms. Similarly, Boone et al. (2010) document that the client-specific ex ante equity risk premium is notably higher for second-tier audit firm clients than for Big 4 clients. However, they find that the degree of performance-adjusted abnormal accruals does not vary significantly across Big 4 and second-tier audit firm clients. Our study contributes to this literature by identifying a relatively direct source of managerial rent extraction and showing that a value discount for cash assets is more likely to take place in second-tier audit clients than in their Big 4 counterparts.

Third, our results are related to the tunneling literature arguing that managers in firms with poor governance practices can expropriate outside shareholders by removing corporate assets from these firms (Johnson et al. 2000a, b; Cheung et al. 2006). Supporting this notion, Dittmar and Mahrt-Smith (2007), Fresard and Salva (2010), and Louis et al. (2012) document evidence that cash assets in conjunction with poor legal protection or weak

monitoring forces result in substantial residual losses. We add to the tunneling literature by demonstrating that the potential for the consumption of private benefits embedded in cash assets is conditional on the monitoring effect of the Big 4 versus non-Big 4 auditors.

The paper unfolds in the following manner: Sect. 2 reviews the literature and develops testable hypotheses. Section 3 presents the research design. Section 4 describes the sample selection procedure and descriptive statistics. Section 5 discusses the empirical results. In Sect. 6, we perform robustness tests. Section 7 concludes the paper.

2 Literature review and hypothesis development

The monitoring role of an audit firm has received considerable attention from extant literature. As Jensen and Meckling (1976) point out, an audit firm can testify to the accuracy of its audit client's accounting reports as the external monitor of the financial reporting process. This, in turn, can reduce the appropriation of private benefits masked by misleading financial statements and increase the value of the firm. Watts and Zimmerman (1983) further argue that an external auditor can attenuate the residual loss by reporting discovered breaches of contracts to outside parties. Fan and Wong (2005) add that an audit firm can restrict managerial ability to expropriate outside shareholders by preventing the executives from engaging in aggressive and potentially opportunistic financial reporting obscuring their diversion of corporate resources.

There are some arguments as to whether or not Big 4 (Big N) and non-Big 4 (non-Big N) auditors should demonstrate comparable monitoring quality. The irrelevance story argues that the observable performance differences between Big 4 and non-Big 4 firms are attributable to heterogeneity in audit client characteristics (Lawrence et al. 2011). As a result, Big 4 and non-Big 4 auditors are likely to provide similar monitoring services. In contrast, the local story, proposed by Louis (2005), argues that non-Big 4 firms, relative to their Big 4 rivals, have a greater information advantage about local firms and their business communities, thereby providing more valuable and customized services to their audit clients. The local story implies that non-Big 4 auditors are likely to serve as more effective corporate monitors than their Big 4 counterparts. The size or reputation story, however, argues that Big 4 auditors are more likely to deter the management from reaping private control benefits than their smaller non-Big 4 rivals, because large audit firms are less reliant on any particular client (DeAngelo 1981). Further, Simunic (1980), Palmrose (1988), and DeFond et al. (2016) argue that large accounting firms can perform monitoring functions more effectively than do small audit firms, as the former—with substantial investments in building brand names—have more reputation capital at stake than the latter.

The empirical literature focuses on a multitude of proxies for the performance of Big 4 versus non-Big 4 firms. These proxies encompass, but are not restricted to, accrual management, accounting fraud, analyst forecast accuracy, and cost of capital. As a whole, the existing evidence is mixed. More prominently, differentiating the monitoring effect from the information effect of Big 4 compared with non-Big 4 firms has been an uphill task due to the presence of both adverse selection and moral hazard problems in the vast majority of previous proxies. While adverse selection problems stem from asymmetric information between managers and outside investors in the pre-contracting, moral hazard problems arise from managerial rent-seeking actions in the post-contracting (Titman and Trueman 1986; Menon and Williams 1991; Djankov et al. 2008). Given that auditor performance can consist of both the monitoring effect and the information effect associated with the

lemons problem in financial markets, researchers often face a challenging task to pin down the monitoring effect of Big 4 relative to non-Big 4 auditors.

A first strand of literature casts light on accrual-based earnings management as a proxy for auditor performance. For example, Becker et al. (1998) and Francis et al. (1999) document that Big 4 auditors are more likely to constrain opportunistic and aggressive reporting, as measured by the extent of discretionary accruals, than their non-Big 4 rivals. In contrast, Kim et al. (2003) find that Big 4 accounting firms are less effective in deterring opportunistic earnings management than their non-Big 4 counterparts when managers have incentives to choose income-decreasing accruals. Alternatively, Boone et al. (2010) uncover that the level of accrual management for Big 4 and second-tier audit clients is similar.

A second strand of literature relies on litigation risk or accounting fraud as a proxy for auditor performance. Palmrose (1988) and Lys and Watts (1994) provide evidence that Big 4 audit firms have lower litigation activity relative to their non-Big 4 counterparts. Their evidence suggests that Big 4 clients are less likely to provide false or misleading financial statements via-a-vis their non-Big 4 peers. Examining the Accounting and Auditing Enforcement Releases (AAERs), Lennox and Pittman (2010) also document a lower incidence of accounting fraud in Big 4 clients than in non-Big 4 clients.

A third strand of literature that utilizes analyst forecast accuracy as a proxy for auditor performance gains insight into the connection between accounting firms and decision-making processes of financial statement users. Behn et al. (2008) demonstrate that Big 4 auditees, compared to their non-Big 4 counterparts, enjoy significantly higher analyst forecast accuracy and lower forecast dispersion. However, Lawrence et al. (2011) find that the effect of Big 4 auditors on analyst forecast accuracy is largely subsumed by their client attributes.

A fourth strand of literature uses cost of capital as a measure of auditor performance. Khurana and Raman (2004) find that the ex ante cost of equity capital is substantially lower for Big 4 clients vis-à-vis non-Big 4 clients in the United States. In addition, Kim et al. (2013) find that the loan interest rate is remarkably lower for borrowers with Big 4 auditors relative to borrowers with non-Big 4 auditors. However, Slovin et al. (1990) find weak evidence that the stock market reaction to a seasoned equity offering is less negative in Big 4 clients relative to non-Big 4 clients. Examining a sample of private firms, Fortin and Pittman (2007) also fail to find that the yield spreads are notably lower for Big 4 clients than for non-Big 4 clients.

Although these strands of literature provide useful insight into the association between auditor type and auditor performance, it is unclear whether the choice between Big 4 and non-Big 4 auditors influences managerial power to expropriate shareholder wealth. As Lambert et al. (2007) point out, the cost of equity is directly influenced by the estimation or information risk but is indirectly affected by managerial real decisions. Abnormal accruals are likely to be used for conveying managerial private information to outside investors in lieu of concealing insider expropriation of outside shareholders (Louis and Robinson 2005; Tucker and Zarowin 2006). Similarly, analyst forecast errors can relate more to asymmetric information between firm management and financial analysts than to managerial wealth extraction from outside investors (Thomas 2002; Custodio and Metzger 2014).

Moreover, accounting fraud is likely to capture adverse selection problems in capital markets because firms can manipulate accounting information so as to issue new securities at inflated prices. Consistent with this notion, Dechow et al. (1996) find that the demand for external financing is significantly stronger for firms subject to accounting enforcement actions by the SEC for alleged violations of Generally Accepted Accounting Principles

than for other firms. The data of accounting fraud can also involve selection bias. Notably, Karpoff et al. (2008) find that 44% of the regulatory releases and 19% of the enforcement actions in their sample have no AAER designation. In addition, AAERs are likely to limit their statistical power in empirical tests because these relatively rare events can be restricted to firms whose managers expropriate outside shareholders mainly in an illegal manner (DeFond and Zhang 2014).

Hence, it remains an empirical question of whether non-Big 4 auditors serve as adequate substitutes for the Big 4 in curbing managerial expropriation of shareholder wealth. One viable approach to measuring the appropriation of private benefits is to shed light on the degree of rent extraction from corporate assets, commonly referred to as tunneling or self-dealing in agency contexts (Johnson et al. 2000a, b; Djankov et al. 2008). Cash assets are expected to better serve this purpose than fixed assets because the value of cash and near-cash is less sensitive to the information effect than to the monitoring effect of auditors. The intuition is that, compared with fixed assets, actual cash and short-term marketable securities are less subject to the adverse selection problem in financial markets due to their much greater asset liquidity (Myers and Majluf 1984; Myers and Rajan 1998; Hall et al. 2005; Hill et al. 2014; Huang et al. 2015).

However, cash assets are more vulnerable to insider expropriation than fixed assets. As Myers and Rajan (1998) point out, it is easier to siphon cash assets than fixed assets from the firm because cash reserves tend to be anonymous and transferrable in nature. Similarly, Wells (2003) identifies cash assets as the favorite target of rent-seeking managers, accounting for nine in ten asset misappropriation cases. Moreover, corporate cash reserves can intensify managerial discretion and exacerbate agency conflicts by sheltering managers from the scrutiny of capital market participants (Easterbrook 1984; Jensen 1986; Dittmar and Mahrt-Smith 2007; Lee and Lee 2009; Iskandar-Datta and Jia 2014). As a result, cash assets can facilitate a vast array of agency conflicts, such as outright stealing, tunneling through loan guarantees, transfer pricing advantageous to managers, perks, excessive executive compensation, and self-dealing investment (Harford 1999; Johnson et al. 2000a, b; Bertrand et al. 2002; Cheung et al. 2006; Tong 2011; Huang and Zhang 2012).

High-quality auditors are expected to play a central role in preventing embezzlement and the private consumption of corporate cash holdings by detecting unauthorized transactions and curbing unorthodox financial statements (Mitton 2002; La Porta et al. 2006; Coates 2007; Dash 2011; Jenco 2013). Auditors can also limit managerial abilities to siphon cash reserves from corporations by disclosing abnormal related-party activities (e.g., asset acquisitions, intercorporate loans) to outside parties (Allen et al. 2005; Fan and Wong 2005; Jiang et al. 2010). Further, audit firms can constrain the inefficient use of cash assets toward self-dealing projects by revealing timely information about the audit clients' poor performance to outside shareholders (Basu 1997; Ahmed and Duellman 2007; Louis et al. 2012; Kim et al. 2015). Accordingly, the economic consequences of cash assets are expected to improve significantly with the monitoring quality of an audit firm.

It follows that outside shareholders in firms that engage auditors of high monitoring intensity should not receive less than the face value of cash holdings. As Pinkowitz et al. (2006) indicate, cash assets are worth less than their full value only when managers extract a part of cash and cash equivalents from outside investors. However, an additional dollar of cash assets is more likely to approximate a dollar or more when the residual loss is less likely to be embodied in cash assets. Fresard and Salva (2010) add that the marginal value of cash and short-term marketable securities is close to, or even above, their face value when a U.S. cross-listing helps to mitigate the private consumption of liquid assets. Therefore, an extra dollar of corporate cash reserves is more likely to contribute more than

one dollar to clients audited by accounting firms with strong monitoring strengths vis-à-vis clients audited by those with weak monitoring intensities.

While the marginal value of cash reserves tends to respond positively to the monitoring effect of auditors, the corresponding value is likely to decrease with the information effect of auditors. As a large body of literature (Myers and Majluf 1984; Kim et al. 1998; Almeida et al. 2004; Faulkender and Wang 2006) illustrates, internal finance becomes less valuable when the alleviation of adverse selection in financial markets reduces the likelihood that positive net present value projects will be bypassed because external finance is prohibitively expensive. In other words, cash reserves are less beneficial to an audit client whose audit firm helps to narrow the spread between external and internal financing costs by ameliorating the adverse selection bias intrinsic to security issuances.

As a result, the economic consequences of cash assets enable us to explore the tension between the monitoring effect and the information effect of Big 4 versus non-Big 4 auditors. To the extent that Big 4 firms serve as more effective corporate monitors than their non-Big 4 rivals, we should observe a positive relation between the presence of the Big 4, as opposed to non-Big 4 auditors, and the value of cash reserves. In this instance, outside shareholders in Big 4 clients are less likely to receive a discount from the face value of cash reserves than their peers in non-Big 4 clients. In contrast, the superior information effect of Big 4 compared with non-Big 4 audit firms is expected to yield a strikingly different set of results. In this case, cash holdings should be less beneficial to Big 4 audit clients because Big 4 clients, characterized by less severe adverse selection problems, tend to incur lower costs of external financing than their non-Big 4 counterparts. Nevertheless, neither outside investors in Big 4 auditees nor those in non-Big 4 auditees should receive less than the full value of cash assets if the information effect of audit firms drives the economic consequences of cash resources.

3 Model specification

To test whether Big 4 and Non-Big 4 auditors exert a comparable influence on the value of cash assets, we perform a regression analysis based on Faulkender and Wang's (2006) model. In spirit, their model is similar to a long-run (one-year) event study, which enables researchers to assess the influence of a specific event (i.e., unexpected change in cash) on a firm's stock price movement (i.e., stock return). We augment their empirical framework by inserting a Big 4 indicator variable and its interaction with unexpected changes in cash and short-term marketable securities. Our regression model is specified as follows:

$$r_{i,t} - R^{B}_{i,t} = \beta_0 + \Delta C_{i,t} + Big4_{i,t} + \Delta C_{i,t} * Big4_{i,t} + \delta Z + \varepsilon \quad (1)$$

In Eq. (1), the dependent variable $\left(r_{i,t} - R^{B}_{i,t}\right)$ denotes a firm's excess return, which is defined as the spread between its stock raw return and its benchmark portfolio return based on the 25 Fama and French's (1993) size and book-to-market portfolios. We delineate $\Delta C_{i,t}$ as change in cash and cash equivalents from fiscal year $t-1$ to t scaled by the lagged market value of equity ($M_{i,t-1}$). $Big\ 4_t$ is an indicator variable that takes a value of 1 if the firm is a Big 4 audit client, and 0 otherwise. Based on the coefficient on the interaction term between $Big4_{i,t}$ and $\Delta C_{i,t}$, we explore the capacities of the Big 4 relative to non-Big 4 accounting firms in restricting managerial power to expropriate the firm's liquid assets. To the extent that Big 4 and non-Big 4 auditors exhibit similar

monitoring quality, we should observe that the coefficient (β_3) on $\Delta C_{i,t} * Big4_{i,t}$ is statistically indistinguishable from zero. As the stock return is the spread between $M_{i,t}$ and $M_{i,t-1}$ normalized by $M_{i,t-1}$, we can interpret this coefficient as the marginal value of cash assets.

The control variables contained in vector Z are directly derived from Faulkender and Wang's model. Specifically, we consider variation in earnings before interest and extraordinary items $\left(\Delta E_{i,t}\right)$ to control for corporate profitability. We allow for heterogeneity in financing policy by incorporating changes in interest expense $\left(\Delta I_{i,t}\right)$, changes in common dividends $\left(\Delta D_{i,t}\right)$, and net changes in financing $\left(NF_{i,t}\right)$, which represents the sum of total issuance of debt and equity, debt redemptions, and stock repurchases. We also adjust for change in noncash assets $\left(\Delta NA_{i,t}\right)$ and change in research and development expenditures ($\Delta R\&D_{i,t}$). We set R&D to zero if research and development expenditures are unreported in COMPUSTAT. Finally, we take into account the possibility that the value of cash reserves can hinge on the prior year's cash balance, as well as the likelihood that the value of cash holdings can vary with a firm's leverage. Accordingly, we include the previous year's cash holdings ($C_{i,t-1}$), financial leverage ($L_{i,t}$), and their individual interactions with change in cash assets ($\Delta C_{i,t}$). All the control variables are deflated by the lagged market value of equity except $L_{i,t}$, which is the ratio of total debt over the sum of total debt and the market value of equity.

4 Sample selection and description

We derive our initial sample from COMPUSTAT over the fiscal period of 1990–2010. We delete observations that do not have auditor information in COMPUSTAT. We drop firms that are in utility or financial industries with SIC codes between 4900–4999 and 6000–6999 because such firms may hold a certain level of cash and cash equivalents to meet regulations. We also remove observations with non-positive net assets from our sample. We require all firm-year observations to have necessary stock return information from the Center for Research in Security Prices (CRSP) and accounting information from COMPUSTAT. We winsorize all continuous variables at the 1% and 99% levels to attenuate the potential influence of outliers. Our final sample consists of 49,725 firm-year observations.

Table 2 provides the summary statistics of variables in our empirical analysis. The mean excess return $\left(r_{i,t} - R^B_{i,t}\right)$ is 0.3%. The mean change in cash assets from the previous year accounts for 1.4% of lagged market value of equity. A typical firm-year observation has notable increases in earnings $\left(\Delta E_{i,t}\right)$ and non-cash assets $\left(\Delta NA_{i,t}\right)$, while it has negligible changes in research and development expenditures ($\Delta R\&D_{i,t}$), interest expense (ΔI_t), and dividends $\left(\Delta D_{i,t}\right)$. The median cash balance at the end of the previous year is nearly 9.3% of the lagged market value of equity, whereas the mean approximates 18.2%. The mean (median) ratio of total debt to the sum of total debt and equity ($L_{i,t}$,) is 0.215 (0.142). The mean of $NF_{i,t}$ indicates that an average firm's issuance of debt and equity is greater than its debt redemptions and stock repurchases. Nearly 83% of our sample firms are audited by the Big 4.

Table 3 presents the Pearson correlation matrix. We find that financial leverage ($L_{i,t}$,) is significantly negatively associated with $\left(r_{i,t} - R^B_{i,t}\right)$. However, changes in cash assets $\left(\Delta C_{i,t}\right)$, financial performance $\left(\Delta E_{i,t}\right)$, change in non-cash assets $\left(\Delta NA_{i,t}\right)$, change in research and development expenditures ($\Delta R\&D_{i,t}$), change in dividend $\left(\Delta D_{i,t}\right)$, prior cash

Table 1 Variable definitions

$r_{i,t} - R^B_{i,t}$ = Excess stock return between the annual stock return of firm i at year t and stock i's benchmark return at year t, which is calculated based on Fama and French's 25 size and book-to-market matched portfolios

$r_{i,t} - R^I_{i,t}$ = Industry-adjusted return equals the difference between a firm's raw return and the value-weighted average return for an industry-specific portfolio based on Fama and French's 48 sector classifications

ΔC_t = Change in cash and short-term marketable securities from year $t-1$ to t deflated by the lagged market value of equity

ΔE_t = Change in earnings before extraordinary items plus interest, deferred tax credits, and investment tax credits from year $t-1$ to t scaled by the lagged market value of equity

ΔNA_t = Change in total assets minus cash holdings normalized by the lagged market value of equity

$\Delta R\&D_t$ = Change in R&D expenditures from year $t-1$ to t deflated by the lagged market value of equity

ΔI_t = Change in interest expense from year $t-1$ to t scaled by the lagged market value of equity

ΔD_t = Change in common dividends paid deflated by the lagged market value of equity

C_{t-1} = Level of cash and short-term marketable securities at year $t-1$ deflated by the lagged market value of equity

L_t = Ratio of total debt over the sum of total debt and the market value of equity

NF_t = Net financing at year t deflated by the lagged market value of equity

Big 4 = Indicator variable that takes the value of 1 if the firm is a Big 4 (Big 5, Big 6 or Big 8 in earlier eras) client, and 0 otherwise

BTR2 = Indicator variable that takes the value of 1 if the firm is a Big 4 client, and 0 if the firm is a second-tier audit firm client

TR2/3 = Indicator variable that takes the value of 1 if the firm is a second-tier audit firm client, and 0 if the firm is a third-tier audit firm client

$XCash_1$ = Level of excessive cash assets (i.e., abnormal change in cash assets) estimated from Eq. (2)

$XCash_2$ = Level of excessive cash assets (i.e., abnormal change in cash assets) estimated from Eq. (3)

PostSOX = Indicator variable that takes the value of 1 if the sample is in the post-SOX period (2002 through 2010), and 0 otherwise

N−B = Indicator variable that takes the value of 1 if the firm switches from a non-Big4 auditor to a Big4 auditor, and 0 otherwise

EINX = Entrenchment index from Bebchuk et al. (2009)

EINXD = Indicator variable that equals 1 if the firm is not covered by the entrenchment index, and 0 otherwise

GINX = Gompers Index developed by Gompers et al. (2003)

GINXD = Indicator variable that equals 1 if the firm is not covered by the Gompers Index, and 0 otherwise

SIZE = Natural logarithm of total assets

ATURN = Ratio of sales revenue to total assets

CURR = Current assets scaled by current liabilities

DA = Long-term debt normalized by total assets

ROA = Net income before extraordinary items divided by average total assets

ROALOSS = ROA multiplied by 1 if the firm has negative net income, and multiplied by 0 otherwise

level $\left(C_{i,t-1}\right)$, and net financing $\left(NF_{i,t}\right)$ are positively related to excess return $\left(r_{i,t} - R^B_{i,t}\right)$. The highest correlation among control variables is less than 0.40, suggesting that the multicollinearity problem is less likely to arise in the subsequent empirical analyses.

Table 2 Summary statistics

Variables	N	Mean	Q1	Median	Q3	SD
$r_{i,t} - R^{B}_{i,t}$	49,725	0.003	−0.405	−0.136	0.187	0.752
ΔC_t	49,725	0.014	−0.029	0.002	0.042	0.219
ΔE_t	49,725	0.028	−0.031	0.007	0.045	0.570
ΔNA_t	49,725	0.077	−0.032	0.038	0.155	0.766
$\Delta R\&D_t$	49,725	0.001	0.000	0.000	0.002	0.038
ΔI_t	49,725	0.001	−0.002	0.000	0.003	0.064
ΔD_t	49,725	−0.001	0.000	0.000	0.000	0.046
C_{t-1}	49,725	0.182	0.033	0.093	0.217	0.291
L_t	49,725	0.215	0.015	0.142	0.344	0.227
NF_t	49,725	0.062	−0.028	0.002	0.073	0.359
$Big\ 4_t$	49,725	0.828	1.000	1.000	1.000	0.377

This table summarizes descriptive statistics for the full sample of 49,725 firm-year observations. All variables are defined in Table 1

5 Empirical results

5.1 Influence of Big 4 versus non-Big 4 auditors on value of cash assets

Table 4 presents the first set of our regression results. In Column 1, we find a positive and significant relation between abnormal return and the interaction of auditor type (Big 4 versus non-Big 4 firms) with changes in cash and cash equivalents ($p < 0.01$). Consistent with the size or reputation story, the slope coefficient of 0.218 on $\Delta C_t * Big4_t$ suggests that Big 4 firms exhibit a greater capacity than their non-Big 4 rivals to constrain managers from exploiting cash assets to acquire private benefits. We find that a dollar of cash reserves yields only \$0.88 for the average non-Big 4 client, whereas it is worth \$1.09 for the average client audited by Big 4 auditors (1.125 + (− 0.228*0.182) + (− 0.96 6*0.215) + (0.218*1) = 1.094). Consequently, Big 4 auditors appear to outperform their non-Big 4 counterparts in preventing managerial expropriation of cash assets.

It is likely that the monitoring quality of the Big 4 relative to non-Big 4 audit firms has converged lately due to recent corporate governance reforms (Nelson 2006; Choi et al. 2008; Chang et al. 2010). It appears that the reforms mandated by the Sarbanes–Oxley Act (SOX) of 2002, such as the founding of the Public Company Oversight Board (PCAOB), have imposed greater pressure on all types of auditors to detect financial irregularities with the potential for managerial wealth expropriation. As a result, a natural question to explore is whether or not the private consumption of cash assets has remained more likely in non-Big 4 clients vis-à-vis their Big 4 peers in the post-SOX era.

To address this query, we insert a post-*SOX* indicator variable ($PostSOX_t$) into Column 2 and interact $PostSOX_t$ with $\Delta C_t * Big4_t$. It follows that the spread in the economic consequences of cash assets between Big 4 and non-Big 4 audit clients is based on the sum of the estimated coefficients on (1) $\Delta C_t * Big4_t$. and (2) $\Delta C_t * Big4_t * PostSOX_t$. We uncover that the coefficient on $\Delta C_t * Big4_t$ continues to be positively significant. Moreover, an *F*-test indicates that the sum of the estimated coefficients on $\Delta C_t * Big4_t$. and $\Delta C_t * Big4_t * PostSOX_t$ is positive and statistically distinguishable from zero ($p < 0.01$). This evidence indicates that, even in the post-SOX era, Big 4 auditors exhibit greater

Table 3 Pearson correlation matrix of main variables

Variables	$r_{i,t} - R^{B}_{i,t}$	ΔC_t	ΔE_t	ΔNA_t	$\Delta R\&D_t$	ΔI_t	ΔD_t	C_{t-1}	L_t	NF_t	$Big\ 4_t$
ΔC_t	**0.200**										
ΔE_t	**0.131**	**0.032**									
ΔNA_t	**0.074**	**0.039**	**0.091**								
$\Delta R\&D_t$	**0.011**	**0.082**	**−0.101**	**0.105**							
ΔI_t	−0.006	**0.027**	**−0.077**	**0.242**	**0.013**						
ΔD_t	**0.016**	**−0.016**	**−0.013**	**0.012**	0.000	−0.008					
C_{t-1}	**0.100**	**−0.165**	**0.060**	**−0.083**	**−0.059**	**−0.080**	−0.004				
L_t	**−0.139**	**−0.023**	0.008	0.006	**−0.032**	**0.050**	**−0.036**	**0.044**			
NF_t	**0.101**	**0.290**	0.001	**0.387**	**0.063**	**0.193**	0.000	**0.031**	**0.111**		
$Big\ 4_t$	0.002	0.003	−0.002	**0.014**	0.006	−0.001	−0.001	**−0.037**	**0.035**	**−0.015**	

All variables are given in Table 1. Coefficients in bold indicate significance at the 5 percent level or better

Table 4 Value of cash assets, Big 4 versus non-Big 4 auditors, and post-SOX era

Independent variables	Predicted signs	Dependent variable = $r_{i,t} - R^B_{i,t}$		Dependent variable = $r_{i,t} - R^I_{i,t}$	
		(1)	(2)	(3)	(4)
Intercept		0.135*** (0.00)	−0.011 (0.65)	0.227*** (0.00)	0.121*** (0.00)
ΔC_t	+	1.125*** (0.00)	1.138*** (0.00)	1.101*** (0.00)	1.126*** (0.00)
ΔE_t	+	0.138*** (0.00)	0.138*** (0.00)	0.135*** (0.00)	0.136*** (0.00)
ΔNA_t	+	0.066*** (0.00)	0.065*** (0.00)	0.065*** (0.00)	0.064*** (0.00)
$\Delta R\&D_t$	+	0.018 (0.42)	−0.028 (0.37)	0.039 (0.33)	−0.023 (0.40)
ΔI_t	−	−0.180*** (0.00)	−0.148*** (0.00)	−0.169*** (0.00)	−0.162*** (0.00)
ΔD_t	+	0.273*** (0.00)	0.243*** (0.00)	0.260*** (0.00)	0.252*** (0.00)
C_{t-1}	+	0.356*** (0.00)	0.372*** (0.00)	0.349*** (0.00)	0.376*** (0.00)
L_t	−	−0.527*** (0.00)	−0.505*** (0.00)	−0.504*** (0.00)	−0.486*** (0.00)
NF_t	+	0.047*** (0.00)	0.046*** (0.00)	0.047*** (0.00)	0.045*** (0.00)
$\Delta C_t * C_{t-1}$	−	−0.228*** (0.00)	−0.227*** (0.00)	−0.223*** (0.00)	−0.229*** (0.00)
$\Delta C_t * L_t$	−	−0.966*** (0.00)	−0.973*** (0.00)	−0.946*** (0.00)	−0.957*** (0.00)
$Big\ 4_t$	?	0.034*** (0.00)	0.021** (0.02)	0.032*** (0.00)	0.032*** (0.00)
$\Delta C_t * Big\ 4_t$	?	0.218*** (0.00)	0.238*** (0.00)	0.211*** (0.00)	0.220*** (0.00)
$PostSOX_t$	?		0.017** (0.01)		−0.059*** (0.00)
$\Delta C_t * Big4_t * PostSOX_t$	?		−0.033 (0.31)		−0.013 (0.67)
Observations		49,725	49,725	49,725	49,725
Adjusted R^2		13.46%	11.68%	12.28%	11.42%

The numbers in parentheses are *p*-values based on robust standard errors clustered by firm. All variables are given in Table 1. All model specifications allow for year- and industry fixed effects, whose coefficient estimates are suppressed. *, **, and *** denote significance at 10%, 5%, and 1% levels on a one-tailed test for coefficients with sign predictions and on a two-tailed test for those without sign predictions

monitoring intensity and remain more effective against the appropriation of private benefits embodied in cash holdings than their non-Big 4 rivals.

A concern for our baseline specification is that the book-to-market ratio, which is an essential component of our benchmark return, is likely to be endogenous. This, in turn, can cloud the interpretation of our main results. Accordingly, we follow Masulis et al. (2009) and test the validity of our results by alternatively using an industry-adjusted return

$\left(r_{i,t} - R^{I}_{i,t}\right)$ as the response variable. In particular, we redefine our dependent variable as the difference between a firm's raw return and the value-weighted average return for an industry-specific portfolio based on Fama and French's 48 sector classifications. As reported in Columns 3 and 4, the coefficients on the interactions of changes in cash assets and the Big 4 indicator are still positively significant, and the superior monitoring intensity of the Big 4 versus non-Big 4 auditors is not confined to the pre-SOX period.[4] These additional results make us confident that the connection between the value of cash assets and auditor type is not driven by the potentially endogenous nature of book-to-market ratios.

Consistent with Faulkender and Wang (2006), we also find that the market valuation of cash assets hinges upon a firm's leverage and cash balances in the prior period. Specifically, the coefficient on the interaction term of changes in cash assets with debt ratios is significantly negative, suggesting that financial flexibility is less valuable for shareholders in a higher leveraged firm because shareholders own call options on a firm's assets. A negative coefficient on the interaction between cash spread and prior cash balances implies that cash assets are less beneficial to firms that have piled up more cash and cash equivalents in the previous year.

5.2 The Big 4 versus second-tier/third-tier auditors and valuation of cash reserves

Thus far, our analyses have indicated that the marginal value of liquid assets is remarkably higher for Big 4 clients relative to non-Big 4 clients. However, these results are generally contingent on the presumption that all non-Big 4 auditors are characterized by similar natures, and that all provide similar monitoring quality. Accordingly, our basic conclusion is likely to be confounded by the likelihood that second-tier auditors, as compared to their third-tier peers, are more likely to provide oversight functions similar to those offered by Big 4 auditors. This issue appears legitimate because Jopson (2006) indicates that second-tier auditors have expanded their client portfolios significantly and are likely to emerge as viable alternatives to the Big 4. Further, Cassel et al. (2013) suggest that second-tier audit firm clients are likely to have higher financial reporting quality than other non-Big 4 clients.

Therefore, we are prompt to investigate whether our previous inference is largely driven by smaller-size, third-tier audit firms. To address this possibility, we exclude all non-Big 4 clients except second-tier audit firm clients. This additional test enables us to explicitly compare the disciplining effect of second-tier auditors relative to Big 4 auditors. If second-tier audit firms monitor top executives as dominantly as do Big 4 auditors, we should find no evidence that managerial expropriation through cash assets is more likely to prevail in second-tier audit firm clients. To perform this test, we define $BTR2_t$ as 1 if the firm is a Big 4 client in the given year, and 0 if the firm is a second-tier audit firm client. Consistent with our results in Table 4, we demonstrate in Column 1 of Table 5 that the coefficient on $\Delta C_t * BTR2_t$ is 0.165 and statistically significant ($p < 0.01$). To put the magnitude of this result into perspective, we find that an additional dollar of cash assets is worth \$0.96 for Tier-2 audit firm clients, whereas it rises to \$1.12 for Big 4 firm clients. Supporting the size story, this result indicates that Big 4 auditors also outperform second-tier audit

[4] An F-value of 27.12 suggests that the total of the estimated coefficients on $\Delta C_t * Big4_t$ and $\Delta C_t * Big4 * PostSOX_t$ is statistically different from zero at the 1% level.

Table 5 Value of cash assets across Big 4 and tier 2 & 3 audit firm clients

Independent variables	Predicted signs	(1)	(2)
Intercept		0.143*** (0.00)	0.196*** (0.01)
ΔC_t	+	1.219*** (0.00)	0.984*** (0.00)
ΔE_t	+	0.131*** (0.00)	0.214*** (0.00)
ΔNA_t	+	0.066*** (0.00)	0.096*** (0.00)
$\Delta R\&D_t$	+	−0.081 (0.19)	0.482*** (0.01)
ΔI_t	−	−0.198*** (0.00)	−0.370*** (0.00)
ΔD_t	+	0.265*** (0.00)	0.499*** (0.01)
C_{t-1}	+	0.371*** (0.00)	0.253*** (0.00)
L_t	−	−0.517*** (0.00)	−0.565*** (0.00)
NF_t	+	0.041*** (0.00)	0.039* (0.06)
$\Delta C_t * C_{t-1}$	−	−0.235*** (0.00)	−0.259*** (0.00)
$\Delta C_t * L_t$	−	−1.015*** (0.00)	−0.640*** (0.00)
$BTR2_t$	?	0.018 (0.14)	
$\Delta C_t * BTR2_t$	?	0.165*** (0.00)	
$TR2/3_t$	+		0.031** (0.04)
$\Delta C_t * TR2/3_t$	+		0.149** (0.03)
Observations		44,631	8538
Adjusted R^2		13.56%	13.67%

In column 1, we restrict attention to client firms audited by Big 4 or second-tier auditors. In column 2, the sample consists of only client firms audited by second-tier- or third-tier auditors. In both columns, the dependent variable is $r_{i,t} - R^B_{i,t}$. The numbers in parentheses are p-values based on robust standard errors clustered by firm. All variables are given in Table 1. All model specifications allow for year- and industry fixed effects, whose coefficient estimates are suppressed. *, **, and *** denote significance at 10%, 5%, and 1% levels on a one-tailed test for coefficients with sign predictions and on a two-tailed test for those without sign predictions

firms in preventing managerial expropriation of cash and cash equivalents from outside shareholders.

To evaluate the efficacy of second-tier versus third-tier auditors as corporate monitors, we also restrict our attention to the subsample of non-Big 4 auditors and perform a similar analysis. This procedure yields a subgroup of 8538 firm-year observations. We delineate

$TR2/3_t$ as 1 if the firm is a second-tier audit firm client in the given year, and 0 if the firm is a smaller third-tier audit firm client. Not surprisingly, we find that the coefficient on $\Delta C_t * TR2/3_t$ is positive. We observe that the marginal value of cash assets is less than their full value for both tier-2 and tier-3 audit firm clients, whereas the incremental value is 15 cents greater for tier-2- than for tier-3 audit clients. This evidence is consistent with the conventional wisdom that tier-2 auditors play a more active role vis-à-vis tier-3 auditors in preventing the transfer of cash resources out of a firm to its management. Nevertheless, our results suggest that tier-2 audit firms do not appear to perform as well as their Big 4 peers in reducing agency costs inherent in cash assets.

5.3 Auditor type and value of excessive cash assets

It seems plausible that our previous measure of cash reserves captures the time-specific variation in cash assets that are committed to short-term operations and long-run growth, rather than the variation in funds that are at risk of managerial expropriation. To alleviate this concern, we follow Jensen (1986) and Harford (1999) and focus on the change in cash assets in excess of the normal change for business operations and investment opportunity. Based on Almeida et al. (2004), we build two regression models to estimate the normal change in cash assets for business activities and capture the degree of excessive cash assets (i.e., abnormal change in cash assets) by the error terms:

$$\Delta C_{i,t} = \theta_0 + \theta_1 CF_{i,t-1} + \theta_2 MB_{i,t-1} + \theta_3 SIZE_{i,t-1} + \eta_{i,t} \tag{2}$$

In Eq. (2), $\Delta C_{i,t}$ refers to changes in cash and near cash during fiscal year t deflated by the market value of equity at the end of fiscal-year $t-1$. $CF_{i,t-1}$ is lagged cash flow normalized by the lagged market value of equity. MB_{it-1} is the ratio of market value to book value of assets, and $SIZE_{i,t-1}$ is the natural logarithm of total assets. We define our first measure of excessive cash assets ($XCash_{1t}$) as the difference between the actual change in cash resources and the normal change in cash balances estimated from Eq. (2).

In the second regression model specification, we incorporate additional firm characteristics that are likely to have incremental effects on the change in cash balances. In particular, $EXP_{i,t-1}$ and $ACQ_{i,t-1}$ are the lagged capital expenditures and acquisitions, respectively, deflated by the lagged market value of equity. $\Delta NWC_{i,t-1}$ and $\Delta SD_{i,t-1}$ denote respective changes in net working capital and short-term debt over the previous year scaled by the lagged market value of equity. Our second measure of excessive cash assets ($XCash_{2t}$) is computed as the actual change in cash assets minus the normal change in cash holdings derived from the equation as follows:

$$\begin{aligned}\Delta C_{i,t} = {} & \theta_0 + \theta_1 CF_{i,t-1} + \theta_2 MB_{i,t-1} + \theta_3 SIZE_{i,t-1} + \theta_4 EXP_{i,t-1} + \theta_5 ACQ_{i,t-1} \\ & + \theta_6 \Delta NWC_{i,t-1} + \theta_7 \Delta SD_{i,t-1} + \eta_{i,t}\end{aligned} \tag{3}$$

In Column 1 of Table 6, the coefficient on $XCach_{1t} * Big4_t$ is significantly positive at $p < 0.01$. This evidence highlights the idea that non-Big 4 audit firms are likely to underperform their Big 4 rivals in precluding the misallocation of surplus funds. In particular, we demonstrate that the value loss stemming from extra cash resources arises only in non-Big 4 audit firm clients. We find that, while an additional dollar of excess cash balances contributes only \$0.89 to non-Big 4 clients, outside shareholders in Big 4 clients tend to receive more than the full value of these surplus cash resources. This observation is justifiably extended to Column 2, in which we focus on $XCash_{2t}$ as a

Table 6 Value of excessive cash assets in Big 4 versus non-Big4 audit firm clients

Independent variables	Predicted signs	(1)	(2)
Intercept		0.195*** (0.00)	0.211*** (0.00)
$XCash_{1t}$	+	1.054*** (0.00)	
$XCash_{2t}$	+		1.052*** (0.00)
ΔE_t	+	0.153*** (0.00)	0.147*** (0.00)
ΔNA_t	+	0.044*** (0.00)	0.048*** (0.00)
$\Delta R\&D_t$	+	00.159** (0.04)	0.092 (0.15)
ΔI_t	−	−0.129*** (0.01)	−0.150*** (0.01)
ΔD_t	+	0.243*** (0.00)	0.265*** (0.00)
C_{t-1}	+	0.382*** (0.00)	0.408*** (0.00)
L_t	−	−0.682*** (0.00)	−0.682*** (0.00)
NF_t	+	0.169*** (0.00)	0.169*** (0.00)
$XCash_{1t} * L_t$	−	−0.036 (0.23)	
$XCash_{1t} * C_{t-1}$	−	−0.839*** (0.00)	
$XCash_{2t} * L_t$	−		0.027 (0.29)
$XCash_{2t} * C_{t-1}$	−		−0.817*** (0.00)
$Big\ 4_t$	?	0.037*** (0.00)	0.036*** (0.00)
$XCash_{1t} * Big4_t$	?	0.262*** (0.00)	
$XCash_{2t} * Big4_t$	?		0.273*** (0.00)
Observations		49,725	45,444
Adjusted R^2		11.01%	11.14%

In both columns, the dependent variable is $r_{i,t} - R^B_{i,t}$. The numbers in parentheses are *p*-values based on robust standard errors clustered by firm. All variables are given in Table 1. All model specifications allow for year- and industry fixed effects, whose coefficient estimates are suppressed. *, **, and *** denote significance at 10%, 5%, and 1% levels on a one-tailed test for coefficients with sign predictions and on a two-tailed test for those without sign predictions

refined measure of excess cash assets. Consequently, our main inference seems not to be contaminated by using the temporal change in cash assets as a proxy for excessive cash holdings. Taken together, our ancillary findings reinforce the notion that Big 4 audit

firms are more likely to safeguard shareholder wealth than their non-Big 4 peers by curbing agency costs intrinsic to surplus funds.

5.4 Corporate governance and value of cash holdings

The main results shown in our prior analyses provide compelling evidence of the disciplining influences of Big 4 auditors on the value destruction of cash assets. Although Faulkender and Wang's (2006) model specification greatly reduces concerns about bias attributable to correlated omitted variables and appears parsimonious, we cannot eliminate these concerns. Thus, we further test whether the disciplinary effect of Big 4 auditors versus their non-Big 4 counterparts on managerial expropriation of cash holdings illuminates a spurious association due to the absence of controls for heterogeneity in corporate governance.

We measure corporate governance mechanisms by utilizing the number of antitakeover provisions in a firm's charter and in the legal code of the state in which the firm is incorporated. The rationale is that antitakeover provisions can exacerbate managerial entrenchment by sheltering top executives from the scrutiny and discipline of the market for corporate control (Bertrand and Mullainathan 2003; Cremers and Nair 2005). To allow for this possibility, we focus on the Gompers index ($GINX_t$), which is reported every 2 years. When the firm's index is not available in the particular year, we use the firm's most recently available index due to the sticky nature of the index (Dittmar and Mahrt-Smith 2007). Given that a nontrivial portion of our sample firms is not included in this index, we follow Biddle et al. (2009) and set the missing $GINX_t$ to 0. To assess the potential influence of missing index data on excess return, we add an indicator variable ($GINXD_t$) that takes a value of 1 when $GINX_t$ is not available, and 0 otherwise.

In Column 1 of Table 7, we show that the coefficient on the interaction of changes in cash assets with $GINX_t$ is negative and statistically significant. This evidence is consistent with Dittmar and Mahrt-Smith (2007) that managerial extraction of funds is likely to intensify for firms with more anti-takeover provisions. The negatively significant coefficient on $\Delta C_t * GINXD_t$ ($p < 0.01$) seems to indicate that expropriation risk is likely to deteriorate with firms that are not covered by the Gompers index. The intuition is that these non-covered firms are likely to be less scrutinized and hence are subject to less monitoring from capital markets. More importantly, the positive coefficient on $\Delta C_t * Big4_t$ remains positive and is highly significant. This evidence suggests that the superior disciplining effect of Big 4 firms compared to non-Big 4 firms is not sensitive to controlling for the variation in corporate governance mechanisms.

We also use the entrenchment index developed by Bebchuk et al. (2009) as an alternative measure of corporate governance. The entrenchment index ($EINX_t$) is constructed based on six provisions: staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes, and supermajority requirements for mergers and charter amendments. Each firm is assigned a score ranging from zero to six, based on the number of these entrenching provisions in a given year, with a higher value of the score indicating greater entrenchment. In Column 2 of Table 7, we again find that the coefficients on both $\Delta C_t * EINX_t$ and $\Delta C_t * EINXD_t$ are significantly negative. Nevertheless, we continue to find that the coefficient on $\Delta C_t * Big4_t$ is significantly positive at the 1% level. Hence, this supplementary evidence validates the premise that Big 4 firms, compared to their non-Big 4 rivals, are more likely to play an independent role in constraining insiders from seeking rents from corporate cash assets.

Table 7 Value of cash assets, Big4 versus non-Big 4 Auditors, and corporate governance

Independent variables	Predicted signs	(1)	(2)
Intercept		0.062* (0.10)	0.093*** (0.01)
ΔC_t	+	1.851*** (0.00)	1.603*** (0.00)
ΔE_t	+	0.138*** (0.00)	0.138*** (0.00)
ΔNA_t	+	0.066*** (0.00)	0.066*** (0.00)
$\Delta R\&D_t$	+	0.016 (0.43)	0.015 (0.43)
ΔI_t	−	−0.180*** (0.00)	−0.181*** (0.00)
ΔD_t	+	0.274*** (0.00)	0.274*** (0.00)
C_{t-1}	+	0.357*** (0.00)	0.356*** (0.00)
L_t	−	−0.529*** (0.00)	−0.528*** (0.00)
NF_t	+	0.047*** (0.00)	0.047*** (0.00)
$\Delta C_t * C_{t-1}$	−	−0.224*** (0.00)	−0.224*** (0.00)
$\Delta C_t * L_t$	−	−0.966*** (0.00)	−0.961*** (0.00)
$Big\ 4_t$	?	0.040*** (0.00)	0.038*** (0.00)
$\Delta C_t * Big\ 4_t$	?	0.207*** (0.00)	0.205*** (0.00)
$GINX_t$	?	0.005** (0.00)	
$\Delta C_t * GINX_t$	−	−0.060*** (0.01)	
$GINXD_t$	?	0.071** (0.02)	
$\Delta C_t * GINXD_t$	?	−0.735*** (0.00)	
$EINX_t$	?		0.010 (0.13)
$\Delta C_t * EINX_t$	−		−0.096** (0.04)
$EINXD_t$	?		0.042** (0.02)
$\Delta C_t * EINXD_t$	?		−0.485*** (0.00)
Observations		49,725	49,725
Adjusted R^2		13.37%	13.35%

The dependent variable is $r_{i,t} - R^B_{i,t}$. The numbers in parentheses are *p*-values based on robust standard errors clustered by firm. All variables are given in Table 1. All model specifications allow for year- and industry fixed effects. *, **, and *** denote significance at 10%, 5%, and 1% levels on a one-tailed test for coefficients with sign predictions and on a two-tailed test for those without sign predictions

5.5 Change in auditor type and value of cash assets

To lend further credence to the efficacy of the Big 4 relative to non-Big 4 auditors as governance facilitators, we also examine the influence of a change in auditor type on the marginal value of cash assets. The rationale behind this test is that the stock market reaction to changes in cash assets is also likely to depend on the change in auditor type. If non-Big 4 auditors provide monitoring services comparable to those of the Big 4, we should not observe that auditor turnover from the former to the latter has any incremental effect on the value of cash reserves. To the extent that non-Big 4 audit firms fail to play an oversight role similar to that played by their Big 4 counterparts, cash valuation is expected to increase with a switch from a non-Big 4 auditor to a Big 4 auditor. In this instance, cash assets should contribute more to the average audit client when it switches from a non-Big 4 auditor to a Big 4 auditor than when it switches from a Big 4 firm to a non-Big 4 firm or does not change its auditor type. We view this analysis as complementing and strengthening our prior cross-sectional results because this temporal approach can further mitigate the potential biases attributable to correlated omitted variables and endogeneity (Healy et al. 1999; Bens and Monahan 2004).

Extant research documents that auditor switches are undertaken primarily for seeking lower audit fees and/or better services (Sankaraguruswamy and Whisenant 2004; Ettredge et al. 2007; Chang et al. 2010). Our untabulated results indicate that there are 3728 auditor changes among 39,717 firm-year observations. Consistent with Knechel et al. (2007), we find that more firms switch from the Big 4 to non-Big 4 auditors than do those from non-Big 4 to Big 4 auditors possibly due to fee concerns. Specifically, there are 916 observations that switch from Big 4 to non-Big 4 auditors, whereas only 483 observations change from non-Big 4 to Big 4 audit firms. We find that 2329 observations experience auditor turnovers within the same category of audit firms.

To explicitly test the effect of a change in auditor type on the marginal value of cash assets, we denote the indicator variable $(N-B_t)$ as 1 if the firm changes from a non-Big 4 auditor in the prior year to a Big 4 auditor in the current year, and 0 otherwise. Our variable of particular interest is the interaction of changes in cash assets with $N-B_t$. In column 1 of Table 8, our dependent variable is excess return based on Fama and French's size and book-to-market matched portfolio return. Consistent with our previous observation, the coefficient of 0.453 on $\Delta C_t * N - B_t$ is positively significant ($p<0.01$). This magnitude suggests that an additional dollar of cash assets is worth 45 cents more to the average audit client when it switches from a non-Big 4 auditor to a Big 4 auditor than when it changes from a Big 4 firm to a non-Big 4 firm or does not change its auditor type. We find qualitatively similar results when we use an industry-adjusted return as an alternative excess return in Column 2. Overall, this supplementary evidence corroborates the idea that non-Big 4 audit firms tend to be less effective in monitoring top executives and affecting the allocation efficiency of cash and short-term marketable securities vis-à-vis their Big 4 rivals.

5.6 Propensity score-matching analysis

As discussed above, auditor choice is likely to be endogenous. An alternative explanation for our findings is that reputable auditors are more likely to accept audit clients with stronger economic fundamentals and thus lower litigation risks. To address this issue, we perform a matched sample analysis in which we compare the value of cash assets in Big 4 clients

Table 8 Change in auditor type and value of cash assets

Independent variables	Predicted signs	Dependent variable = $r_{i,t} - R^{B}_{i,t}$ (1)	Dependent variable = $r_{i,t} - R^{I}_{i,t}$ (2)
Intercept		0.183*	0.020
		(0.09)	(0.85)
ΔC_t	+	1.354***	1.225***
		(0.00)	(0.00)
ΔE_t	+	0.145***	0.137***
		(0.00)	(0.00)
ΔNA_t	+	0.092***	0.089***
		(0.00)	(0.00)
$\Delta R\&D_t$	+	−0.144*	−0.020
		(0.08)	(0.42)
ΔI_t	−	0.007	0.013
		(0.46)	(0.43)
ΔD_t	+	0.370***	0.366***
		(0.00)	(0.00)
C_{t-1}	+	0.379***	0.341***
		(0.00)	(0.00)
L_t	−	−0.505***	−0.449***
		(0.00)	(0.00)
NF_t	+	0.020**	0.014*
		(0.05)	(0.10)
$\Delta C_t * C_{t-1}$	−	−0.240***	−0.219***
		(0.00)	(0.00)
$\Delta C_t * L_t$	−	−1.039***	−0.922***
		(0.00)	(0.00)
$N-B_t$	?	0.104***	0.053*
		(0.00)	(0.07)
$\Delta C_t * N-B_t$	?	0.453***	0.450***
		(0.00)	(0.00)
Observations		39,717	39,717
Adjusted R^2		14.08%	11.30%

In column 1, our dependent variable is excess return based on Fama and French's size and book-to-market matched portfolio return. In column 2, we utilize an industry-adjusted return as an alternative measure of abnormal return. The numbers in parentheses are *p*-values based on robust standard errors clustered by firm. All variables are given in Table 1. All model specifications allow for year and industry fixed effects, whose coefficient estimates are suppressed. *, **, and *** denote significance at 10%, 5%, and 1% levels on a one-tailed test for coefficients with sign predictions and on a two-tailed test for those without sign predictions

with that in non-Big 4 clients, conditional on the likelihood of selecting a particular type of accounting firm. To this end, we use a propensity score-matching approach to account for variables that could affect the firm's decision to choose a specific category of auditors (Rosenbaum 2002; Murphy and Sandino 2010). We build our logistic choice model based on Chaney et al. (2004) and Lawrence et al. (2011) as follows:

$$Big4_{it} = \alpha_0 + \alpha_1 SIZE_{it} + \alpha_2 ATURN_{it} + \alpha_3 CURR_{it} + \alpha_4 DA_{it} + \alpha_5 ROA_{it} + \alpha_6 ROALOSS_{it} + \mu_{it} \quad (4)$$

Table 9 Comparison of means in firm characteristics between the treatment and control samples

Variable	Matched pairs			
	Means		Difference in means	Differences t-statistics (*p* value)
	Big4 clients	Non-Big4 clients		
SIZE	4.008	4.012	−0.004	0.15 (0.82)
ATURN	1.204	1.208	−0.004	0.28 (0.78)
CURR	3.359	3.338	0.021	−0.30 (0.76)
DA	0.130	0.132	−0.002	0.51 (0.61)
ROA	−0.075	−0.072	−0.003	0.61 (0.54)
ROALOSS	−0.122	−0.119	−0.003	0.67 (0.50)
N	7339	7339		

We match a non-Big 4 audit client with a Big 4 audit client based on the propensity scores derived from the logit model for the likelihood of appointing a Big 4 audit firm. We use the paired *t* test to test the differences in means for this matched sample. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Table 1

In Eq. (4), the response variable is a selection indicator variable for a Big 4 audit firm ($Big4_t$). Firm size ($SIZE_t$) is denoted as the natural logarithm of total assets as of fiscal year-end. Asset turnover ($ATURN_t$) is defined as sales revenue normalized by total assets. We include current ratio ($CURR_t$), as measured by current assets deflated by current liabilities. We delineate leverage ratio (DA_t) as long-term debt scaled by total assets, use return on assets (ROA_t) to denote financial performance, and define $ROALOSS_t$ as ROA multiplied by 1 if a firm has negative net income, and multiplied by 0 otherwise.

For each non-Big 4 audit client, we identify its matched Big 4 audit client that has the closest propensity score in the given year. Our matching procedure generates a matched sample of 14,678 firm-years with an equal number of observations for Big 4 and non-Big 4 audit clients. To assess the quality of our matched sample, we further conduct paired tests of the means of firm characteristics for the treatment and control subsamples. The results displayed in Table 9 confirm that the mean values of all firm characteristics are not significantly different between the treatment and the control groups at conventional levels. This evidence suggests that all the pairs of firms, on average, have similar characteristics.

In Table 10, we replicate our previous analyses in Table 4 based on this attribute-based matched sample. In Column 1, the coefficient on $\Delta C_t * Big4_t$ is positive and remains highly significant. In Column 2, we detect evidence that the sum of the coefficients on $\Delta C_t * Big4_t * PostSOX_t$ and $\Delta C_t * Big4_t$ is statistically distinguishable from zero ($p < 0.01$). Our evidence underscores the notion that the outperformance achieved by the Big 4 compared to non-Big 4 firms as corporate monitors persists, even in the post-SOX era. We obtain similar results when we focus on an industry-adjusted return as an alternative measure of stock performance in Columns 3 and 4. All in all, the propensity score analysis confirms the superior ability of Big 4 firms versus their non-Big 4 rivals in

Table 10 Attributed-based matched sample: value of cash assets in Big 4 versus non-Big 4 audit firm clients

Independent variables	Predicted signs	Dependent variable = $r_{i,t} - R^B_{i,t}$		Dependent variable = $r_{i,t} - R^I_{i,t}$	
		(1)	(2)	(3)	(4)
Intercept		0.086 (0.20)	−0.142** (0.021)	0.182*** (0.01)	0.018 (0.76)
ΔC_t	+	1.155*** (0.00)	1.196*** (0.00)	1.138*** (0.00)	1.196*** (0.00)
ΔE_t	+	0.163*** (0.00)	0.160*** (0.00)	0.164*** (0.00)	0.164*** (0.00)
ΔNA_t	+	0.060*** (0.00)	0.059*** (0.00)	0.060*** (0.00)	0.059*** (0.00)
$\Delta R\&D_t$	+	0.137 (0.21)	0.046 (0.40)	0.165 (0.17)	0.042 (0.40)
ΔI_t	−	−0.307*** (0.00)	−0.291*** (0.00)	−0.306*** (0.00)	−0.307*** (0.00)
ΔD_t	+	0.594*** (0.00)	0.571*** (0.00)	0.547*** (0.00)	0.560*** (0.00)
C_{t-1}	+	0.357*** (0.00)	0.401*** (0.00)	0.349*** (0.00)	0.403*** (0.00)
L_t	−	−0.593*** (0.00)	−0.575*** (0.00)	−0.583*** (0.00)	−0.565*** (0.00)
NF_t	+	0.129*** (0.00)	0.130*** (0.00)	0.136*** (0.00)	0.131*** (0.00)
$\Delta C_t * C_{t-1}$	−	−0.265*** (0.00)	−0.275*** (0.00)	−0.269*** (0.00)	−0.288*** (0.00)
$\Delta C_t * L_t$	−	−1.014*** (0.00)	−1.026*** (0.00)	−1.024*** (0.00)	−1.026*** (0.00)
$Big\ 4_t$	?	0.030** (0.04)	0.028* (0.06)	0.027* (0.06)	0.041*** (0.00)
$\Delta C_t * Big\ 4_t$	?	0.182*** (0.00)	0.185*** (0.01)	0.161*** (0.01)	0.159** (0.02)
$PostSOX_t$	?		0.017 (0.25)		−0.051*** (0.00)
$\Delta C_t * Big4_t * PostSOX_t$	?		0.015 (0.89)		0.016 (0.88)
Observations		14,678	14,678	14,678	14,678
Adjusted R^2		12.88%	11.10%	12.62%	10.83%

The numbers in parentheses are *p*-values based on robust standard errors clustered by firm. All variables are given in Table 1. All model specifications allow for year- and industry fixed effects, whose coefficient estimates are suppressed. *, **, and *** denote significance at 10%, 5%, and 1% levels on a one-tailed test for coefficients with sign predictions and on a two-tailed test for those without sign predictions

restricting managerial power to extract corporate funds and cash equivalents from outside shareholders.

6 Robustness tests

In this section, we explore whether our main results are robust to alternative valuation models employed by Pinkowitz et al. (2006). Notably, they adapt the framework of Fama and French (1998) and split the change in assets into its cash and noncash components to estimate the relation between market value and cash holdings. Given that next-period changes in variables are introduced to absorb changes in expectations, Pinkowitz et al. (2006) focus on the coefficient estimate of the contemporaneous change in liquid asset holdings to measure the value of a dollar of cash. To validate our basic conclusion, we therefore extend their baseline regression by adding a Big 4 indicator variable and its interaction with the contemporaneous change in cash holdings. We summarize the testable specification as follows:

$$\begin{aligned} V_{i,t} =& \alpha + \beta_1 E_{i,t} + \beta_2 dE_{i,t} + \beta_3 dE_{i,t+1} + \beta_4 dNA_{i,t} + \beta_5 dNA_{i,t+1} + \beta_6 RD_{i,t} + \beta_7 dRD_{i,t} \\ &+ \beta_8 dRD_{i,t+1} + \beta_9 I_{i,t} + \beta_{10} dI_{i,t} + \beta_{11} dI_{i,t+1} + \beta_{12} D_{i,t} + \beta_{13} dD_{i,t} + \beta_{14} dD_{i,t+1} + \beta_{15} dV_{i,t+1} \\ &+ \beta_{16} dL_{i,t} + \beta_{17} Big4_{i,t} + \beta_{18} dL_{i,t} * Big4_{i,t} + \beta_{19} dL_{i,t+1} + \varepsilon_{i,t} \end{aligned} \tag{5}$$

where $V_{i,t}$ is defined as the market value of the firm's equity plus the book value of its debt in year t. $E_{i,t}$ is the sum of earnings before extraordinary items, interest, deferred tax credits, and investment tax credits. $NA_{i,t}$ is delineated as total assets minus cash holdings. $RD_{i,t}$ is research and development expense. We use $I_{i,t}$ to represent interest expense and $D_{i,t}$ to denote common dividends. $L_{i,t}$ is delineated as cash and cash equivalents. $dX_{i,t}$ is the firm's change in the level of variable X from year $t-1$ to year t, and $dX_{i,t+1}$ is the company's change in the level of variable X from year t to year $t+1$. We normalize all the variables by the book value of the firm's assets in year t. $Big4_{i,t}$ is set to 1 if the firm is a Big 4 (Big 5, Big 6 or Big 8 in earlier eras) client in year t, and 0 otherwise.

Akin to our prior results, the slope coefficient of 0.382 on $dL_t * Big4_t$ in Column 1 of Table 11 continues to be significant at conventional levels, indicating that a dollar of cash contributes \$0.382 more to Big 4 clients than to their non-Big 4 counterparts. To confirm the validity of our results, we further include the interaction of $Big4_t$ with dL_{t+1} in Column 2 of Table 11. This addition is motivated by the line of reasoning in Pinkowitz et al. (2006) that if the monitoring effect of an investor-protection mechanism (e.g., Big 4 auditing) on corporate cash assets is not overstated, the coefficient on $dL_{t+1} * Big4_t$ is less likely to be negative. As expected, the slope of 0.17 on $dL_{t+1} * Big4_t$ turns out to be non-negative, thereby alleviating the concern that our estimated influence of Big 4 relative to non-Big 4 auditors on the value of liquid asset holdings could be overstated. Moreover, we find that the coefficient on $dL_t * Big4_t$ in Column 2 of Table 11 is again positive and increases to 0.439 at the 1% level of statistical significance.

A potential problem with the changes regression described in Eq. (5) is that an increase in cash could capture expectations about future growth. Nevertheless, Pinkowitz et al. (2006) suggest that this issue should be less of a concern because Eq. (5) comprises lead variables to pick up expectations. As a robustness check, we, consistent with Pinkowitz et al. (2006), alternatively replace the lead and lag of cash changes with the level of cash, as denoted by $L_{i,t}$. Accordingly, our variable of interest now lies in $L_{i,t} * Big4_{i,t}$. We lay out the level regression as follows:

Table 11 Value of cash in Big 4 and non-Big 4 audit clients—alternative valuation models

Variable	(1)	(2)	(3)
Intercept	1.596***	1.600***	1.336***
	(0.000)	(0.000)	(0.000)
E_t	− 0.238*	− 0.251*	0.055
	(0.099)	(0.073)	(0.599)
dE_t	0.272***	0.271***	0.187***
	(0.000)	(0.000)	(0.000)
dE_{t+1}	− 0.049	− 0.058	0.065
	(0.497)	(0.416)	(0.256)
dNA_t	0.667***	0.672***	0.832***
	(0.000)	(0.000)	(0.000)
dNA_{t+1}	− 0.004	− 0.004	− 0.010
	(0.697)	0.649	(0.131)
RD_t	2.193***	2.182***	1.318***
	(0.000)	(0.000)	(0.000)
dRD_t	− 0.249	− 0.269	0.235
	(0.589)	(0.553)	(0.427)
dRD_{t+1}	0.675***	0.705***	0.902***
	(0.002)	(0.001)	(0.000)
I_t	− 0.704	− 0.680	− 3.337***
	(0.459)	(0.473)	(0.000)
dI_t	− 1.856*	− 1.948*	− 2.973***
	(0.082)	(0.062)	(0.000)
dI_{t+1}	− 0.682*	− 0.733*	0.037
	(0.096)	(0.077)	(0.898)
D_t	4.264***	4.259***	3.940***
	(0.000)	(0.000)	(0.000)
dD_t	− 1.280***	− 1.287***	− 1.286***
	(0.000)	(0.000)	(0.000)
dD_{t+1}	0.267	0.238	0.377*
	(0.314)	(0.386)	(0.072)
dV_{t+1}	− 0.024**	− 0.024**	− 0.016*
	(0.022)	(0.020)	(0.076)
dL_t	0.862***	0.817***	
	(0.000)	(0.000)	
$Big\ 4_t$	0.005	0.002	0.072**
	(0.850)	(0.941)	(0.013)
$dL_t * Big\ 4_t$	0.382**	0.439***	
	(0.016)	(0.005)	
dL_{t+1}	0.174**	0.039	
	(0.010)	(0.710)	
$dL_{t+1} * Big\ 4_t$		0.170*	
		(0.091)	
L_t			1.710***
			(0.000)
$L_t * Big\ 4_t$			0.479***
			(0.001)
Observations	41,398	41,398	41,398
Adjusted R^2	25.99%	26.06%	32.07%

We explore the robustness of our main results by alternatively using the valuation framework of Pinkowitz et al. (2006) with V_t as the

Table 11 (continued)

dependent variable. We define V_t as the total of the market value of equity and the book value of debt deflated by the book value of assets. E_t is the sum of earnings before extraordinary items, interest, deferred tax credits, and investment tax credits deflated by the book value of assets. NA_t is delineated as total assets minus cash holdings and then is scaled by the book value of assets. RD_t is research and development expense deflated by the book value of assets. We use I_t to represent interest expense deflated by the book value of assets and D_t to denote common dividends deflated by the book value of assets. L_t is delineated as cash and cash equivalents deflated by the book value of assets. dX_t is the change in the level of variable X from year $t-1$ to year t deflated by the book value of assets, and dX_{t+1} is the change in the level of variable X from year t to year $t+1$ deflated by the book value of assets. $Big4_t$ is set to 1 if the firm is a Big 4 (Big 5, Big 6 or Big 8 in earlier eras) client in year t, and 0 otherwise. The numbers in parentheses are p-values based on robust standard errors clustered by firm. All model specifications allow for year- and industry fixed effects, whose coefficient estimates are suppressed. *, **, and ***denote significance at 10%, 5%, and 1% levels, respectively

$$\begin{aligned} V_{i,t} =& \alpha + \beta_1 E_{i,t} + \beta_2 dE_{i,t} + \beta_3 dE_{i,t+1} + \beta_4 dNA_{i,t} + \beta_5 dNA_{i,t+1} + \beta_6 RD_{i,t} + \beta_7 dRD_{i,t} \\ &+ \beta_8 dRD_{i,t+1} + \beta_9 I_{i,t} + \beta_{10} dI_{i,t} + \beta_{11} dI_{i,t+1} + \beta_{12} D_{i,t} + \beta_{13} dD_{i,t} + \beta_{14} dD_{i,t+1} + \beta_{15} dV_{i,t+1} \\ &+ \beta_{16} L_{i,t} + \beta_{17} Big4_{i,t} + \beta_{18} L_{i,t} * Big4_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{6}$$

Paralleling the results in first two columns, the estimate on $L_t * Big4_t$ in Column 3 of Table 11 is again positive ($p<0.01$). Specifically, the coefficient on the interaction term indicates that a dollar of liquid assets is worth \$0.479 more in Big 4 clients than in their non-Big 4 peers. As a whole, this set of ancillary results verifies that the superior monitoring effect of Big 4 versus non-Big 4 auditors on corporate cash resources survives alternative valuation models.

7 Conclusions

In light of the agency framework, one of the principal functions played by Big 4 and non-Big 4 audit firms is to reduce the agency costs of managerial discretion. Despite numerous studies linking auditor type (Big 4 vs. Non-Big 4) to auditor performance, prior constructs of auditor performance often intertwine the monitoring effect with the information effect of auditors. This, in turn, can cloud inferences on the monitoring effect of Big 4 vis-à-vis non-Big 4 audit firms.

Distinct from many previous studies that focus on a multitude of proxies for auditor performance, we shed light on the value consequences of Big 4 compared with non-Big 4 audit firms. More prominently, we distinguish the monitoring effect from the information effect of the Big 4 vis-à-vis their non-Big 4 rivals on shareholder wealth. We uncover evidence that the value discount of cash holdings is concentrated in clients that are audited by non-Big 4 accounting firms. Conversely, investors tend to attach a value premium to cash resources possessed by Big 4 clients. A refined comparison of Big 4 versus Tier-2 accounting firms gives the same results and interpretation. Our results survive an alternative measure of excess return, different proxies for excessive cash assets, additional controls for corporate governance devices, and alternative valuation models. Moreover, we investigate

whether a change in auditor type triggers a variation in the value of cash holdings. As anticipated, we find that an auditor switch from a non-Big 4 class to a Big 4 class significantly enhances the economic contributions of a firm's cash assets to its shareholders.

We also replicate our empirical analysis by alternatively investigating a propensity score-matched sample. We ask whether our inference is hindered by heterogeneity in client characteristics. Using an attribute-based matched sample, we verify that auditor reputation indeed plays an important role in explaining the value of corporate cash and near-cash. Collectively, our results illuminate the notion that non-Big 4 auditors are likely to be inferior substitutes for their Big 4 peers in preventing self-dealing managers from extracting funds and cash equivalents from outside shareholders.

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