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Auditor industry specialization and corporate risk-taking

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Abstract

Purpose – The purpose of this study is to examine the effects of higher-quality auditors on corporate risk-taking.

Design/methodology/approach – Agency theory suggests that managers have incentives to avoid risk in the interests of perquisite consumption and self-preservation, while investors prefer that managers invest in all projects with a positive net present value, i.e. projects that generally increase corporate risk. Empirical literature finds that managerial risk-aversion is mitigated (and firm value enhanced) when investor protection is higher. The authors examine whether higher-quality auditing is one such mechanism to encourage shareholder-focused corporate risk-taking. They model measures of corporate risk as a function of whether a firm is audited by an industry specialist or not, controlling specifically for accounting quality. They then examine the incremental effect of higher-quality audits on other forms of external monitoring (analyst coverage and institutional holdings) for corporate risk.

Findings – Using a sample from 2003 to 2007, the authors document a positive relationship between local-level audit industry specialization and both the standard deviation of annual stock returns and research and development expenditures (their measures of corporate risk-taking). They then find the effect is mitigated when firms have alternative external monitoring, in the form of either higher analyst coverage or greater institutional holdings.

Research limitations/implications – Given the nature of the question the authors ask, particularly in the context of the auditor–client relationship, a potential limitation is the difficulty in assigning causation. Nonetheless, this study underscores the importance of auditors as an effective mechanism for monitoring corporate managers.

Originality/value – This study provides novel evidence that auditors affect managerial decision making beyond a simple effect on financial statements, and should be of interest to boards of directors, regulators and investors.

Keywords Monitoring, Audit, Corporate risk, Industry specialists

Paper type Research paper

Introduction

In this study, we examine what impact auditor industry specialists have on corporate risk-taking. We follow the finance literature and define corporate risk-taking as: the amount of uncertainty associated with expected outcomes and the corresponding cash flows, as a

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result of new investments (Wright *et al.*, 1996). In this context, managerial risk aversion induces suboptimal risk-taking behavior and results in the exclusion of investment opportunities with the potential to increase firm value (Smith *et al.*, 1985; Guay, 1999). Using this definition, the corporate finance literature is rich in evidence on how an increase in corporate risk-taking has a positive effect on shareholder wealth (Merton, 1974; Jensen and Meckling, 1976; Myers, 1977; Wright *et al.*, 1996; Shin and Stulz, 2000; Rajgopal and Shevlin, 2002; Low, 2009). Yet managers have incentives to engage in suboptimal levels of corporate risk-taking, which may result in otherwise reduced firm value. Consistent with agency theory (Berle and Means, 1932; Jensen and Meckling, 1976), managers consider their own personal risk when making decisions that affect corporate risk-taking tendencies, and managers cannot easily reduce personal risk by diversification, as shareholders can (May, 1995). Due to managers' high concentration of human capital and control, managers can only reduce their risk at the firm level. Accordingly, managers may opt out of riskier but potentially value-enhancing investment opportunities, because risky investments (by definition) increase the potential for financial distress and subsequent job dismissal (Amihud and Lev, 1981; Hirschleifer and Thakor, 1992; John *et al.*, 2008; Low, 2009). In addition, undertaking riskier projects has potential for additional private costs on managers, such as constraining managers' ability to divert corporate resources for their own personal gain (Amihud and Lev, 1981; Hirschleifer and Thakor, 1992; May, 1995).

Jensen and Meckling (1976) show that monitoring promotes goal congruence and encourages managers to operate in the interest of owners. This line of reasoning suggests that better monitoring may encourage (value-enhancing) corporate risk-taking. External auditors are one such form of monitoring (Jensen and Meckling, 1976), and prior literature suggests that audited financial statements mitigate agency costs by decreasing information asymmetry between owners and managers (Bushman and Smith, 2001; Kanodia and Lee, 1998). The effective mechanism is outlined in theory by Trueman (1986), Kanodia *et al.* (2005) and Bertomeu *et al.* (2011), who all show that managers take into account investor perceptions about firm value from *ex post* financial disclosures when making subsequent financing and investment decisions. Higher-quality financial statements more precisely convey project outcomes to financial statement users, and so should impact subsequent managerial decisions to a greater degree than lower-quality statements.

This study examines the "real" effects of financial reporting for corporate risk-taking in the context of engaging an auditor industry specialist[1] Auditor industry specialists have a greater knowledge of industry-specific accounting-related issues (Francis *et al.*, 2005) and as a result have been shown to provide for better firm monitoring than non-specialists, through higher-quality audits. Examples include Craswell *et al.* (1995), Francis *et al.* (2005), Francis and Yu (2009) and Reichelt and Wang (2010), who collectively report that industry specialists are positively associated with client earnings quality in the form of lower client abnormal accruals; clients that are less likely to meet or beat earnings forecasts; and clients that are more likely to receive going concern audit opinions. Consistent with theory reporting better monitoring decreases agency costs (Jensen and Meckling, 1976), which impacts managerial decisions (Trueman, 1986; Kanodia *et al.*, 2005; Bertomeu *et al.*, 2011), and literature that finds a decrease in agency costs can result in firms undertaking riskier but potentially value-enhancing investments (Wright *et al.*, 1996; John *et al.*, 2008; Low, 2009), we expect firms engaging the services of an audit industry specialist to be associated with higher levels of corporate risk-taking.

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To test this, we model corporate risk-taking as a function of auditor industry specialization, while controlling for other variables prior literature suggests to be determinants of corporate risk-taking. We use two measures of corporate risk-taking: the annual standard deviation of monthly stock returns and a company's research and development expenditures. The standard deviation of returns is a commonly used metric of corporate risk-taking and quantifies the dispersion around a company's mean return, where greater dispersion is consistent with higher levels of risk (Markowitz, 1952). As riskier firms tend to engage in higher levels of research and development in pursuit of new investment opportunities (Bargeron *et al.*, 2010), we utilize research and development expenditures as our second proxy for corporate risk-taking. Most recent literature suggests that local-level specialization has a greater impact on audit outcomes than specialization at the national level (Francis and Yu, 2009, Reichelt and Wang, 2010). Accordingly, we designate an auditor as an industry specialist if the firm has the largest annual market share of audit fees within a two-digit SIC code for each city with at least two unique offices (Francis and Yu, 2009).

Using a sample of 5,651 firm-year observations from 1,525 distinct firms, covering the years 2003-2007, we document a positive relationship between local-level audit industry specialization and our measures of corporate risk-taking. Specifically, we find that companies engaging city industry specialists have a significantly higher standard deviation of returns and higher research and development expenditures. The results are significant both statistically and economically and are robust to controlling for financial reporting quality and a company's cost of equity capital. This suggests that industry specialist auditors provide some level of monitoring assurance beyond that of just increased financial reporting quality.

We then seek to understand for which firms this relationship is most important. Following the same rationale for our first expectation (i.e. agency theory), it is suggested that on the one hand, the impact of audit industry specialists may be lower in the presence of other forms of strong external monitoring (i.e. a substitution effect). On the other hand, the additional monitoring provided by higher-quality auditors may provide additional benefits over other forms of external monitoring (i.e. a complementary effect). In a sample of firms for which monitoring of risk is of greater importance for firm value (i.e. firms that report research and development expenditures) (Bargeron *et al.*, 2010), we examine the incremental effects of engaging an auditor industry specialist in relation to other forms of external monitoring. We use two measures of alternative external monitoring; analyst coverage and institutional holdings. Greater analyst following and larger institutional holdings have both been shown to reduce agency costs and allow for greater monitoring of firm investments (Wright *et al.*, 1996; Chung and Jo, 1996). Following this, we re-estimate our initial model but include an interaction term between auditor industry specialization and our two measures of alternative external monitoring. Consistent with a substitution effect, we report a negative interaction term between auditor industry specialization and either analyst following or institutional holdings. This suggests that external monitoring beyond that provided by the auditor mediates the relationship between engaging an industry specialist auditor and corporate risk-taking activities.

The study contributes to the small but growing literature examining "real" effects of auditors, by showing auditors do more than just provide assurance and insurance services, as it relates to financial reporting quality. Other studies find that engaging an industry specialist auditor lowers cost of debt and equity capital, as well as increases tax aggressiveness and investment efficiency (Li *et al.*, 2009, 2010; Francis *et al.*, 2011; McGuire

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et al., 2012). We add to this stream and show that audit industry specialists are associated with enhanced corporate risk-taking, as a substitute for other forms of external monitoring.

We also contribute to the growing literature on factors that affect corporate risk-taking. Recent literature shows that potentially value-enhancing corporate risk-taking decreased after passage of the Sarbanes–Oxley Act of 2002 (SOX) (Bargeron *et al.*, 2010). In addition, former Securities and Exchange Commission (SEC) Chair William Donaldson expressed his concern about the "loss of risk-taking zeal" following the passage of SOX and stated, "There is a huge preoccupation with the dangers and risks of making the slightest mistake" (Michaels, 2003). Our study suggests that auditors may play a role beyond effects on financial reporting that enhances corporate risk-taking.

Finally, the results may be useful for investors when evaluating corporate investment strategies and decision making, and boards of directors (specifically firms' audit committees) when evaluating whether or not to employ the services of an auditor that is an industry specialist.

Literature review and hypotheses development

Managerial risk-aversion, corporate risk-taking and firm value

The finance literature emphasizes that shareholders prefer full investment in all positive net present value projects, regardless of risk (Jensen and Meckling, 1976; Myers, 1977; Wright *et al.*, 1996; LaPorta *et al.*, 1997, 1998; John *et al.*, 2008; Paligorova, 2010). Generally, higher return projects are associated with higher risk. To that end, investors prefer corporate risk-taking, as the outcome is higher firm value (Low, 2009). Following this line of reasoning, empirical studies document that corporate risk-taking positively affects shareholder wealth. Two recent examples are Low (2009), who finds managers who personally protect themselves by reducing corporate risk-taking also reduce firm value, and John *et al.* (2008), who find a positive relationship between shareholder protection and firm-level risk-taking, which they in turn find to be positively associated with firm-level growth. John *et al.* (2008) also find corporate risk-taking is positively associated with macro-level growth[2].

However, managers have incentives to maintain cash positions, or to engage in less than optimal levels of risk in their investment decisions. First by not investing, managers are able to consume firm resources for their own utility maximization at the expense of shareholders (Berle and Means, 1932; Jensen and Meckling, 1976). Second, managers consider their own personal risk when making decisions that affect corporate risk-taking (May, 1995), as managers cannot easily reduce their overall personal risk by diversification, as shareholders easily can; managers can only reduce their risk at the firm level. As a consequence, investing in riskier but potentially value-enhancing investments (for shareholders) may be replaced with lower-risk projects because riskier investments increase the potential for financial distress and subsequently increased private costs for managers (e.g. job dismissal or loss of bonuses) (Amihud and Lev, 1981; Hirschleifer and Thakor, 1992; May, 1995; Parrino *et al.*, 2005). Ultimately, managers can alter corporate risk-taking through the selection of investment projects, and can decrease corporate risk-taking by selecting projects with lower cash flow volatility and/or investing in stabilizing income streams via diversification (Low, 2009).

Thus a classic agency problem exists. Well-diversified shareholders prefer a firm to invest in all net positive present value projects (increasing corporate risk), while

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less-diversified managers are risk-averse and so may have different goals for firm investment, namely, the ability to consume perquisites and job security[3].

Auditor quality and firm monitoring

To counter, an associated line of research stresses the importance of governance and monitoring mechanisms in decreasing agency costs between stockholders and firm managers, to encourage managers to fully invest in positive net present value projects (i.e. increase corporate risk-taking). Jensen and Meckling (1976) suggest external auditors as one form of monitoring to promote goal congruence and encourage managers to operate in the interests of shareholders. Presumably then, higher-quality auditors provide better monitoring opportunities for shareholders, and encourage managers to act in the interests of shareholders.

Independent auditors reduce agency costs by increasing financial reporting transparency, signaling credible financial reporting to investors (Jensen and Meckling, 1976; Watts and Zimmerman, 1983; Titman and Trueman, 1986; Feltham *et al.*, 1991). Investors respond accordingly (e.g. higher earnings response coefficients) when companies receive higher-quality audits (Feltham *et al.*, 1991; Teoh and Wong, 1993; Baber *et al.*, 1995; Klitching, 2009). While audit quality as a construct is a continuum that is difficult to observe (Francis, 2011), audit literature generally focuses on *differential* audit quality, as it relates to office size, brand name and industry specialization (DeAngelo, 1981; Dye, 1993; Francis, 2004; Francis *et al.*, 2005; Francis and Yu, 2009; Reichelt and Wang, 2010; Francis, 2011). In this paper, we focus on industry specialization. Auditor industry specialists have a greater knowledge of industry-specific accounting-related issues and affect audit quality through knowledge sharing and personal knowledge of the clients themselves (Francis *et al.*, 2005)[4]. Additionally, Francis *et al.* (2005) suggest that industry expertise results from specific client knowledge from routine interactions with clients in proximity.

Industry specialists charge fee premiums, suggesting higher-quality audits (DeFond *et al.*, 2000; Balsam *et al.*, 2003; Reichelt and Wang, 2010; Francis, 2011). In addition, Francis *et al.* (2005), as well as Reichelt and Wang (2010), find that firms engaging the services of office-level industry specialists have lower levels of abnormal accruals, are less likely to meet or beat earnings forecasts and are more likely to receive a going concern audit opinion than firms not engaging the services of office-level industry specialists. The effects of engaging an audit industry specialist have been found to go beyond that of increased financial reporting quality to include other "real" effects. Francis *et al.* (2011) make the direct link between industry specialists and increased firm investment efficiency, even when controlling for financial reporting quality. Their results suggest that auditors provide monitoring and value-added services beyond those associated with better financial reporting quality. Similarly, Bae and Choi (2012) find industry specialist auditors help prevent both over-investment and under-investment, with results being robust to alternative definitions of industry specialist auditors. Li *et al.* (2010) find that higher-quality audits provided by city industry specialists decrease information risk, which results in lower cost of debt. Similarly, Li *et al.* (2009) find clients of audit industry specialists have decreased costs of equity capital. Finally, McGuire *et al.* (2012) find that firms that employ the services of auditors with industry tax expertise have higher levels of tax avoidance.

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To sum, audit industry specialists have been shown in prior literature to provide higher-quality audits, and are associated with decreased cost of debt and equity capital, increased firm investment efficiency and increased tax aggressiveness.

Testable hypotheses

Based on the existing literature relating to audit industry specialists, the "real" effects of auditors and corporate risk-taking, we extend this line of literature and examine the effects of engaging an audit industry specialist on corporate risk-taking. Summarizing our discussion above, well-diversified shareholders prefer a firm to accept all net positive value projects, regardless of risk, while mangers are risk-averse and less diversified (Berle and Means, 1932; Jensen and Meckling, 1976; Amihud and Lev, 1981; Hirschleifer and Thakor, 1992; Low, 2009). Managers can alter corporate risk-taking through the selection of investment projects and may reject risk-increasing but positive net present value projects to protect their firm-specific human capital, as well as to maintain their ability to consume firm perquisites (Low, 2009). Increased monitoring reduces agency concerns and mitigates managerial risk aversion. Trueman (1986), Kanodia *et al.* (2005) and Bertomeu *et al.* (2011) provide one mechanism for the effect by suggesting managers take into account investor perceptions about firm value from financial disclosures when making subsequent financing and investment decisions.

Audited financials are one such form of monitoring, and mitigate agency costs by decreasing information asymmetries (i.e. providing financial statement users with more precise information for decision making), allowing for greater external monitoring (Jensen and Meckling, 1976; Watts and Zimmerman, 1983). Managers, aware of the resulting increased scrutiny by investors, are less likely to manipulate financial statements, are less likely to expropriate assets and are more likely to invest more efficiently (Bushman and Smith, 2001)[5]. To the extent that better-quality auditors (i.e. industry specialists) provide for better monitoring, we expect industry specialists to be positively associated with corporate risk-taking:

H1. Engaging an audit industry specialist is associated with greater corporate risk-taking.

We then seek to understand for which firms this relationship is most important. Wright *et al.* (1996) document corporate risk-taking tendencies to be positively associated with an alternative form of monitoring (institutional ownership instead of higher-quality auditing as we suggest here). Ahmed *et al.* (2008) find that using an industry specialist auditor is most effective for reducing cost of capital when other forms of monitoring are weaker. Following this, the association between audit industry specialists and corporate risk-taking may be less pronounced when firms have higher levels of monitoring not provided by the firms' external auditor. More specifically, engaging a city industry specialist may have a substitution effect for other forms of external monitoring on corporate risk-taking (Carey *et al.*, 2000). Alternatively, there may be a complementary effect between engaging a city industry specialist and other forms of external monitoring. Lara *et al.* (2009) discuss how internal and external forms of monitoring are complementary, and the same may be the case for different forms of external monitoring only, as we examine. Thus engaging a higher-quality auditor may incrementally improve overall monitoring and lead to greater corporate risk-taking. Given bidirectional predictions, we propose our second hypothesis in the null:

H2. There is no incremental effect of engaging an industry specialist auditor on corporate risk-taking for companies with alternative forms of external monitoring.

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Methodology

Classification of audit industry specialists

To examine the effects of engaging an industry specialist on corporate risk-taking, we classify an auditor as a city industry specialist if they have the largest annual market share of audit fees within a two-digit SIC code, for each city with at least two unique offices (*CITY_SPECIALIST*). Thus each city-industry-year with more than one observation has a unique audit industry specialist[6]. We determine the auditor's office location from the Audit Analytics Opinion File, based on the engagement office listed on the audit report letterhead filed with the SEC (Francis and Yu, 2009), and calculate *CITY_SPECIALIST* using all observations in Audit Analytics with available data from 2003 to 2007.

We are most concerned with the effect of engaging an auditor considered an industry specialist at the local level, but we also include a variable for national industry specialist (*NAT_SPECIALIST*). We classify an audit firm a national industry specialist in a similar way to a city industry specialist, but at the national instead of the local level (Craswell *et al.*, 1995; Ferguson *et al.*, 2003; Francis and Yu, 2009).

Table I reports descriptive statistics for the number of city (Panel A) and national (Panel B) audit industry specialists in our final sample. PricewaterhouseCoopers LLP (PWC) and Ernst & Young (EY) have the largest number of office-level industry specialists on average (169 and 141 times, respectively), while Deloitte & Touche (97) and KPMG (68) have fewer office-level industry specialists (Panel A). Several large regional audit firms are also city specialists in a given year, including Grant Thornton and BDO Seidman. EY has the largest number of national specialists per year (seven),

Auditors/fiscal years	2003	2004	2005	2006	2007	Average
Panel A: City industry specialists by auditor and year						
PWC	181	179	186	155	146	169
EY	146	129	131	151	149	141
DT	86	81	97	100	121	97
KPMG	63	73	71	67	64	68
Grant Thornton	2	6	4	6	8	5
BDO Seidman	2	3	2	4	3	3
All other auditors	0	1	3	3	1	2
Total city industry specialists	480	472	494	486	492	485
Total cities	100	102	99	99	96	99
Total industries	55	54	54	53	53	54
Panel B: National industry specialists by auditor and year						
PWC	5	8	6	3	4	5
EY	10	7	6	5	7	7
DT	6	5	6	4	5	5
KPMG	1	1	1	2	0	1
Total national industry specialists	22	21	19	14	16	18
Total industries	55	54	54	53	53	54

Notes: Total city industry specialists is the number of unique city industry specialist auditors. Total cities is the number of unique cities in the sample. Total industries is the number of unique two-digit SIC codes in the sample. Total national industry specialists is the number of unique national industry specialist auditors

Table I.
Descriptive statistics of auditor industry specialization

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while PWC and Deloitte & Touche are national specialists in five industries per year on average. Our descriptives of auditor industry specialization both by city and national level, by year and throughout the sample period are similar to that found in prior research (Francis and Yu, 2009; Reichelt and Wang, 2010).

Measures of corporate risk-taking

We use two measures of corporate risk-taking in our empirical analysis. The first is a commonly used metric, the standard deviation of returns (*STD_RET*); this measure quantifies the dispersion around the mean return, where larger values denote more dispersion, and thus higher levels of risk (Markowitz, 1952; Bargeron *et al.*, 2010)[7]. We calculate *STD_RET* as the annual standard deviation of monthly stock returns, computed from return data from the Center for Research in Security Prices (CRSP)[8]. Mean (Median) *STD_RET* in our final sample is 0.248 (0.184) (Table IV).

For our second measure of corporate risk-taking, we use a firm's research and development expenditures. To the extent that R&D captures new investments with unknown future payoff for a firm, the deflated expenditures proxy for overall corporate risk (Coles *et al.*, 2006; Bargeron *et al.*, 2010; Gormley *et al.*, 2012). To calculate our measure (*RD*), we scale Compustat variable XRD by beginning period total assets (AT)[9]. Mean (Median) *RD* in our sample is 0.036 (0.002), consistent with prior literature (Bargeron *et al.*, 2010) (Table IV).

Sample construction

Financial information for our variables of interest is acquired from the Compustat Fundamentals annual database, with stock price information from the CRSP database. We start with 64,932 firm-year observations from the merged Audit Analytics Opinion and Fee File from 2003 to 2007. Following prior research, we exclude firms not domiciled in the USA and missing SIC, audit fee or auditor office data (12,542 firm-year observations). We also exclude firms from the highly regulated financial industry (two-digit SIC 60-69), as these firms face differing investment constraints, opportunities and incentives than other less regulated industries (24,035 firm-year observations). We exclude office industry-years with less than two observations (3,034). Finally, we exclude observations lacking a matching CIK code; missing I/B/E/S, Execucomp or CRSP data; and outliers above and below the 1st and 99th percentile (19,670). Our resulting sample is 5,651 firm-year observations from 1,525 distinct firms from 2003 to 2007[10].

Research model for H1*: auditor industry specialization and corporate risk*

To examine *H1*, we estimate the following model, and estimate separate ordinary least-squares (OLS) regressions for our two measures of *RISK* (standard deviation of returns and research and development expenditures):

$$\begin{aligned} RISK = {} & \alpha + \beta_1 CITY\_SPECIALIST + \beta_2 NAT\_SPECIALIST \\ & + \beta_3 INFLUENCE + \beta_4 LN\_ASSETS + \beta_5 MB + \beta_6 LEV + \beta_7 PAYOUT \\ & + \beta_8 ANNRET + \beta_9 CAPEX + \beta_{10} COMP + \beta_{11} ROA + \beta_{12} TENURE \\ & + \beta_{13} STD\_OCF + \beta_{14} AGE + \beta_{15} ABNAC + \beta_{16} PEG \\ & + INDUSTRY\ YEAR\ FE + \varepsilon \end{aligned} \tag{1}$$

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As our objective is to show that there is an effect of engaging an industry specialist auditor on corporate risk-taking beyond simply the impact on earnings quality, we include a control for client earnings quality. Following prior literature, we use a firm's abnormal accruals, derived from an estimation of "expected accruals", where the residual error term is the level of unexpected, or abnormal accruals. Larger abnormal accruals represent the degree to which managers can use their discretion to manage earnings and thus are consistent with lower earnings quality (Jones, 1991; DeFond and Jiambalvo, 1994; Dechow and Sweeney, 1995; Dechow and Dichev, 2002; Kothari *et al.*, 2005; Reichelt and Wang, 2010). We estimate abnormal accruals from the performance-adjusted Jones model (Jones, 1991; Kothari *et al.*, 2005). Using OLS we estimate the following model for all available firm-year observations from Compustat, by year and two-digit SIC code, where we require a minimum of ten observations for each industry-year:

$$TA = \alpha + \beta_1 \Delta REV + \beta_2 PPE + \beta_3 ROA + \varepsilon \tag{2}$$

Where (Compustat variable names in brackets): TA = total accruals (net income from continuing operations [OIADP], minus operating cash flows [OANCF], scaled by total assets [AT]); ΔREV = change in revenue from prior year [SALE], scaled by total assets [AT]; PPE = property, plant and equipment [PPEGT] scaled by total assets [AT]; ROA = operating income after depreciation [OIADP] scaled by total assets [AT].

The residuals from Equation (2) are captured and used as a measure of abnormal accruals.

Industry specialist auditors are associated with a lower cost of capital (Li *et al.*, 2009; 2010). When a company's cost of capital decreases, investments will by definition have a higher net present value, and our measures will capture greater risk-taking as a result[11]. To control for this effect, we include a variable capturing a company's cost of equity capital (*PEG*). Briefly, we follow Easton (2004) and Ogneva *et al.* (2007) and calculate *PEG* as:

$$r_{PEG} = \sqrt{\frac{eps_2 - eps_1}{P_t}} \tag{3}$$

Where: eps_1 = forecasted earnings per share in year 1; eps_2 = forecasted earnings per share in year 2; P_t = stock price at time t.

In equation (1), we also control for auditor attributes that likely vary among firms and may influence managerial risk-taking. As auditor tenure increases, independence may be compromised (Davis *et al.*, 2009) and lead to more excessive risk-taking by managers. On the contrary, increased auditor tenure may result in heightened firm-specific knowledge and increased monitoring (Geiger and Raghunandan, 2002; Myers *et al.*, 2003), leading to potentially less risk-taking by managers. Accordingly, we control for audit tenure (*TENURE*), by including an indicator variable equal to 1 if auditor tenure is three years or less for a firm and 0 otherwise. We also control for office-level auditor incentives by including a control for client influence (*INFLUENCE*), computed as the ratio of a specific client's total annual fees to the aggregate annual fees earned by the unique office that audits that

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client (Reynolds and Francis, 2000). We refer to previous literature for other controls that explain corporate risk-taking. A firm's investment opportunities affect managers' investment decisions and are an important determinant of corporate risk-taking. Following Eberhart *et al.* (2004), we include the ratio of the market value of equity to book value of equity (*MB*), as firms with higher growth opportunities are likely to take more risk (Myers, 1977; Myers and Majluf, 1984; Smith and Watts, 1992; Billett *et al.*, 2007). We also control for leverage (*LEV*), computed as total liabilities divided by total assets, which may indicate either more available capital to invest or alternatively constraints on investment and corporate risk. In addition, some firms may lack adequate investment opportunities, and therefore have larger dividend payouts (Brav *et al.*, 2005). To control for this possibility, we include dividend payout (*PAYOUT*). We also include the annual return from the previous year (*ANNRET*), as risky investments likely affect the market's assessment of a firm's future cash flows, and managers are more likely to invest as capital increases.

We include a set of controls for firm characteristics that are likely to affect managerial investment behavior. Size (*LN_ASSETS*) is negatively correlated with corporate risk-taking, so we include the log of total assets (Berk, 1995; Perez-Quiros and Timmermann, 2002; Bargeron *et al.*, 2010). We control for the firm's current profitability by including return on assets (*ROA*), measured as the income before extraordinary items scaled by average total assets, as higher levels of risk generally relate to larger returns. Cash flows affect the ability of a firm to engage in investment activities and following Rajgopal and Shevlin (2002), we control for the variance of operating cash flows (*STD_OCF*). *STD_OCF* is calculated as the standard deviation of operating cash flows (Compustat OANCF, deflated by total assets) for the three-year period $t-1$ to $t+1$.

Prior literature also suggests that a firm's capital expenditures are associated with corporate risk-taking. Coles *et al.* (2006) find that risk-seeking managers are more apt to apportion investment dollars away from lower-risk capital expenditures to higher-risk research and development expenses. To account for this relationship, we include capital expenditures (*CAPEX*), calculated as capital expenditures net of sales of property, plant and equipment, scaled by beginning of the year total assets.

Rajgopal and Shevlin (2002) provide evidence that executive stock options (ESOs) provide managers incentives to invest corporate dollars. Additionally, Coles *et al.* (2006) find a strong relationship between managerial compensation and corporate risk-taking. For this reason, we control for managerial compensation (*COMP*) by including the natural logarithm of the sum of a CEO's salary, bonus and the amount of stock options granted and exercised during the year, from the Execucomp Database. Dechow and Sloan (1991) suggest that as executives approach retirement, CEOs likely have fewer incentives to engage in risky investments, so we control for CEO age (*AGE*). See Table AI for details of all variables.

To control for the fact that there may be unobservable industry and year characteristics associated with industry specialization and corporate risk that could result in a correlated omitted variables problem, we include indicator variables for industry and year fixed effects (Wooldridge, 2002). Finally, to reduce the potential for serial correlation of errors due to repeated observations in the sample, we cluster errors at the auditor office level (Petersen, 2009).

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Research model for H2*: incremental effect of auditor industry specialization on other monitoring*

In *H2*, we examine the incremental effect on corporate risk-taking of engaging an industry specialist auditor for companies with alternative forms of external monitoring, but make no directional prediction. To examine whether there is a substitution or complementary effect of engaging an industry specialist auditor in the presence of other forms of external monitoring, we estimate a model similar to equation (1), but include an interaction term between our city specialist variable and two common measures of other forms of external monitoring:

$$
\begin{aligned}
RISK = {} & \alpha + \beta_1 CITY\_SPECIALIST + \beta_2 MONITORING \\
& + \beta_3 CITY\_SPECIALIST * MONITORING + \beta_4 NAT\_SPECIALIST \\
& + \beta_5 INFLUENCE + \beta_6 LN\_ASSETS + \beta_7 MB + \beta_8 LEV + \beta_9 PAYOUT \\
& + \beta_{10} ANNRET + \beta_{11} CAPEX + \beta_{12} COMP + \beta_{13} ROA + \beta_{14} TENURE \\
& + \beta_{15} STD\_OCF + \beta_{16} AGE \\
& + \beta_{17} ABNAC + \beta_{17} PEG + INDUSTRY \ \& \ YEAR \ FE + \varepsilon
\end{aligned} \tag{4}
$$

We estimate the above regression separately for each of our two measures of corporate risk and our two alternative measures of monitoring (*MONITORING*), analyst following (*ANALYST*) and institutional holding (*INSTHOLD*) (i.e. four regressions total). All other variables are as previously defined, including fixed effects. The coefficient on the interaction term captures the incremental effect of engaging an industry specialist on corporate risk-taking in the presence of increasing analyst coverage and institutional holdings. If there is a substitution effect of engaging a city specialist auditor with increasing levels of alternative forms of external monitoring in place, then we should observe a negative coefficient on the interaction term. The opposite holds true if instead we observe a complementary effect; in that case, we should observe a positive coefficient on the interaction term.

We use two different proxies to measure firm monitoring beyond that provided by the *external* auditor. Chung and Jo (1996) find the monitoring of firm performance by analysts motivates managers and reduces agency costs. Thus, our first proxy is analyst coverage, measured as the number of unique analysts issuing forecasts within 30 days of a firm's fiscal year end (*ANALYST*). Analyst data are obtained from I/B/E/S[12]. Prior literature also documents benefits of monitoring by institutional ownership, such as reduced earnings management, a greater likelihood of ousting poorly performing CEOs and larger seasoned equity offering announcement returns (Burns *et al.*, 2010; Aggarwal *et al.*, 2011; Demiralp *et al.*, 2011). As such, our second proxy for monitoring is the percentage of a firm's common shares held by institutions (*INSTHOLD*). Institutional holding data are obtained from Thompson Reuters 13-F Filings[13].

Results

Univariate results

Table II reports descriptive statistics of the industries (two-digit SIC codes) included in our main sample. From that, the industry distribution of our sample is representative of the population of firms in Compustat.

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Table III reports the descriptive statistics for our variables of interest, measures of risk and related control variables for our final sample.

Similar to Coles *et al.* (2006), our mean (median) value of research and development expenditures is 0.036 (0.002). The mean (median) standard deviation of annual stock returns is 0.248 (0.184)[14]. The average market-to-book ratio is 3.33 (2.53), leverage is 23.4 per cent (20.9 per cent) of total assets, capital expenditures are 5.8 per cent (3.9 per cent) of assets, firms pay out 1.2 per cent (0 per cent) of total sales as dividends, return on assets is 6.5 per cent (6.3 per cent) and annual returns average 22.5 per cent (15.6 per cent). Mean (Median) cost of capital in our final sample is 9.7 per cent (9.5 per cent). All reported values are similar to those reported in previous studies (Coles *et al.*, 2006; Ogneva *et al.*, 2007; Bargeron *et al.*, 2010; Imhof and Seavey, 2013).

Pearson correlations are reported in Table IV. Correlations are as expected and are similar to those found in prior literature.

Consistent with Bargeron *et al.* (2010), larger firms have a lower variance of annual returns, higher leverage, fewer capital expenditures, lower cost of equity capital and pay out a greater percentage of sales as dividends. Larger firms also have higher levels of CEO compensation and employ CEOs who are older. None of the correlations between the independent variables from our multivariate models exceeds |0.493|, which diminishes concern of multi-collinearity problems. Furthermore, none of the variance inflation factors for our multivariate models exceeds 4.0, suggesting that multi-collinearity is not an issue in multivariate tests.

Multivariate results for H1

Table V presents results for estimating equation (1), where we model our measures of corporate risk-taking (*STD_RET* and *RD*) each as a function of audit city specialist and controls. Again, our prediction is that firms engaging the services of a city specialist auditor will have higher levels of corporate risk-taking.

For all models, we include industry and year fixed effects and *t*-statistics are based on robust standard errors clustered at the auditor office level (Petersen, 2009). Model fit statistics suggest that our models are reasonably well-specified, as all models are significant at $p < 0.01$ (not shown). The adjusted R-squares are 41 per cent and 44 per cent for the *STD_RET* and *RD*, respectively. In both of our models, having a city specialist auditor (*CITY_SPECIALIST*) is positively and significantly associated with corporate risk-taking[15]. Firms engaging an industry specialist auditor have higher levels of research and development expenditures and higher variance of stock returns, indicating increased levels of corporate risk-taking and providing support for *H1*. Our results hold when controlling for a firm's financial reporting quality (*ABNAC*) and cost of capital (*PEG*).

Controls, where significant, are generally consistent with prior literature. We find no association between corporate risk-taking and national auditor specialist (Reynolds and Francis, 2000; Francis *et al.*, 2005; Reichelt and Wang, 2010), and consistent with Perez-Quiros and Timmermann (2002), larger firms appear to be less risky. Firms with a higher standard deviation of operating cash flows (*STD_OCF*) have greater corporate risk (Rajgopal and Shevlin, 2002), and consistent with Dechow and Sloan (1991), CEO age is negative and significantly related to both proxies for risk.

Our results are economically as well as statistically significant. Engaging a city specialist is associated with an increase of 5.3 per cent in the standard deviation of

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SIC code	SIC descriptives	Number of observations	Per cent observations
1	Agricultural production crops	7	0.12
10	Metal mining	13	0.23
12	Coal mining	18	0.32
13	Oil and gas extraction	200	3.54
14	Mining and quarrying of nonmetallic minerals, except fuels	20	0.35
15	Building construction general contractors and operative builders	42	0.74
16	Heavy construction other than building construction contractors	26	0.46
17	Construction special trade contractors	13	0.23
20	Food and kindred products	183	3.24
21	Tobacco products	8	0.14
22	Textile mill products	26	0.46
23	Apparel and other finished products made from fabrics	69	1.22
24	Lumber and wood products, except furniture	23	0.41
25	Furniture and fixtures	48	0.85
26	Paper and allied products	91	1.61
27	Printing, publishing, and allied industries	92	1.63
28	Chemicals and allied products	439	7.78
29	Petroleum refining and related industries	50	0.88
30	Rubber and miscellaneous plastics products	55	0.97
31	Leather and leather products	31	0.55
32	Stone, clay, glass, and concrete products	37	0.65
33	Primary metal industries	114	2.02
34	Fabricated metal products, except machinery and transportation equipment	90	1.59
35	Industrial and commercial machinery and computer equipment	422	7.47
36	Electronic and other electrical equipment and components, except computer	550	9.73
37	Transportation equipment	166	2.94
38	Measuring, analyzing and controlling instruments	424	7.52
39	Miscellaneous manufacturing industries	51	0.90
40	Railroad transportation	19	0.34
42	Motor freight transportation and warehousing	53	0.94
44	Water transportation	30	0.53
45	Transportation by air	49	0.87
47	Transportation services	30	0.53
48	Communications	101	1.79
49	Electric, gas and sanitary services	339	6.00
50	Wholesale trade-durable goods	144	2.55
51	Wholesale trade-non-durable goods	63	1.11
52	Building materials, hardware, garden supply and mobile home dealers	5	0.09
53	General merchandise stores	68	1.20
54	Food stores	29	0.51
55	Automotive dealers and gasoline service stations	48	0.85
56	Apparel and accessory stores	128	2.26
57	Home furniture, furnishings and equipment stores	49	0.87
58	Eating and drinking places	126	2.23
59	Miscellaneous retail	114	2.02
70	Hotels, rooming houses, camps and other lodging places	15	0.27
72	Personal services	31	0.55
73	Business services	598	10.58
75	Automotive repair, services and parking	8	0.14
78	Motion pictures	12	0.21
79	Amusement and recreation services	38	0.67
80	Health services	124	2.19
82	Educational services	35	0.62
83	Social services	2	0.04
87	Engineering, accounting, research, management and related services	85	1.50
		5,651	100

Table II.
Sample industry analysis

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Variable	*N*	Mean	Median	SD	Q1	Q3
STD_RET	5,651	0.2485	0.1843	0.1975	0.1197	0.2996
RD	5,651	0.0360	0.0018	0.0685	0.0000	0.0474
CITY_SPECIALIST	5,651	0.4288	0.0000	0.4949	0.0000	1.0000
NAT_SPECIALIST	5,651	0.3228	0.0000	0.4676	0.0000	1.0000
INFLUENCE	5,651	0.1052	0.0412	0.1680	0.0159	0.1096
LN_ASSETS	5,651	7.3234	7.1753	1.5527	6.2312	8.3074
MB	5,651	3.3357	2.5297	4.7473	1.7200	3.9027
LEV	5,651	0.2341	0.2094	0.2242	0.0407	0.3488
PAYOUT	5,651	0.0124	0.0000	0.0269	0.0000	0.0160
ANNRET	5,651	0.2252	0.1560	0.4770	−0.0468	0.3896
CAPEX	5,651	0.0581	0.0387	0.0671	0.0209	0.0694
COMP	5,651	7.9322	7.9206	1.3666	7.1147	8.7989
ROA	5,651	0.0652	0.0630	0.1207	0.0295	0.1061
TENURE	5,651	0.1844	0.0000	0.3878	0.0000	0.0000
STD_OCF	5,651	0.0442	0.0300	0.0576	0.0157	0.0553
AGE	5,651	55.4990	56.0000	7.2467	50.0000	60.0000
ABNAC	5,651	−0.0752	−0.0336	0.2036	−0.1364	0.0198
PEG	5,651	0.0972	0.0945	0.0317	0.0799	0.1045

Notes: *STD_RET* is the annual standard deviation of daily stock returns. *RD* is research and development expenses scaled by lagged total assets and set to 0 if missing. *CITY_SPECIALIST* is an indicator variable set equal to 1 if the auditor has the largest annual market share of audit fees within a two-digit SIC code, for each city with at least two unique Big 4 offices, and 0 otherwise. *NAT_SPECIALIST* is an indicator variable set equal to 1 if the audit firm has the largest annual market share of audit fees within a two-digit SIC code, and 0 otherwise. *INFLUENCE* is computed as the ratio of a client's total annual fees to the aggregate annual fees earned by the unique office that audits that *client.LN_ASSETS* is the log of total assets. *MB* is the ratio of the market value of equity to book value of equity. *LEV* is measured as total liabilities divided by total assets. *PAYOUT* is annual dividend payout. *ANNRET* is the annual return from the previous year. *CAPEX* is capital expenditures net of sales of property, plant and equipment, scaled by beginning of the year total assets. *COMP* is the natural logarithm of the sum of a CEO's salary, bonus and the amount of stock options granted and exercised during the year. *ROA* is income before extraordinary items scaled by average total assets. *TENURE* is an indicator variable equal to 1 if auditor tenure is three years of less for a firm, and 0 otherwise. *STD_OCF* is the standard deviation of operating cash flows deflated by total assets for the three-year period $t-1$ to $t+1$. *AGE* is CEO age and *ABNAC* is the value of abnormal accruals estimated from the performance-adjusted Jones model (Jones, 1991). *PEG* is cost of equity capital and calculated as in Easton (2004)

Table III. Descriptive statistics

returns and an absolute increase in R&D expenditures of 0.0029 (equivalent to an 8.6 per cent increase)[16]. Overall, the results suggest engaging a city-level industry specialist auditor is positively associated with corporate risk-taking.

Multivariate results for H2

Table VI reports tests of *H2* using either the number of analysts (Panel A) or institutional holdings (Panel B) as our measures of other forms of external monitoring. For brevity we only report results for our variables of interest; coefficients and *t*-statistics for all other variables (not shown) are very similar to those in Table V.

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Table IV.
Pearson correlation matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 *STD_RET*																	
2 *RD*	**0.214**																
3 *CITY_LEADER*	**−0.050**	**−0.087**															
4 *NAT_LEADER*	−0.015	**0.046**	**0.116**														
5 *INFLUENCE*	**−0.069**	**−0.102**	**0.038**	**−0.053**													
6 *LN_ASSETS*	**−0.326**	**−0.256**	**0.173**	**0.151**	**0.271**												
7 *MB*	**0.029**	**0.105**	0.006	**0.029**	**−0.031**	−0.020											
8 *LEV*	**−0.056**	**−0.099**	**0.069**	**0.071**	**0.088**	**0.233**	−0.026										
9 *PAYOUT*	**−0.204**	**−0.086**	**0.049**	0.005	**0.059**	**0.256**	**0.106**	**0.046**									
10 *ANNRET*	**0.463**	**0.072**	0.001	−0.003	−0.005	**−0.110**	**0.120**	0.006	**−0.059**								
11 *CAPEX*	−0.002	**−0.110**	−0.017	**−0.035**	**−0.028**	−0.013	0.019	**0.059**	**−0.031**	0.010							
12 *COMP*	**−0.170**	**−0.107**	**0.078**	**0.093**	**0.138**	**0.493**	**0.080**	**0.106**	**0.109**	**0.042**	**0.057**						
13 *ROA*	**−0.056**	**−0.285**	0.006	0.006	**−0.027**	0.018	**0.152**	**−0.113**	**0.077**	**0.071**	**0.164**	**0.166**					
14 *TENURE*	**0.088**	−0.011	**−0.066**	**−0.041**	0.022	**−0.106**	−0.011	0.006	**−0.035**	**0.045**	**0.031**	**−0.072**	**−0.048**				
15 *STD_OCF*	**0.217**	**0.366**	**−0.056**	**−0.050**	**−0.058**	**−0.290**	**0.062**	**−0.044**	**−0.088**	**0.082**	**0.038**	**−0.111**	**−0.191**	**0.028**			
16 *AGE*	**−0.073**	**−0.077**	−0.011	0.006	0.021	**0.081**	**−0.048**	**0.050**	**0.064**	−0.009	−0.005	**0.090**	−0.010	−0.009	**−0.054**		
17 *ABNAC*	−0.004	**−0.127**	0.021	**−0.027**	0.014	**0.042**	**−0.071**	**0.077**	−0.012	0.001	−0.018	**−0.026**	**−0.147**	−0.002	**−0.043**	0.023	
18 *PEG*	**−0.162**	**−0.034**	−0.006	0.012	−0.004	**−0.106**	**−0.113**	**0.090**	**−0.152**	0.015	0.025	**−0.103**	**−0.127**	**0.035**	**0.057**	−0.002	**0.049**

Notes: Bold denotes significance at $p < 0.05$. All variables are as defined in the Appendix and Table III

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Variable	Predicted sign	Measure of risk STD_RET	RD
INTERCEPT		0.3031 (8.55)***	0.0624 (4.92)***
CITY_SPECIALIST	(+)	0.0097 (3.55)***	0.0029 (2.53)**
NAT_SPECIALIST	(?)	−0.0006 (−0.12)	−0.0021 (−1.18)
INFLUENCE	(?)	0.0106 (1.61)	−0.0110 (−3.46)***
LN_ASSETS	(−)	−0.194 (−7.87)***	−0.0051 (−5.14)***
MB	(+)	−0.0001 (−0.26)	0.0009 (3.60)***
LEV	(?)	0.0056 (1.02)	−0.0048 (−0.80)
PAYOUT	(−)	−0.5010 (−4.59)***	−0.0459 (−2.24)**
ANNRET	(+)	0.1668 (25.88)***	0.0058 (3.18)***
CAPEX	(+)	0.1048 (2.08)**	0.0486 (1.20)
COMP	(+)	−0.0048 (−2.10)**	0.0038 (4.03)***
ROA	(+)	−0.0987 (−2.88)***	−0.1122 (−5.50)***
TENURE	(?)	−0.0051 (−0.70)	−0.0051 (−2.63)***
STD_OCF	(+)	0.6012 (2.99)***	0.2631 (7.56)***
AGE	(−)	−0.0005 (−1.65)*	−0.0003 (−2.86)***
ABNAC	(?)	0.0359 (2.75)**	−0.0045 (−1.71)*
PEG	(−)	−0.5687 (−6.92)***	−0.1003 (−3.36)***
Industry and Year FE		Y	Y
N		5,651	5,651
R^2		0.413	0.440

Notes: ***, **and *Denote significance at the 1, 5 and 10 per cent level, respectively. Two-sided *t*-statistics are in parentheses and are based on clustering at the auditor office level. The dependent variables are *STD_RET*, which is the annual standard deviation of daily stock returns, and *RD*, which is research and development expenses scaled by lagged total assets and set to 0 if missing. *CITY_SPECIALIST* is an indicator variable set equal to 1 if the auditor has the largest annual market share of audit fees within a two-digit SIC code, for each city with at least two unique Big 4 offices, and 0 otherwise. *NAT_SPECIALIST* is an indicator variable set equal to 1 if the audit firm has the largest annual market share of audit fees within a two-digit SIC code, and 0 otherwise. *INFLUENCE* is the ratio of a client's total annual fees to the aggregate annual fees earned by the unique office that audits that client. *LN_ASSETS* is the log of total assets. *MB* is the ratio of the market value of equity to book value of equity, *LEV* is total liabilities divided by total assets and *PAYOUT* is annual dividend payout. *ANNRET* is the annual return from the previous year. *CAPEX* is capital expenditures net of sales of property, plant and equipment, scaled by beginning of the year total assets. *COMP* is the natural logarithm of the sum of a CEO's salary, bonus and the amount of stock options granted and exercised during the year. *ROA* is income before extraordinary items scaled by average total assets. *TENURE* is an indicator variable equal to 1 if auditor tenure is three years of less for a firm, and 0 otherwise. *STD_OCF* is the standard deviation of operating cash flows deflated by total assets for the three-year period $t-1$ to $t+1$. *AGE* is CEO age and *ABNAC* is the abnormal accruals estimated from the performance-adjusted Jones model. *PEG* is cost of equity capital and calculated as in Easton (2004)

Table V. OLS estimation of corporate risk and industry specialist auditors

Our prediction is that the effect of engaging an industry specialist auditor on corporate risk-taking is incrementally different for firms with alternative forms of external monitoring, but we make no directional prediction on the interaction term. Model fit statistics suggest that our model is well-specified, as the adjusted *R*-squared ranges from 42 to 47 per cent. Whether we proxy for monitoring by including the

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$$\begin{aligned}\text{RISK} = {} & a + b_1 CITY\_SPECIALIST + b_2 MONITORING \\ & + b_3 CITY\_SPECIALIST{*}MONITORING + b_4 NAT\_SPECIALIST + b_5 INFLUENCE \\ & + b_6 LN\_ASSETS + b_7 MB + b_8 LEV + b_9 PAYOUT + b_{10} ANNRET + b_{11} CAPEX \\ & + b_{12} COMP + b_{13} ROA + b_{14} TENURE + b_{15} STD\_OCF + b_{16} AGE \\ & + b_{17} ABNAC + b_{17} PEG + INDUSTRY\ \&\ YEAR\ FE + \text{e}\end{aligned}$$

Measure of risk	STD_RET	RD
Panel A: Monitoring equals analyst following		
CITY_SPECIALIST	0.0310 (1.85)*	0.0203 (5.88)***
ANALYST	0.0052 (7.87)***	0.0042 (7.87)***
CITY_SPECIALIST × *ANALYST*	−0.0021 (−2.17)**	−0.0014 (−4.44)***
CONTROLS	Y	Y
Industry and year FE	Y	Y
N	2,875	2,875
R^2	0.423	0.474
Panel B: Monitoring equals institutional holdings		
CITY_SPECIALIST	0.0955 (2.64)**	0.0485 (4.03)***
INSTHOLD	−0.0045 (−0.13)	0.0485 (1.90)*
CITY_SPECIALIST × *INSTHOLD*	−0.0113 (−3.46)***	−0.0057 (−3.29)***
CONTROLS	Y	Y
Industry and year FE	Y	Y
N	2,875	2,875
R^2	0.474	0.460

Notes: This table presents results of estimating equation (3). Additional controls are included in all models, but not shown for brevity. The symbols ***, ** and * denote significance at the 1 per cent, 5 per cent and 10 per cent level, respectively. Two-sided *t*-statistics are in parentheses and are based on clustering at the auditor office level. All variables are as previously defined with the inclusion of our interaction term where *ANALYST* is the number of unique analysts issuing forecasts within 30 days of a firm's fiscal year end and *INSTHOLD* is the ratio of institutional holdings to common stock outstanding

Table VI. Incremental effect of industry specialist auditors and other external monitoring

number of analysts tracking each firm or institutional holdings, we find a negative and significant coefficient on the interaction term (*CITY_SPECIALIST*ANALYST* and *CITY_SPECIALIST*INSTHOLD*; *t*-stats range from −2.17 to −4.44), for both measures of corporate risk-taking (*STD_RET* and *RD*). These results suggest that the effect of using an industry specialist auditor on corporate risk-taking is incrementally lower for firms with alternative forms of external monitoring. In other words, we observe a substitution effect; the positive relationship between engaging a city industry specialist and corporate risk-taking is weakened when a firm has increasing levels of alternative external monitoring.

Selection bias

A logical concern with our story is one of endogeneity, more specifically selection bias. Audit committees at riskier firms may be more likely to select an industry specialist auditor as an added governance mechanism against overly risky managerial behavior.

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But descriptive statistics between firms that do and do not engage an industry specialist auditor suggest that this is not the case. Firms that engage industry specialists are considerably larger than those that do not (mean total assets of $1.99B with compared to $1.24B without, $p < 0.001$), and prior research has found that larger firms are less risky than smaller firms, on average, biasing against finding results in the face of potential selection bias (Berk, 1995; Perez-Quiros and Timmermann, 2002; Bargeron *et al.*, 2010)[17]. As an attempt to reduce concerns about selection bias, we use two techniques. First, re-estimate all of the models and include firm and year fixed effects. To the extent that there is a fixed correlated omitted variable that causes risker firms to select an industry specialist auditor, firm fixed effects provide a reasonable control. Our results from those estimations are very similar to those presented in Tables V and VI, and our conclusions are the same. Second, similar to Li *et al.* (2010), we use a Heckman (1979) two-stage approach. In the first stage, we estimate a probit model of the decision of whether to choose a city-level industry specialist or not as a function of auditor and client characteristics shown to affect the decision[18]. From that we calculate the inverse Mills ratio (IMR) and include it in our estimations of equations (2) and (4) (our second-stage models). In all cases, the IMR is significantly different than zero, suggesting we are controlling for selection bias. Our conclusions are unchanged when including the IMR, though the significance of our variables of interest is reduced slightly in most estimations.

Conclusion

A small but growing body of literature has examined auditor effects beyond that of higher financial reporting quality and increased audit fees. Industry specialist auditors have been associated with a decrease in the cost of debt and equity capital (Li *et al.*, 2009; 2010), increased investment efficiency (Francis *et al.*, 2011; Bae and Choi, 2012) and increased tax aggressiveness (McGuire *et al.*, 2012). Our study extends this line of literature and examines further "real" effects of engaging an industry specialist. Specifically, we investigate the relationship between auditors considered industry specialists and corporate risk-taking.

Prior literature suggests that increased monitoring of managerial decisions has a positive effect on corporate risk-taking, as managers consume fewer firm resources for personal benefit and instead use firm resources for investment in value increasing, but riskier investment opportunities (Wright *et al.*, 1996; John *et al.*, 2008; Low, 2009). Through their role as external monitors, we expect and document that higher-quality auditors are associated with higher levels of corporate risk-taking. In addition, we examine for which firms this relationship is most important. In doing so, we document a substitution effect between engaging an industry specialist auditor and other forms of external monitoring, for corporate risk-taking. To sum, our results show that auditors influence managerial decision making beyond simply their impact on financial reporting quality, in this case impacting managerial investment behavior.

We note that our findings should be interpreted with caution, as there are limitations to our study. First, while we attempt to control for selection bias in our sensitivity tests, our study may suffer from broader concerns of endogeneity that could bias our findings. Second, our measures of corporate risk-taking, while common in the literature, likely capture other constructs that may confound our interpretations. These two issues reduce our ability to provide any definitive statements regarding causation. Finally, due

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to limited coverage by the collective union of our data sources, our sample is predominately composed of large, profitable firms, somewhat limiting the generalizability of our findings.

Nonetheless, our results and conclusions may be of importance to varying interests, including boards of directors (more specifically the Audit Committee) in their selection of an auditor and investors, who can potentially use our findings in evaluating managers and potential investments. Our findings may also be of interest to regulators (e.g. the SEC and Public Company Accounting Oversight Board) and others who are concerned with matters of corporate governance.

Notes

1. Prior studies on the "real" effects of auditing (i.e. beyond that of higher earnings quality and fees) include Francis *et al.* (2011), as well as Bae and Choi (2012), who both find a direct link between auditor industry specialization and investment efficiency, even when controlling for financial reporting quality. Other examples include Li *et al.* (2009) and (2010), who find that auditor industry specialization is associated with lower client cost of debt and equity capital, respectively.
2. Macroeconomic studies show entrepreneurs who are more risk-seeking in the pursuit of profits have more sustained levels of economic growth (Faccio *et al.*, 2011).
3. The importance of firms' willingness to engage in value-enhancing risk for the benefit of shareholders has been of critical importance recently, with studies surrounding the implementation of the SOX. Cohen *et al.* (2007) and Shadab (2008) both report that SOX limits directors from accepting riskier but potentially value-enhancing investments that would be costly to monitor. Further, Bargeron *et al.* (2010) document a decline in corporate risk-taking for firms in the USA following the passage of SOX.
4. While the first studies focused on national industry specialization, more recent work provides evidence that the localized effect of city specialist auditors is of greatest importance (Reynolds and Francis, 2000; Ferguson *et al.*, 2003; Francis *et al.*, 2005; Reichelt and Wang, 2010).
5. First, we expect both a direct and an indirect effect of higher audit quality on corporate risk-taking. The indirect effect is a result of higher-quality financial reporting with better-quality auditing, reducing a firm's cost of capital while also allowing for better external monitoring of managerial behavior (Bushman and Smith, 2001; Li *et al.*, 2009, 2010). Second, we expect a direct effect in the form of interaction between managers and auditors. If managers are aware that a higher-quality auditor is scrutinizing their behavior, they are more likely to act in the interests of shareholders and invest more efficiently (Francis *et al.*, 2011).
6. The mean (median) difference in market share between the office industry specialist and the auditor with the second largest market share in that office industry is 38.4% (37.8%), suggesting there is a clear market specialist in each industry.
7. The standard deviation of a firm's stock return (*STD_RET*) is generally considered the most commonly used proxy for corporate risk. For example, recent studies applying the measure include Coles *et al.* (2006), Low (2009), Bargeron *et al.* (2010), Bartram *et al.* (2011), Faccio *et al.* (2011) and Gormley *et al.* (2012).
8. Prior studies such as Low (2009) and Bargeron *et al.* (2010) calculate the annual standard deviation of returns using daily stock returns. For brevity we calculate the annual standard

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deviation of returns using monthly stock returns, as the Pearson (Spearman) correlation between the two is 0.820 (0.892).

9. For our primary test we set research and development expenditures (*RD*), Compustat variable XRD, equal to zero where missing (Bargeron *et al.*, 2010).
10. For testing our second hypothesis, we focus on firms with positive levels of research and development expenditures, as external monitoring is a greater concern for these firms (Bargeron *et al.* 2010). This reduces the sample for those tests to 2,875 firm-year observations.
11. The authors thank an anonymous reviewer for this suggestion.
12. The mean (median) number of analysts is 10.0 (8.0).
13. The mean (median) institutional holding in our sample is 65.8% (62.5%).
14. The variance is larger than that documented by Bargeron *et al.* (2010), as we use monthly rather than daily stock returns in the calculation. Given that, our descriptives are reasonable by comparison.
15. Our results are also robust to a third measure of corporate risk. In untabulated results, we include the gain–loss spread. The gain–loss spread is the difference between the expected gain and the expected loss for a year based on monthly returns (Estrada, 2009). The gain–loss spread is highly correlated with the standard deviation of returns but more intuitive, as it is based on the magnitude of risk, rather than relative risk (Estrada, 2009).
16. Here we use the mean of firms, as the sample is highly skewed, with 49.2% of firms in our sample not reporting R&D expenditures.
17. Differences in descriptive statistics for our other variables between firms that do and do not engage an industry specialist auditor are either insignificant or display no pattern in predicting differences in risk, thus we focus on the size of the firm as a dominant determinant. For example, *RD* is lower for firms that engage an industry specialist, suggesting those firms have lower overall risk, but *STD_RET* is (almost equally) higher, suggesting the opposite (both differences are statistically significant).
18. Our first-stage model is the same as in Li *et al.* (2009) (their footnote 16) and includes controls for size, market-to-book, whether or not the company is in a high litigation industry, profitability, leverage, analyst coverage and company beta and whether the company has special items or not. We all add controls for company payout (*PAYOUT*), stock return (*ANNRET*), capital expenditures (*CAPEX*) and cost of equity capital (*PEG*) (all described in the Table AI, the same as in our primary models). Our instrumental variable is the Herfindahl Index for auditor market share, as it is correlated with whether a company is audited by a city specialist, but not with our measures of risk.

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Appendix

Variable	Detail (Compustat variable names in square brackets)	Source
STD_RET	The annual standard deviation of monthly stock returns	CRSP
RD	Research and development expenditures scaled by lagged total assets [XRD/AT $_{t-1}$]	Compustat
CITY_SPECIALIST	Indicator variable set equal to 1 if the audit firm has the largest annual market share of audit fees within a two-digit SIC code, for each city with at least two unique Big 4 offices, and 0 otherwise	Audit Analytics
NAT_SPECIALIST	Indicator variable set equal to 1 if the audit firm has the largest annual market share of audit fees within a two-digit SIC code, and 0 otherwise	Audit Analytics
INFLUENCE	Ratio of a specific client's total annual fees to the aggregate annual fees earned by the unique office that audits the client	Audit Analytics
LN_ASSETS	The natural log of a firm's total assets in millions in year *t*; [AT]	Compustat
MB	Market value of equity/book value of equity; [CSHO PRCC_F/CEQ]	Compustat
LEV	Total liabilities$_{t-1}$/Total assets$_{t-1}$; [(DLTT$_{t-1}$ + DLC$_{t-1}$) / AT$_{t-1}$]	Compustat
PAYOUT	Dividends/Sales [DVC/SALE]	Compustat
ANNRET	Annual return from the previous year	CRSP
CAPEX	Capital expenditures net of sales of property, plant, and equipment, scaled by beginning of the year total assets [(CAPX-SPPE/AT$_{t-1}$]	Compustat
COMP	Natural logarithm of the sum of a CEO's salary, bonus, and the amount of stock options granted and exercised during the year [TDC2]	Execucomp
ROA	Income before extraordinary items scaled by average total assets [OAIDP/AT$_{t-1}$]	Compustat
TENURE	Dummy variable equal to 1 if auditor tenure is three years or less for a firm, 0 otherwise	Audit Analytics
STD_OCF	Std deviation of *OCF* for $t-2$ to t, requires minimum of three years to calculate [OANCF]	Compustat
VAR_RETURN	Annual standard deviation of daily stock returns for year $t-1$	CRSP
AGE	Age of the CEO and the end of the year $t-1$	Execucomp
ABNACC	Abnormal accruals estimated from the performance-adjusted Jones Model (equation (2))	Compustat
PEG	Cost of equity capital from Easton (2004)	I/B/E/S
ANALYST	The number of unique analysts issuing forecasts within 30 days of a firm's fiscal year end	I/B/E/S
INSTHOLD	Ratio of institutional holdings to common stock outstanding [CSHO]	Thompson Reuters

Table AI.
Variable definition for multivariate tests

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