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Auditor industry specialization, board governance, and earnings management

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Auditor Industry Specialization, Board Governance, and Earnings Management

Abstract

Purpose – The purpose of this study is to investigate the interaction effect of auditor industry specialization and board governance on earnings management. This study examines whether board independence is more or less effective in constraining earnings management for firms audited by industry specialists than for firms audited by non-specialists.

Design/methodology/approach – The U.S. data were collected from the RiskMetrics Directors database and the Compustat database. Regression analysis was used to test the research proposition.

Findings – It was found that earnings management is more negatively associated with board independence for firms audited by industry specialists than for firms audited by non-specialists, consistent with the notion that there is a complementary relationship between auditor industry specialization and board governance. The findings suggest a positive interaction effect of auditor industry specialization and board governance on accounting quality.

Originality/value – This study contributes to the literature by documenting explicit evidence that high quality boards can be more effective through hiring industry specialist auditors. This study also suggests that it may be worth investigating the interaction effect among different corporate governance mechanisms on accounting quality.

Keywords Auditor industry specialization, Board governance, Earnings management

Research type Research paper

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1. Introduction

Industry specialist auditors have more industry-specific knowledge and expertise than non-specialist auditors (Dunn and Mayhew, 2004). Prior research (e.g., Balsam *et al.*, 2003; Dunn and Mayhew, 2004) finds that auditor industry specialization is positively associated with accounting quality, suggesting that industry specialist auditors can provide high quality audit services to clients. Thus, industry specialist auditors serve an important role in monitoring financial reporting process.

Industry specialist auditors may constrain earnings management not only through the audit of financial statements but also through their interaction with the client's internal corporate governance mechanisms including board of directors. Auditors may interact with board of directors as directors are involved in resolving the conflicts between management and auditors (Klein, 2002). Beasley and Petroni (2001) and Carcello *et al.* (2002) suggest that high quality boards of directors demand high quality auditors. If the interaction between the board of directors and auditors is effective, high quality boards will benefit from hiring industry specialist auditors. In other words, there may be a complement relationship between board governance and auditor industry specialization.

Contrary to the U.S. study by Carcello *et al.* (2002), Tsui *et al.* (2001) document a negative association between board independence and audit fees in Hong Kong, which is inconsistent with the complement relationship between board governance quality and audit quality. Kwon *et al.* (2007) also find that auditor industry specialization is more effective in improving accounting quality measured by discretionary accruals in countries

with a weak legal environment than in countries with a strong legal environment. As corporate governance is usually weak in a weak legal environment (DeFond and Hung, 2004), their study suggests that auditor industry specialization may serve as a substitute to other corporate governance mechanisms.[1] Thus, it is still unclear whether auditor industry specialization complements or substitutes to board governance.

To shed more light on the relationship between auditor industry specialization and board governance, this study examines whether there is a complement or substitute relationship between auditor industry specialization and board governance from a different but more explicit perspective. Based on the framework of Klein (2002), we examine the interaction effect of board independence and auditor industry specialization on earnings management. If auditor industry specialization can complement (substitute) to board governance, we expect that earnings management will be more (less) negatively associated with board independence for firms whose auditors have high industry specialization than for firms whose auditors have low industry specialization.

Using a sample of 18,513 firm-year observations over the period 1996 to 2010, we document evidence that the negative association between earnings management and board independence is stronger for firms with high auditor industry specialization than for firms with low auditor industry specialization, consistent with the notion that there is a complement relationship between auditor industry specialization and board governance. Overall, our results suggest that auditor industry specialization can improve the effectiveness of boards of directors in constraining earnings management.

This study contributes to academics and practitioners in the following ways. First, we extend a stream of research on the relationship between board governance and audit quality. Unlike prior research (e.g., Beasley and Petroni, 2001; Carcello *et al.*, 2002), our study employs a more explicit approach to testing whether auditor industry specialization can complement or substitute to board governance. Although previous studies find that high quality boards demand high quality auditors, there is no empirical evidence that high quality auditors can help high quality boards to increase the monitoring effectiveness, which can be regarded as the benefits of hiring industry specialist auditors. Our study fills in this literature gap by documenting explicit evidence that high quality boards can be more effective through hiring industry specialist auditors. Second, this study adds to the extant literature on the effect of corporate governance on accounting quality (e.g., Beasley, 1996; Klein, 2002). Prior research focuses on the main effect of corporate governance on accounting quality. Our study suggests that it may be worth investigating the interaction effect among different corporate governance mechanisms on accounting quality. Third, this study also has a practical implication for boards of directors. Our findings suggest that industry specialist auditors can help outside directors to more effectively oversee financial reporting process. Therefore, it is valuable for boards of directors to hire industry specialist auditors.

2. Literature review

2.1 Board governance and accounting quality

There is a strand of research that investigates the effect of board governance on accounting quality. Beasley (1996) examines whether board composition affects the

likelihood of financial statement fraud. He finds that financial statement fraud is less likely to occur for firms with high percentages of outside directors than for firms with low percentages of outside directors, suggesting that high board independence can reduce the occurrence of accounting fraud. Vafeas (2000) uses earnings-returns relationship as a proxy for earnings quality. He finds that earnings-returns relationship is not affected by the fraction of outside directors on the board. Klein (2002) investigates the relationship between board and audit committee characteristics and earnings management. She documents that board independence and audit committee independence are negatively associated with discretionary accruals. Likewise, Xie *et al.* (2003) find that high board independence is associated with less earnings management measured by discretionary accruals. Vafeas (2005) also finds that managers are less likely to manipulate earnings when boards and audit committees have high governance quality as measured by various board and audit committee characteristics. These results suggest that high quality boards are more effective in constraining earnings management.

Again, Bedard *et al.* (2004) document lower earnings management for firms whose audit committee members possess high financial and governance expertise.[2] Abbott *et al.* (2004) examine whether audit committee structures identified by the BRC reduce the likelihood of accounting restatement.[3] They find that firms with high audit committee independence and activity (i.e., whether the committee meets at least four times per year) are less likely to experience accounting restatement. Beekes *et al.* (2004) find that firms with high board independence more timely recognize bad news in earnings. Thus, board governance can improve earnings quality.

2.2 Auditor industry specialization and accounting quality

It is argued that industry specialist auditors provide high quality audit services to their clients, resulting in high quality accounting information of the clients. This is because industry specialist auditors gain more industry specific knowledge and have more industry expertise than non-specialist auditors (Dunn and Mayhew, 2004). Balsam *et al.* (2003) examine the association between auditor industry specialization and earnings quality. They find that auditor industry specialization is negatively associated with absolute discretionary accruals and is positively associated with earnings response coefficients. Krishnan (2003) also finds that the level of absolute discretionary accruals is higher for non-specialist auditors than for specialists. These results are consistent with the notion that industry specialist auditors conduct higher quality audits than non-specialists.

Dunn and Mayhew (2004) examine whether auditor industry specialization affects clients' disclosure quality. They argue that a client's selection of auditors may be part of its overall disclosure strategy. They document that auditor industry specialization is positively associated with a client's disclosure quality as measured by analysts' disclosure quality evaluations.[4] Kwon *et al.* (2007) investigate the role of auditor industry specialization in the international context. Using a sample from 28 countries over 1993 to 2003, they find that clients of industry specialist auditors have low discretionary accruals and high earnings response coefficients. They also find that auditor industry specialization has a more positive effect on earnings quality in countries with a weak legal environment than in countries with a strong legal environment. Their

findings suggest that auditor industry specialization may substitute to other corporate governance mechanisms because corporate governance is usually weaker in weak legal environments than in strong legal environments (La Porta *et al*., 1997; DeFond and Hung, 2004).

2.3 Board governance and audit quality

Prior research regarding the relation between board governance and audit quality focuses on the association between board governance and audit fees, where audit fees are deemed to reflect audit quality. There are two conflicting arguments on the relationship between board governance quality and audit fees. One argument is that board governance quality is positively associated with audit fees as high quality boards are more concerned with the effective oversight of management through external audit function. These boards of directors may expect external auditors to expend more audit effort, thus increasing the audit fees (Carcello *et al*., 2002). The opposite argument is that board governance quality is negatively associated with audit fees because there may be a substitute relationship between the governance mechanism of boards and the governance mechanism of auditors (Tsui *et al*., 2001).

Carcello *et al.* (2002) examine the association between board characteristics and audit fees for a sample of 258 U.S. firms. They find positive relations between board characteristics (independence, diligence, and expertise) and audit fees, suggesting that a high quality board purchases more audit work to protect its reputation capital, to avoid legal liability, and to promote shareholder interests. Abbott *et al.* (2003) examine the association between audit committee characteristics and audit fees using a sample of 492

U.S. firms. They find that audit fees are positively associated with certain audit committee characteristics including committee independence and financial expertise, consistent with the notion that high quality audit committees have a higher demand for increased audit coverage as reflected in higher audit fees. Knechel and Willekens (2006) examine whether corporate governance and disclosure of risk management affect audit fees. Using a sample of 50 Belgian firms, they document that audit fees are higher when firms have high board independence. Overall, these studies support the argument that the governance mechanism of auditors may complement to the governance mechanism of boards.

Tsui *et al.* (2001) also investigate the association between board independence and audit fees based on a sample of 659 firm-year observations in Hong Kong. In contrast to the above studies, they find that board independence is negatively associated with audit fees, and that the negative association between board independence and audit fees is weakened by growth opportunities. Their findings suggest that firms with high quality board governance may demand less audit effort, but the decrease in audit effort is less evident for high growth firms because growth opportunities mitigate the effectiveness of board governance. Their results are consistent with the alternative argument that the governance mechanism of auditors may substitute to the governance mechanism of boards.

Prior research also considers the relationship between board governance and audit quality that is measured by auditor specialization. Abbott and Parker (2000) argue that independent and active audit committee members demand a high level of audit quality

because they are more concerned with reputational or monetary losses that may result from lawsuits or SEC sanction. Using a sample of 500 U.S. listed companies, they document that firms with audit committees that consist of non-employees and meet at least twice per year are more likely to employ industry specialist auditors. Beasley and Petroni (2001) examine whether board independence affects the choice of external auditors for 681 U.S. insurance companies. They find that insurers with high board independence are more likely to choose a specialist brand name auditor, suggesting that outside directors prefer to hire specialist auditors to more closely monitor management.

Overall, prior research on the relationship between board governance and audit quality suggests that high quality boards have a demand for high audit quality at least in some countries such as U.S. It is argued that directors on these boards use high quality auditors to effectively oversee management. However, there is limited research in the literature that provides explicit evidence on the benefits of hiring specialist auditors for high quality boards.

3. Research proposition

Prior research (e.g., Klein, 2002; Xie *et al.*, 2003) finds that high board independence leads to less earnings management, suggesting that outside directors on the board serve an important role in monitoring financial reporting process. While outside directors have incentives to protect reputational capitals and reduce litigation risks by hindering accounting fraud (Carcello *et al*., 2002), they do not directly audit financial statements. Adams *et al.* (2010) argue that it is difficult for boards of directors to directly

detect managerial malfeasance. Boards of directors may indirectly protect against managerial malfeasance through their choice of auditors.

A complementary relationship between auditor industry specialization and board governance may arise from the interaction between outside directors and external auditors. Outside directors, especially those sitting on the audit committee, have opportunities to regularly meet with external auditors to review the company's financial statements, audit process, and internal control systems. During these meetings, auditors can provide advice to outside directors on the effective oversight of financial reporting process. Outside directors may be alerted of potential accounting problems when they intervene in the resolution of disputes between managers and auditors (Klein, 2002). Thus, external auditing can strengthen the role of outside directors in monitoring management, suggesting that external auditing may complement to board governance.

The effectiveness of the interaction between outside directors and auditors will largely depend on the quality of auditors. Industry specialist auditors have high industry specific knowledge and can provide high quality audit services (Balsam *et al.*, 2003; Krishnan, 2003). Industry specialist auditors are more likely to see through earnings management and detect accounting misstatements or frauds. When industry specialist auditors identify an accounting issue and struggle with management to adjust accounting numbers, the board will play a decisive role. Boards with high governance quality are more likely to adopt the auditor's opinion on the issue, which facilitates the boards to see through earnings management. Thus, high auditor industry specialization may complement to high quality boards in monitoring financial reporting process. Based on

the above discussion, we conjecture that there could be a complement relationship between auditor industry specialization and board governance.

It is also possible for a substitute relationship between auditor industry specialization and board governance although we conjecture a complement relationship between them. We are concerned with this competing conjecture because Tsui *et al.* (2001) and Kwon *et al.* (2007) suggest that auditor industry specialization may substitute to corporate governance. Hermalin and Weisbach (2003) and Adams *et al.* (2010) contend that board composition is endogenously determined, suggesting that the monitoring effectiveness of outside directors is affected by economic factors. The demand for board effectiveness may decrease when the quality of alternative corporate governance mechanisms is high. Thus, whether there is a complement or substitute relationship between auditor industry specialization and board governance could be an empirical question.

Based on prior research into the relationship between earnings management and board governance quality (e.g., Klein, 2002; Xie *et al*., 2003), we investigate the effect of auditor industry specialization on the effectiveness of board governance in constraining earnings management. Specifically, we conjecture a more (less) negative association between earnings management and board governance quality for firms audited by industry specialists if auditor industry specialization complements (substitutes) to board governance quality. Since this is an empirical question, we develop the research proposition as follows:

Research Proposition: The association between earnings management and board governance quality is different for firms audited by industry specialist auditors and firms audited by non-specialist auditors.

4. Data, variables, and models

We start with selecting sample firms from the latest version of RiskMetrics Directors database, which provides information about the composition of board of directors for around 1,500 largest companies during the years 1996 to 2010. The RiskMetrics Directors database defines an independent director as a director who is neither affiliated nor currently an employee of the company.[5] The RiskMetrics dataset consists of 221,144 firm-year-director observations, which are used to determine board independence for 23,239 firm-year observations. We then collect financial statement data from the Compustat database for the same sample period to compute other variables used in the analyses. After merging the RiskMetrics dataset with the Compustat dataset, we obtain the final sample consisting of 18,513 firm-year observations for the years 1996 to 2010. Table 1 presents the breakdown of the sample by year.

Insert Table 1

Like prior research (e.g., Klein, 2002; Chung and Kallapur, 2003), we use discretionary accruals to measure earnings management. We adopt Kothari *et al.* (2005) and compute discretionary accruals as follows. First, we estimate the cross-sectional variant of the Jones (1991) model within each two-digit SIC industry-year:

$$ACC/TA_{-1} = a_0\ 1/TA_{-1} + a_1\ \Delta SALES/TA_{-1} + a_2\ PPE/TA_{-1} + \varepsilon \qquad (1)$$

In equation (1), *ACC* is total accruals measured as the difference between earnings before extraordinary items and discontinued operations and cash flow from operations. TA_{-1} is total assets at the beginning of the year. Δ*SALES* is change in sales between year *t*-1 and year *t*. *PPE* is gross property, plant, and equipment.

Like Klein (2002), we use all firm-year observations on the Compustat to estimate the parameters in equation (1) for each two-digit SIC industry-year that has at least eight firms. Discretionary accruals for the sample observations are measured as the residual values from equation (1). Next, we match each firm-year observation in the sample to a firm-year observation from the population by the same two-digit SIC industry-year and the closest return on assets (*ROA*) to control for the effect of firm performance on the estimate of discretionary accruals. We then compute the performance-matched discretionary accruals for each sample observation by subtracting the discretionary accruals of the matched observation from the discretionary accruals of the observation. Kothari *et al.* (2005) suggest that the performance-matched discretionary accruals based on the above procedures are less misspecified than other measures of discretionary accruals. Finally, we use the absolute value of the performance-matched discretionary accruals (*ADAC*) as a measure of earnings management. Similar to prior research (e.g., Klein, 2002; Chung and Kallapur, 2003), we take the absolute value for the measurement because managers manipulate earnings not only upward but also downward (Levitt, 1998).

Prior research (e.g., Beasley, 1996; Klein, 2002; Xie *et al*., 2003) on boards of directors usually uses board independence, i.e., the proportion of independent directors

on the board, to measure board governance quality as independent directors are regarded as effective monitors of the management. These studies document a positive association between board independence and financial reporting quality, suggesting that board independence positively affects the effectiveness of financial reporting process. Thus, we use board independence (*BDIND*) as a major measure of board governance quality in our study.

We consider audit firms as specialist auditors in a specific industry where they have devoted the most resources to develop industry-specific knowledge. Since clients' size reflects auditors' efforts on the clients, we use portfolio shares for industries, i.e., the ratio of the sum of the square root of the total assets of the clients of an auditor in a specific industry to the total sum of the square root of the total assets of all clients of the auditor (Behn *et al.*, 2008), to measure auditor industry specialization (*AISPE*). A large portfolio share indicates large investments by audit firms in developing industry audit technologies.

We also use several control variables in the analyses because they may affect earnings management or board governance quality. Firm size (*FSIZE*) is measured as the natural logarithm of market value of common equity. We include *FSIZE* as large firms have high political costs and thus are more likely to manage earnings (Watts and Zimmerman, 1986). On the other hand, Boone *et al.* (2007) find that board independence is positively associated with firm size. Financial leverage (*LEV*) is measured by the ratio of long-term debt to total assets. *LEV* is added in regression models because Dechow *et al.* (1996) and Klein (2002) find that this variable is positively associated with earnings

management. Nevertheless, Jensen and Meckling (1976) propose that financial leverage can reduce agency costs, suggesting that *LEV* may affect the demand for board governance quality.[6] Market-to-book ratio (*MB*) is measured by the ratio of the market value of common equity to the book value of common equity. We include *MB* in regression models because Skinner and Sloan (2002) suggest that firms with high growth opportunities, identified by high market-to-book ratio, are more likely to engage in earnings management. Other studies, such as Bathala and Rao (1995) and Linck *et al.* (2008), also find that board governance quality is negatively associated with growth opportunities.

In addition, implicit claim (*ICLAIM*) is measured as one minus the ratio of gross plant, property, and equipment to total assets. As Bowen *et al.* (1995) indicate that implicit claims may positively affect earnings management, we control for implicit claims in the regressions. Net operating assets (*NOA*) are measured as shareholders' equity minus cash and marketable securities plus total liability at the end of fiscal year *t*-1, scaled by sales of fiscal year *t*-1. Litigation risk (*LITI*) is coded "1" if the firm belongs to one of the following industries: pharmaceutical / biotechnology (SIC codes 2833-2836, 8731-8734), computer (3570-3577, 7370-7374), electronics (3600-3674), or retail (5200-5961), and "0" otherwise. Based on Cheng and Warfield (2005), firms with high net operating assets or high litigation risks are less likely to manage earnings. Thus, we include *NOA* and *LITI* in the model. Loss dummy (*LOSS*) is a dummy coded "1" if net income is negative for both year *t*-1 and year *t*, and "0" otherwise. We add *LOSS*

because Francis *et al.* (2004) find that accrual quality is lower for firms that incur losses, suggesting that those firms may have higher earnings management.

Before testing the interaction effects of board independence and auditor industry specialization, we examine their main effects on earnings management based on the following regression model:[7]

$$ADAC = \beta_0 + \beta_1 BDIND + \beta_2 AISPE + \beta_3 FSIZE + \beta_4 LEV + \beta_5 MB + \beta_6 ICLAIM + \beta_7 NOA + \beta_8 LITI + \beta_9 LOSS + \varepsilon \quad (2)$$

For all tests, we estimate regression models with standard errors that cluster by year, which can mitigate the effect of autocorrelation of time series data. In equation (2), *BDIND* and *AISPE* are standardized by (*BDIND* – mean (0.64))/std (0.18) and (*AISPE* – mean (0.04))/std (0.04), respectively. As prior research (e.g., Klein, 2002; Balsam et al., 2003) finds that board independence and auditor industry specialization are negatively associated with earnings management, we expect a negative coefficient on both BDIND and AISPE.

To examine our research proposition, we expand equation (2) by including the interaction term of board independence and auditor industry specialization as follows:

$$ADAC = \beta_0 + \beta_1 BDIND + \beta_2 AISPE + \beta_3 BDIND * AISPE + \beta_4 FSIZE + \beta_5 LEV + \beta_6 MB + \beta_7 ICLAIM + \beta_8 NOA + \beta_9 LITI + \beta_{10} LOSS + \varepsilon \quad (3)$$

In equation (3), we expect the coefficient on *BDIND*AISPE* to be negative (positive) if board independence and auditor industry specialization have a complement (substitute) relationship on enhancing earnings quality. Based on the literature, we also expect that

the coefficients on *MB*, *ICLAIM*, and *LOSS* are positive, and that the coefficients on *NOA* and *LITI* are negative.[8]

5. Empirical results

Table 2 reports the descriptive statistics of the variables for the full sample. The mean and median of the absolute value of performance-matched discretionary accruals are 0.09 and 0.06, respectively. The mean and median of board independence are 0.64 and 0.67, respectively, which indicate that approximate 64 to 67% of directors on the board are independent directors during our sample period. The mean and median of auditor industry specialization are 0.04 and 0.03, respectively, which are close to those reported in Behn *et al.* (2008) (i.e., mean = 0.042, median = 0.037). Table 2 also compares the descriptive statistics between firms with high *AISPE* and firms with low *AISPE*, where high (low) *AISPE* means that a firm's *AISPE* is not less than (less than) the median of *AISPE* for a given year.

Insert Table 2

Table 3 presents the correlation coefficients between the independent variables. We find that board independence and auditor industry specialization are negatively associated with absolute discretionary accruals (r = -0.06, p < .01; -0.03, p < .01, respectively). These correlations provide univariate evidence that board independence and auditor industry specialization negatively affect earnings management. We also find that auditor industry specialization is positively correlated with board independence (r = 0.08, p < .01), consistent with the notion that high quality boards have a high demand for high quality audits (Abbott and Parker, 2000; Beasley and Petroni, 2001). The maximum

absolute value of those correlation coefficients is 0.37 for the correlation between *AISPE* and *NOA*. Since the correlations are not excessively high, multicollinearity is not a substantive issue in this study.

Insert Table 3

Table 4 reports the main results on the effects of board independence and auditor industry specialization on earnings management. The results in columns 3 and 4 show that the coefficient on board independence is negative and significant (t = -3.59, p <.01), consistent with Klein (2002), while the coefficient on auditor industry specialization is insignificant, inconsistent with Balsam *et al.* (2003). The results in columns 5 and 6 indicate a negative and significant coefficient (t = -4.15, p <.01) on the interaction of board independence and auditor industry specialization. The results suggest that auditor industry specialization could be a complement rather than substitute to board independence in improving accounting quality. Thus, high quality boards are more effective in constraining earnings management when they hire industry specialist auditors.

Insert Table 4

To test the robustness of our results, we conduct several additional analyses as follows. First, we use signed discretionary accruals in place of absolute discretionary accruals to measure earnings management. We estimate equations (2) and (3) for positive or negative discretionary accruals separately. We expect that the coefficient on *BDIND*AISPE* is significantly negative for positive discretionary accruals, and is

significantly positive for negative discretionary accruals if the interaction of board independence and auditor industry specialization can enhance earnings quality.

Table 5 provides the results on signed discretionary accruals. We find that the coefficient on the interaction of board independence and auditor industry specialization is negative and significant for positive discretionary accruals (t = -5.64, p < .01), and is positive and significant for negative discretionary accruals (t = 3.17, p < .01). These results are consistent with the complement argument, suggesting that auditor industry specialization enhances the effectiveness of board governance in reducing both income-increasing and income-decreasing discretionary accruals. Thus, our results still hold when we use signed discretionary accruals to measure earnings management.

Insert Table 5

Second, we use the market share measure as an alternative measure of auditor industry specialization, which is computed as the ratio of the sum of the sales of the clients of an auditor in a two-digit SIC industry to the total sum of the sales of all companies in that industry. Table 6 reports the results on the market share measure. We still find a negative coefficient on *BDIND*AISPE* for absolute discretionary accruals although this coefficient is not statistically significant. We also find that the coefficient on *BDIND*AISPE* for positive discretionary accruals is negative and significant at the one-tailed test (t = -1.61, p < .10), consistent with the complement argument. Overall, the results based on the market share measure of auditor industry specialization are inclined to support the complement argument rather than the substitute argument.

Insert Table 6

Third, we test the research proposition by allowing for the endogeneity of board independence. We are concerned with this issue because prior research (e.g., Hermalin and Weisbach, 1998; Boone *et al.*, 2007) suggests that board composition is endogenously determined. We employ a two-stage regression to deal with this issue. The first-stage regression is to regress board independence on exogenous variables and an instrumental variable. We use two ways to choose the instrumental variable. Following Frankel *et al.* (2006), we rank observations by board governance quality and then categorize them into three equal-sized portfolios. The first instrument is the portfolio rank of board independence measured by "0", "1" or "2" for observations in the lowest, middle, or highest portfolio, respectively.[9] We also use the lagged value of board independence as the second instrument in that it is an alternative econometric approach to dealing with endogeneity (Fisher, 1965). We estimate the first-stage equation as follows:

$$BDIND = \alpha_0 + \alpha_1 MB + \alpha_2 LEV + \alpha_3 FSIZE + \alpha_4 INSTR + \varepsilon \quad (4)$$

In equation (4), the instrumental variable (*INSTR*) is measured by (a) the portfolio rank of *BDIND* coded "0", "1", and "2" for observations in the lowest, middle, and highest portfolio, respectively, or (b) the lagged value of *BDIND*. We include *MB*, *LEV*, and *FSIZE* in equation (4) as exogenous variables because these firm characteristics may affect board independence.[10] We run the second-stage regression by replacing *BDIND* in equation (3) with the fitted value of *BDIND* from equation (4).

Table 7 presents the results on the two-stage regression. Panels A and B of Table 7 contain the results of the first-stage and second-stage regressions, respectively. Columns 3 and 4 report the results when the portfolio rank of board independence is used

as the instrumental variable. We document a negative and significant coefficient on the interaction term between board independence and auditor industry specialization (t = -3.19, p < .01). When the lagged value of board independence is used as the instrumental variable in columns 5 and 6, we also find that the coefficient on the interaction term is negative and significant (t = -4.30, p < .01). Thus, we find the results supporting the complement argument even when allowing for the endogeneity of board governance quality.

Insert Table 7

Fourth, we test the robustness of our results to using the likelihood of small positive earnings as an alternative measure of earnings management. We identify earnings as small positive earnings if earnings deflated by total assets are between 0 and 0.02. We replace *ADAC* in equation (3) with a dummy coded "1" for firms with small positive earnings and "0" otherwise and run the logistic regression. We document a negative and significant coefficient on *BDIND*AISPE* (non-tabulated χ^2 = 1.93, p < .10). These results are consistent with the results based on discretionary accruals.

Fifth, we examine the research proposition by using alternative measures of board governance quality. When we use audit committee independence to replace board independence in equation (3) for 1996 to 2002,[11] we find a negative and significant coefficient on the interaction of audit committee independence and auditor industry specialization (non-tabulated t = -1.99, p < .10), consistent with the results on board independence. By estimating equation (3) based on the proportion of financial experts on the board (i.e. board financial expertise) for 2007 to 2010,[12] we find an insignificant

coefficient on the interaction of board financial expertise and auditor industry specialization. A possible explanation for the results on board financial expertise is that directors with financial expertise may not need complement of financial expertise from auditors. When we estimate equation (2) using the proportion of directors who attend not less than 75% of board meetings,[13] which reflects active board involvement, we also find an insignificant coefficient on the interaction of active board involvement and auditor industry specialization. A possible explanation for the results on active board involvement is that directors with less attendance, who may be less familiar with the company, may have a higher demand for expertise from auditors to monitor managers, which may offset the interaction effect of active board involvement and auditor industry specialization.

Sixth, we examine whether the results are driven by firm performance or firm size. We consider this issue because firms with sound board governance or firms audited by industry specialist auditors may have higher firm performance or larger size. We split the sample into two groups based on *ROA* or firm size, i.e., high vs. low *ROA* groups, and large vs. small firm groups, and estimate equation (3) for each group. We find that the coefficient on *BDIND*AISPE* is all significantly negative for high *ROA* group, low *ROA* group, large firm group, and small firm group (non-tabulated $t = -1.51$, $p < .10$ one-tailed test; $t = -4.21$, $p < .01$; $t = -4.06$, $p < .01$; $t = -2.56$, $p < .05$). Thus, our results are less likely to be driven by firm performance or firm size.

Finally, we estimate equation (3) using accruals data at year *t* and board independence and auditor industry specialization data at year *t*-1 to examine whether the

interaction of board independence and auditor industry specialization is the causation of lower earnings management. We also find a negative and significant coefficient on *BDIND*AISPE* (non-tabulated t = -4.15, p < .01). This suggests that lower earnings management is caused by the interaction of board independence and auditor industry specialization.

6. Conclusions

This paper examines whether auditor industry specialization enhances the effectiveness of board governance in constraining earnings management. We argue that earnings management is more (less) negatively associated with board independence for firms with high auditor industry specialization than for firms with low auditor industry specialization if there is a complement (substitute) relationship between auditor industry specialization and board governance. Using a sample of 18,513 firm-year observations from 1996 to 2010, we document evidence on the positive effect of auditor industry specialization on the effectiveness of board independence. The results are consistent with the notion that auditor industry specialization complements to board governance. Overall, our findings suggest that high quality boards are more effective in constraining earnings management when they hire industry specialist auditors.

This study makes the following contributions and implications to academics and practitioners. First, we add to the extant research into the relationship between audit quality and board governance by examining whether auditor industry specialization complements or substitutes to board governance. Unlike prior research (e.g., Beasley and Petroni, 2001; Carcello *et al.*, 2002), this study provides more explicit evidence that high

quality boards can benefit from industry specialist auditors. Second, this study suggests that in addition to the main effects examined in prior research, it may be worth examining the interaction effects among different corporate governance mechanisms on accounting quality. Third, this study also provides a practical implication that it is valuable for boards of directors to hire industry specialist auditors.

We note that our results should be cautiously interpreted because of the following limitations of this study. First, the endogeneity of board governance is still a concern of our analyses while we allow for this issue by running the two stage regression. Like other corporate governance studies, it is difficult for our study to find the most appropriate instrumental variable. Future research may employ more refined approaches to dealing with this issue. Second, the large dataset in this study constrains the possibility of considering more aspects of board governance, which may reduce the generalizability of our findings. Future research may explore more alternative measures of board governance. Third, there are data constraints to measure city-specific auditor industry specialization in this study. Future research may examine whether our results can hold for city-specific auditor industry specialization.

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Table 1
Sample breakdown by year

Year	Frequency	Percent (%)
1996	1,155	6.24
1997	1,290	6.97
1998	1,416	7.65
1999	1,407	7.60
2000	1,414	7.64
2001	1,471	7.95
2002	1,190	6.43
2003	1,198	6.47
2004	1,198	6.47
2005	1,189	6.42
2006	1,146	6.19
2007	1,014	5.48
2008	1,072	5.79
2009	1,211	6.54
2010	1,142	6.17
Total	18,513	100.00

Table 2
Descriptive statistics

	Full Sample (N =18,513)			High *AISPE* (N =9,339)			Low *AISPE* (N=9,174)			High vs. Low *AISPE*	
Variable	Mean	Median	Std	Mean	Median	Std	Mean	Median	Std	*t*-statistic	*z*-statistic
ADAC	0.09	0.06	0.10	0.10	0.06	0.11	0.08	0.06	0.09	10.47***	6.21***
BDIND	0.67	0.71	0.18	0.69	0.71	0.18	0.66	0.69	0.18	9.89***	10.51***
AISPE	0.04	0.03	0.04	0.06	0.05	0.04	0.01	0.01	0.01	135.48***	117.47***
FSIZE	7.40	7.31	1.49	7.59	7.50	1.51	7.20	7.13	1.44	17.82***	16.92***
LEV	0,19	0.18	0.16	0.19	0.17	0.17	0.20	0.19	0.16	-5.45***	-6.98***
MB	3.03	2.18	3.19	3.19	2.24	3.39	2.86	2.13	2.96	7.00***	8.37***
ICLAIM	0.46	0.54	0.38	0.49	0.60	0.40	0.43	0.48	0.36	10.83***	15.24***
NOA	1.25	0.89	1.13	1.54	1.06	1.32	0.96	0.77	0.79	36.15***	38.43***
LITI	0.29	0.00	0.45	0.38	0.00	0.49	0.20	0.00	0.40	26.92***	26.37***
LOSS	0.08	0.00	0.27	0.10	0.00	0.30	0.06	0.00	0.24	10.17***	10.12***

ADAC is the absolute value of performance-matched discretionary accruals based on the Jones model.
BDIND is board independence, measured by the proportion of independent directors on the board.
AISPE is auditor industry specialization, measured by the ratio of the sum of the square root of the total assets of the clients of an auditor in a specific industry to the total sum of the square root of the total assets of all clients of the auditor.
FSIZE is the natural logarithm of the market value of the common equity.
LEV is leverage, measured by the ratio of long-term debt to total assets.
MB is market-to-book value, measured by the ratio of the market value of the common equity to the book value of the common equity.
ICLAIM is implicit claim, measured by one minus the ratio of gross plant, property, and equipment to total assets.
NOA is net operating assets, measured by shareholders' equity minus cash and marketable securities plus total liability at the end of fiscal year t-1, scaled by sales of fiscal year t-1.
LITI is litigation risk, coded "1" if the firm belongs to one of the following industries: pharmaceutical / biotechnology (SIC codes 2833-2836, 8731-8734), computer (3570-3577, 7370-7374), electronics (3600-3674), or retail (5200-5961), and "0" otherwise.
LOSS is a dummy coded 1 if net income is negative for both year *t*-1 and year *t*, and 0 otherwise.
*** $p <$ .01 (two-tailed).

Table 3
Pearson correlations

Variable	*BDIND*	*AISPE*	*FSIZE*	*LEV*	*MB*	*ICLAIM*	*NOA*	*LITI*	*LOSS*
ADAC	-0.06***	-0.03***	-0.05***	-0.08***	0.09***	0.15***	-0.06***	0.13***	0.11***
BDIND		0.08***	0.17***	-0.00	-0.01	-0.07***	0.01	-0.05***	-0.06***
AISPE			0.12***	0.08***	-0.03***	-0.07***	0.37***	-0.01*	0.02**
FSIZE				-0.01*	0.35***	0.01*	0.12***	0.03***	-0.22***
LEV					-0.08***	-0.28***	0.24***	-0.24***	0.08***
MB						0.10***	-0.12***	0.12***	-0.07***
ICLAIM							-0.06***	0.17***	0.02***
NOA								-0.18***	0.10***
LITI									0.10***

All variables are defined in Table 2.
*** $p <$ .01 (two-tailed). ** $p <$ .05 (two-tailed). * $p <$ .10 (two-tailed).

Table 4
Main results

		Equation (2)		Equation (3)	
Variable	Predicted sign	Coefficient	*t*-statistic	Coefficient	*t*-statistic
Intercept	+/-	0.097	23.72***	0.099	23.61***
BDIND	-	-0.003	-3.59***	-0.003	-3.99***
AISPE	-	0.001	0.52	0.002	1.14
*BDIND*AISPE*	+/-			-0.004	-4.15***
FSIZE	-	-0.004	-8.11***	-0.004	-8.19***
LEV	+/-	-0.013	-2.03*	-0.013	-2.01*
MB	+	0.003	11.16***	0.003	11.08***
ICLAIM	+	0.031	9.26***	0.030	9.40***
NOA	-	-0.003	-3.01***	-0.003	-3.21***
LITI	-	0.016	5.17***	0.016	5.08***
LOSS	+	0.036	9.08***	0.034	8.74***
N			18,513		18,513
F-statistic			44.73***		58.77***
R^2			5.61%		5.73%

The regression models are as follows:

$$ADAC = \beta_0 + \beta_1 BDIND + \beta_2 AISPE + \beta_3 FSIZE + \beta_4 LEV + \beta_5 MB + \beta_6 ICLAIM + \beta_7 NOA + \beta_8 LITI + \beta_9 LOSS + \varepsilon \quad (2)$$

$$ADAC = \beta_0 + \beta_1 BDIND + \beta_2 AISPE + \beta_3 BDIND * AISPE + \beta_4 FSIZE + \beta_5 LEV + \beta_6 MB + \beta_7 ICLAIM + \beta_8 NOA + \beta_9 LITI + \beta_{10} LOSS + \varepsilon \quad (3)$$

All variables are defined in Table 2.
*** $p < .01$ (two-tailed). * $p < .10$ (two-tailed).

Table 5
Results on signed discretionary accruals

Panel A. Positive discretionary accruals

		Equation (2)		Equation (3)	
Variable	Predicted sign	Coefficient	*t*-statistic	Coefficient	*t*-statistic
Intercept	+/-	0.096	16.33***	0.098	16.66***
BDIND	-	-0.001	-1.20	-0.002	-1.37
AISPE	-	-0.000	-0.31	0.001	0.44
*BDIND*AISPE*	+/-			-0.004	-5.64***
FSIZE	+/-	-0.004	-6.57***	-0.004	-6.74***
LEV	+/-	-0.001	-0.15	-0.002	-0.21
MB	+	0.002	7.52***	0.002	7.02***
ICLAIM	+	0.010	2.27**	0.009	2.08*
NOA	-	-0.002	-2.65**	-0.002	-2.73**
LITI	-	0.005	1.71	0.005	1.67
LOSS	+	0.030	6.86***	0.028	6.54***
N			8,134		8,134
F-statistic			38.59***		33.25***
R^2			3.45%		3.67%

Panel B. Negative discretionary accruals

		Equation (2)		Equation (3)	
Variable	Predicted sign	Coefficient	*t*-statistic	Coefficient	*t*-statistic
Intercept	+/-	-0.103	-16.44***	-0.105	-15.93***
BDIND	+	0.004	3.97***	0.005	4.42***
AISPE	+	-0.001	-0.68	-0.002	-1.28
*BDIND*AISPE*	+/-			0.004	3.17***
FSIZE	+/-	0.004	5.39***	0.004	5.39***
LEV	+/-	0.023	2.92**	0.023	2.90**
MB	-	-0.004	-8.13***	-0.004	-8.03***
ICLAIM	-	-0.041	-10.94***	-0.040	-11.15***
NOA	+	0.004	3.52***	0.005	3.70***
LITI	+	-0.021	-5.99***	-0.021	-5.87***
LOSS	-	-0.032	-7.36***	-0.031	-7.09***
N			10,379		10,379
F-statistic			51.64***		77.41***
R^2			7.40%		7.51%

All variables are defined in Table 2.
** $p <$ .05 (two-tailed). *** $p <$ .01 (two-tailed).

Table 6
Results on market share measure

	Absolute discretionary accruals			Positive discretionary accruals			Negative discretionary accruals		
Variable	Predicted sign	Coefficient	*t*-statistic	Predicted sign	Coefficient	*t*-statistic	Predicted sign	Coefficient	*t*-statistic
Intercept	+/-	0.095	21.82***	+/-	0.095	16.81***	+/-	-0.100	-16.27***
BDIND	-	-0.003	-3.76***	-	-0.001	-1.21	+	0.004	4.00***
AISPE	-	-0.002	-3.72***	-	-0.001	-1.50	+	0.002	3.18***
*BDIND*AISPE*	+/-	-0.000	-0.59	+/-	-0.001	-1.61	+/-	-0.000	-0.51
FSIZE	+/-	-0.004	-6.74***	+/-	-0.004	-6.46***	+/-	0.004	4.88***
LEV	+/-	-0.013	-1.98*	+/-	-0.001	-0.15	+/-	0.022	2.87**
MB	+	0.003	10.65***	+	0.002	7.40***	-	-0.004	-7.92***
ICLAIM	+	0.030	9.12***	+	0.009	2.12*	-	-0.040	-11.05***
NOA	-	-0.003	-2.42**	-	-0.002	-2.42**	+	0.004	3.08***
LITI	-	0.016	5.00***	-	0.005	1.60	+	-0.021	-5.89***
LOSS	+	0.036	9.08***	+	0.030	6.89***	-	-0.032	-7.35***
N			18,513			8,134			10,379
F-statistic			73.26***			37.54***			53.05***
R^2			5.65%			3.52%			7.45%

All variables are defined in Table 2.
* $p <$ .10 (two-tailed).
** $p <$ .05 (two-tailed).
*** $p <$ .01 (two-tailed).

Table 7
Results on two-stage regression

Panel A. First-stage regression

		Portfolio rank		Lagged value	
Variable	Predicted sign	Coefficient	*t*-statistic	Coefficient	*t*-statistic
Intercept	+/-	-1.182	-65.57***	-0.072	-3.41***
MB	-	-0.003	-2.86***	-0.005	-4.02***
LEV	-	-0.164	-7.87***	0.011	0.44
FSIZE	+	0.024	9.50***	0.025	8.80***
INSTR	+	1.068	251.88***	0.822	204.22***
N			18,513		15,748
F-statistic			16,561.00***		10,870.40***
R^2			78.16%		74.41%

Panel B. Second-stage regression

		Portfolio rank		Lagged value	
Variable	Predicted sign	Coefficient	*t*-statistic	Coefficient	*t*-statistic
Intercept	+/-	0.099	23.62***	0.097	19.86***
BDIND	-	-0.003	-3.78***	-0.003	-2.12*
AISPE	-	0.002	1.03	0.002	1.53
*BDIND*AISPE*	+/-	-0.004	-3.19***	-0.006	-4.30***
FSIZE	+/-	-0.004	-8.50***	-0.004	-6.84***
LEV	+/-	-0.013	-1.95*	-0.008	-1.23
MB	+	0.003	11.09***	0.003	8.64***
ICLAIM	+	0.030	9.31***	0.029	8.48***
NOA	-	-0.003	-3.15***	-0.003	-3.01**
LITI	-	0.016	5.11***	0.015	5.19***
LOSS	+	0.035	8.88***	0.029	8.35***
N			18,513		15,748
F-statistic			74.27***		219.31***
R^2			5.68%		4.90%

The first-stage regression model is as follows:

$$BRDGQ = \alpha_0 + \alpha_1 MB + \alpha_2 LEV + \alpha_3 FSIZE + \alpha_4 INSTR + \varepsilon \quad (5)$$

INSTR is the instrumental variable, measured by (a) the portfolio rank of *BRDGQ* coded 0, 1, and 2 for observations in the lowest, middle, and highest portfolio, respectively, or (b) the lagged value of *BRDGQ*. *BRDGQ* in equation (3) is replaced with the fitted value of *BRDGQ* from equation (5). All other variables are defined in Table 2.

* $p <$ .10 (two-tailed).
** $p <$ .05 (two-tailed).
*** $p <$ .01 (two-tailed).

Notes:

[1] We acknowledge that legal environment is different from corporate governance in many aspects.

[2] Financial expertise is coded "1" if at least one audit committee member has financial expertise and "0 " otherwise. Governance expertise is measured by the average number of other board seats held by outside directors on the audit committee.

[3] BRC is abbreviated from the Blue Ribbon Committee on Improving the Effectiveness of Corporate Audit Committee. The purpose of BRC is to strengthen the role of audit committee in overseeing the financial reporting process (Abbott *et al.,* 2004).

[4] The analysts' disclosure quality evaluations are provided in the annual Association for Investment Management Research (AIMR) Corporate Information Committee Reports.

[5] This definition of independent director is similar to that of the U.S. exchanges.

[6] Specifically, there might be a substitute relationship between financial leverage and board governance quality.

[7] All continuous variables are winsorized at 1% and 99%.

[8] The coefficients on *LEV* and *FSIZE* could be either positive or negative because *LEV* and *FSIZE* may positively or negatively affect accounting quality and corporate governance.

[9] The portfolio rank of an endogenous variable can be used as an instrument because it captures the level of the variable but not the endogenously determined variations around those levels, it can be used (Hentschel and Kothari, 2001).

[10] We have discussed these variables in the section entitled "Data, variables, and models".

[11] Since all audit committee members are required to be independent directors after the Sarbanes-Oxley Act was signed into law in 2002, we use the period of 1996 to 2002 for this analysis.

[12] The RiskMetrics Directors database provides data on financial expertise of directors only for years after 2006.

[13] The RiskMetrics Directors database provides data on whether a director attends less than 75% of board meetings.