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Industry specialist auditors, outsider directors, and financial analysts

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Abstract

This study investigates the relationships among industry specialist auditors, outside directors, and financial analysts. Specifically, we examine the effect of analyst coverage on the association between auditor industry specialization and outside directorship. We find that outside directors are less likely to hire industry specialist auditors for firms with high analyst coverage than for firms with low analyst coverage. Our findings suggest that analyst coverage moderates outside directors' demand for industry specialist auditors, that is, financial analysts may compete with industry specialist auditors to some extent in monitoring financial reporting process.

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1. Introduction

Industry specialist auditors provide expertise services to their clients because they have great industry-specific knowledge (Solomon, Shields, and Whittington, 1999; Balsam, Krishnan, and Yang, 2003). As a result, outside directors are inclined to hire industry specialist auditors, who can effectively monitor financial reporting process, in order to reduce the likelihood of their reputational/litigation losses. Abbott and Parker (2000) and Beasley and Petroni (2001) document that the proportion of outside directors on the audit committee or the board is positively associated with auditor industry specialization, suggesting that outside directors are more willing to hire industry specialist auditors than inside directors.

Like industry specialist auditors, financial analysts are industry experts and possess industry-specific knowledge as they track firms to make earnings forecasts and stock recommendations. Recently, Yu (2008) and Knyazeva (2007) find that high analyst coverage is associated with less earnings management, suggesting that analysts play an important monitoring role in financial reporting process. Moreover, Dyck, Morse, and Zingales (2008) indicate that analysts may be more likely to detect accounting fraud than external auditors. Thus, as an external corporate governance mechanism, analysts are competitive with external auditors. If high analyst coverage can improve financial reporting quality to some extent, firms will have to rely less heavily on auditor industry specialization in detecting accounting misstatement or fraud.

Thus, outside directors may have less pressure to hire specialist auditors if their firms are covered by more analysts. In other words, high analyst coverage may reduce outside directors' demand for industry specialist auditors. Furthermore, the possible audit fee premium charged by auditor specialists may also reduce the willingness of hiring specialist auditors if firms are covered by more analysts and have high financial reporting quality.

This study investigates the relationships among industry specialist auditors, outside directors, and financial analysts based on a sample of 11,748 firm-year observations over the period 1996 to 2006. Specifically, we examine whether analyst coverage affects the relationship between auditor industry specialization and outside directorship. We find that auditor industry specialization is less positively associated with board independence for firms with high analyst coverage than for firms with low analyst coverage, suggesting that analyst coverage moderates the effect of board independence on auditor industry specialization. This also suggests that outside directors are more likely to hire industry specialist auditors especially when another external corporate governance mechanism, i.e., analyst coverage, is weak.

This study contributes to the literature in the following ways. First, we extend the limited research on the effect of corporate governance mechanisms on the demand for industry specialist auditors. Prior research (Abbott and Parker, 2000; Beasley and

Petroni, 2001) examines the relationship between auditor industry specialization and outside directorship. Unlike those studies, our study focuses on the moderating effect of analyst coverage on the relationship between auditor industry specialization and outside directorship. Our findings suggest that corporate governance mechanisms interactively affect clients' demand for industry specialist auditors. Nevertheless, we recognize that our results are suggestive rather than conclusive because of the potential endogeneity problem that outside directors may be attracted to well managed firms with superior financial reporting practices as they require less monitoring effort and entail lower reputational / litigation risk. Second, this study sheds more light on the monitoring role of analysts in financial reporting process. Prior research on this topic (e.g., Yu, 2008; Knyazeva, 2007) is limited to examining the effect of analyst coverage on earnings quality. Our study considers the effect of analyst coverage on the demand for auditor industry specialization. We provide further evidence that analysts play an important monitoring role in financial reporting process.

The remainder of the paper is organized as follows. We introduce the background in Section 2, develop the hypothesis in Section 3, discuss the research design in Section 4, present the empirical results in Section 5, and conclude in Section 6.

2. Background

2.1. Auditor industry specialization

Industry specialist auditors are auditors who have gained great training and experience concentrated in a specific industry. Solomon et al. (1999) find that industry specialist auditors have more accurate non-error frequency knowledge than non-industry specialists. Owhoso, Messier, and Lynch (2002) suggest that industry specialists can more effectively detect seeded errors in staff work papers during the audit review process. Low (2004) finds that auditors' industry specialization improves their audit risk assessments. Hammersley (2006) finds that matched specialists (i.e., specialists working in their industry) develop more complete problem representations about the seeded misstatement when they receive partial- or full-cue patterns than when they receive no-cue patterns, whereas mismatched specialists are not able to develop more complete problem representations even when they receive full-cue patterns. These behavioral auditing studies suggest that auditor industry specialization can enhance the effectiveness of auditors' work as a result of their greater industry-specific knowledge.

There is also a stream of archival auditing research that examines the effect of auditor industry specialization on financial reporting quality. Balsam, Krishnan, and Yang (2003) investigate the association between earnings quality and auditor industry specialization. Using the absolute value of discretionary accruals and earnings response

coefficients as measures of earnings quality, they find that clients of industry specialist auditors have higher earnings quality than clients of non-specialists. Dunn and Mayhew (2004) examine the effect of auditor industry specialization on clients' disclosure strategy. They find that analysts' rating of disclosure quality is higher for clients of industry specialist auditors than for clients of non-specialists in unregulated industries where enhanced disclosures add more value than in regulated industries. Stanley and DeZoort (2007) and Romanus, Maher, and Fleming (2008) find that firms audited by industry specialists are less likely to have accounting restatement than firms audited by non-specialists. Lim and Tan (2008) find that both earnings response coefficients and increased propensity to miss analysts' forecasts are more positively associated with non-audit services acquired from industry specialist auditors than from non-specialist auditors. These archival auditing studies indicate that auditor industry specialization can increase clients' financial reporting quality.

2.2. Outside directors and industry specialist auditors

Outside directors can more effectively monitor managers in financial reporting process than inside directors as outside directorship is presumably independent of the management and is less likely to become an instrument of the management. There is empirical evidence that outside directorship itself can enhance financial reporting quality. Klein (2002) finds that the proportion of outside directors on the board or the audit

committee, i.e., board or audit committee independence, is negatively associated with the absolute value of discretionary accruals, suggesting that outside directors are effective in constraining earnings management. Jaggi, Leung, and Gul (2009) also show that board independence can reduce earnings management. Beasley (1996) finds that the likelihood of financial statement fraud is lower for firms with high board independence than for firms with low board independence. Karamanou and Vafeas (2005) suggest that firms are more likely to voluntarily disclose information when they are more effectively monitored by the board or the audit committee. Kanagaretnam, Lobo, and Whalen (2007) document that firms with higher board independence have lower information asymmetry around quarterly earnings announcements.

Outside directors may have a high demand for auditor industry specialization because these directors may be more concerned with monetary or reputational losses that result from lawsuits or SEC sanction. Abbott and Parker (2000) investigate the relationship between auditor industry specialization and outside directorship of audit committee members. Using a sample of 500 U.S. listed companies, they find that firms with audit committees that do not include employees are more likely to hire industry specialist auditors. Beasley and Petroni (2001) examine the effect of outside directorship of board members on the choice of external auditors for a sample of 681 U.S. insurance companies. They document that insurers with high proportion of outside

directors on the board are more likely to choose a specialist auditor than insurers with low proportion of outside directors on the board. In summary, prior research provides empirical evidence on the positive association between outside directorship and auditor industry specialization, suggesting that outside directors hire industry specialist auditors to increase financial reporting quality.

2.3. Governance role of analysts

Dyck et al. (2008) report that analysts can detect 16.9% of the total corporate fraud cases revealed by external governance mechanisms, which is higher than the percentage of the cases brought to light by auditors (11.3%), suggesting that analysts may be as competitive as auditors in terms of overseeing managers. Analysts' remuneration and career prospects are affected by their reputation, which is established over time with job performance. To make accurate forecasts and valuable recommendations, analysts are motivated to track corporate information, acquire industry-specific knowledge, and perform insightful analysis. Thus, analysts have advantage to monitor managers.

Recently, Yu (2008) examines whether analyst coverage plays a governance role in terms of constraining earnings management. He documents a negative association between analyst coverage and the level of discretionary accruals. He also finds that firms with high analyst coverage are less likely to just beat or meet earnings benchmarks than firms with low analyst coverage. His findings suggest that firms followed by more

analysts engage in less earning management than firms followed by fewer analysts. Similarly, Knyazeva (2007) finds that analyst coverage is negatively associated with earnings management. Overall, these studies suggest that analysts can effectively oversee financial reporting process while the research on the governance role of analysts is still limited.

3. Hypothesis

Prior research (e.g., Balsam et al., 2003; Dunn and Mayhew, 2004; Romanus et al., 2008) finds that auditor industry specialization can enhance financial reporting quality. Outside directors have an incentive to ensure high financial reporting quality because accounting fraud or low financial reporting quality impairs their reputation and increases the risk of lawsuits (Carcello, Hermanson, Neal, and Riley, 2002). Abbott and Parker (2000) and Beasley and Petroni (2001) document a positive relationship between auditor industry specialization and outside directorship. These findings suggest that outside directors may not be able to effectively monitor financial reporting process without hiring industry specialist auditors. Although outside directors (especially those sitting on the audit committee) play a monitoring role in financial reporting process, they do not audit the financial statements themselves. Some outside directors may not have accounting expertise and experience. External auditors can aid outside directors in the oversight of financial reporting process by auditing the client's financial statements and interacting

with outside directors to resolve the client's accounting issues (Klein, 2002). Hence, outside directors would be more willing to hire industry specialist auditors so that they can effectively monitor financial reporting process to protect their reputational capital and reduce their litigation risks exposure.

Even though outside directors have requisite accounting and financial expertise, they may find it suboptimal to oversee financial reporting process as a specialist auditor would because outside directors usually sit on several companies' boards and thus are busy. On the one hand, since outside directors' busyness can weaken their monitoring effectiveness (Fich and Shivdasini, 2006), they may demand specialist auditors to offset or mitigate the negative effect of their busyness. On the other hand, however, busy outside directors may be less involved in or may hardly monitor the process of hiring external auditors, resulting in a lower level of auditor industry specialization in their companies.

Analysts can play a governance role in financial reporting process because their routine work facilitates the whistle blowing of accounting misstatement or fraud. Yu (2008) and Knyazeva (2007) find that analyst coverage can effectively constrain earnings management. Dyck et al. (2008) indicate that analysts are more likely to reveal corporate fraud than external auditors. Thus, existing literature suggests that firms followed by more analysts will have higher quality financial reporting than firms with

lower analyst coverage. Firms have a certain demand for external corporate governance, and analysts and auditors are two important components of the external mechanism. While outside directors cannot hire analysts, they can hire external auditors based on the level of analyst coverage. If high analyst coverage can reduce accounting misstatement or fraud to a certain extent, outside directors would have less pressure to hire industry specialist auditors since their firms do not need to rely heavily on auditor specialization in overseeing financial reporting quality. Thus, firms with high analyst coverage may have a lower demand for auditor specialization than firms with low analyst coverage.

Moreover, firms with high analyst coverage and thus low financial reporting fraud risks may be less willing to hire industry specialist auditors if specialist auditors charge audit fee premium. Craswell, Francis, and Taylor (1995) find that industry specialist auditors earn more premium than non-specialists in Australia. Casterella, Francis, Lewis, and Walker (2004) find that small size clients pay fee premium to U.S. specialist auditors. Francis, Reichelt, and Wang (2005) document that audit fee premium is paid to city-level industry specialist auditors in U.S. Overall, these studies suggest that auditing costs are probably higher when industry specialists are hired. Firms with low analyst coverage and thus low accounting information quality need to pay premium to specialist auditors in order to obtain higher quality audit. Firms followed by more analysts, however, may have less accounting misstatement or fraud, and thus outside

directors would have less pressure to rely on auditor specialization and pay premium to specialist auditors. Even if specialist auditors do not charge premium, as shown in some existing studies, firms that do not need to rely heavily on specialist auditors may have more choices in selecting their auditors, and thus may be less likely to hire a specialist auditor.

Based on the above discussion, we conjecture that outside directors of firms with high analyst coverage may demand lower auditor industry specialization than outside directors of firms with low analyst coverage, which means that the relationship between auditor industry specialization and board independence may be moderated by analyst coverage. Thus, we develop the hypothesis as follows:

H1: Auditor industry specialization is less positively associated with board independence for firms with high analyst coverage than for firms with low analyst coverage.

4. Research design

4.1. Data collection

We first collect the data on the board of directors from the RiskMetrics Directors database over the period 1996 to 2006.[1] Using these data, we compute board independence, board size, and directors' meeting attendance. Second, we collect the

[1] 1996 to 2006 is the whole data period of RiskMetrics Directors database when we initiated data collection.

data on individual analysts' earnings forecasts from the I/B/E/S detail file database. Following Yu (2008), analyst coverage is measured using individual analysts' forecasting activities for each firm. Third, we collect the data on CEO characteristics such as CEO ownership, CEO tenure, and CEO compensation from the Execucomp database. Fourth, we collect the data on financial statements and auditors from the Compustat database to compute auditor industry specialization and several control variables. Finally, we collect the data from the CRSP database to compute bid-ask spread and firm age. The above data sets are merged to yield a sample of 11,748 firm-year observations over the period 1996 to 2006. Table 1, Panel A presents the sample breakdown by year. Table 1, Panel B shows the most representative industries of the sample firms.[2]

Insert Table 1

4.2. Model

We test our hypothesis by estimating the following regression model:

$$\begin{aligned} AISPE = {} & \beta_0 + \beta_1 BDIND + \beta_2 ANCOV + \beta_3 BDIND*ANCOV + \beta_4 SIZE + \beta_5 DEBT \\ & + \beta_6 ROA + \beta_7 FINAC + \beta_8 SPREAD + \beta_9 AGE + \beta_{10} BDSIZE + \beta_{11} BMATN \\ & + \beta_{12} CEOOWN + \beta_{13} CEOTEN + \beta_{14} CEOCOM + Year\ dummies \\ & + Industry\ dummies + \varepsilon \end{aligned} \quad (1)$$

where

[2] We find similar results when we exclude financial and utilities firms from our sample.

AISPE = *auditor industry specialization*, measured as the ratio of the sum of the square root of the total assets of the clients of an auditor in a two-digit SIC industry to the total sum of the square root of the total assets of all clients of the auditor (Behn, Choi, and Kang, 2008),

BDIND = *board independence*, measured as the proportion of independent directors on the board,

ANCOV = *analyst coverage*, measured as the total number of analysts who issued forecasts of year *t*+1's earnings per share for a firm during year *t* (Yu, 2008),[3]

SIZE = *size*, measured as the natural logarithm of total assets,

DEBT = *debt ratio*, measured as long-term debt divided by total assets,

ROA = *return on assets*, measured as income before extraordinary items divided by total assets,

FINAC = *financing*, measured as the annual increase in long-term debt and common share capital divided by total assets,

SPREAD = *bid-ask spread*, measured as the yearly median of daily spread, i.e., the difference between ask and bid price divided by the mid-point,

AGE = *firm age*, measured as the number of years for which a firm has been included

[3] The results are not substantially changed when using the natural logarithm of analyst coverage in the regression.

in the CRSP database,

BDSIZE = *board size*, measured as the number of directors on the board,

BMATN = *board meeting attendance*, measured as the proportion of directors on the board who attended less than 75% of board meetings,

CEOOWN = *CEO ownership*, measured as the percentage of common shares owned by a CEO,

CEOTEN = *CEO tenure*, measured as the number of years for which an employee has been the company's CEO,

CEOCOM = *CEO compensation*, measured as the natural logarithm of a CEO's total compensation.

In equation (1), the coefficient on *BDIND*ANCOV* (i.e., β_3) is expected to be negative if *H1* is supported. We include *SIZE* and *DEBT* in the model because Francis, Maydew, and Sparks (1999) suggest that large firms and firms with low debt ratio may be more likely to hire high quality auditors. Johnson and Lys (1990) and Abbott and Parker (2000) indicate that return on assets may be positively associated with the engagement of high quality auditors because a more profitable client is more likely to pay the fee premium to such auditors. Thus, we add *ROA* in the model. *FINAC* is included in the model as DeFond (1992) and Johnson and Lys (1990) suggest that a firm's acquisition of new funds may be positively related to the use of a specialist auditor as the specialist can

provide high quality services which enhance the credibility of the firm's financial reporting at the time of debt or equity issuance. Titman and Trueman (1986) indicate that high risk firms are less likely to choose high quality auditors. Thus, we include *SPREAD* and *AGE* to capture firm-specific risk. *BDSIZE* and *BMATN* are included in the model because Beasley and Petroni (2001) suggest that high quality boards are more likely to hire specialist auditors. CEO characteristics such as CEO ownership, CEO tenure, and CEO compensation reflect CEO entrenchment and agency problems of a firm (Hermalin and Weisbach, 1998; Bathala and Rao, 1995; Fahlenbrach, 2003). On the one hand, high CEO entrenchment may reduce the effectiveness of outside directorship on the board. On the other hand, outside directors may be more willing to hire specialist auditors when the firm has more agency problems. Since these CEO characteristics may affect firms' auditor choice, we include *CEOOWN*, *CEOTEN*, and *CEOCOM* in the model. In addition, we include year dummies and industry dummies in the model to control for fixed year effect and fixed industry effect. Based on the above discussions, we expect that the coefficients on *SIZE*, *ROA*, *FINAC*, *AGE*, and *BDSIZE* are positive, and that the coefficients on *DEBT*, *SPREAD*, and *BMATN* are negative. We do not expect the sign of the coefficients on *CEOOWN*, *CEOTEN*, and *CEOCOM* because these CEO characteristics may either positively or negatively affect the demand for industry specialist auditors.[4]

[4] All continuous variables in equations (1) are winsorized at the level of 1% and 99%. We find

5. Empirical results

We report descriptive statistics in Table 2. We find that the mean of auditor industry specialization is 0.041, which is close to 0.042 reported in Behn et al. (2008). The median of auditor industry specialization is 0.031, which is close to 0.037 reported in Behn et al. (2008). The mean and median percentages of independent directors on the board are 65.8% and 66.7%, respectively. The mean and median of analyst coverage are 11.00 and 13.41, suggesting that on average, our sample firms are followed by approximate 11 to 13 analysts.

Insert Table 2

Table 3 provides the Pearson correlations among variables. The highest correlation coefficient is 0.59 for firm size and CEO compensation, subsequently followed by the correlation coefficient for firm size and board size (r = 0.57) and the correlation coefficient for firm size and analyst coverage (r = 0.55).[5] Thus, large firms have higher CEO compensation and larger boards of directors, and are followed by more analysts. We find that large firms and firms with high board independence are more likely to hire industry specialist auditors. The results on correlation coefficients also indicate that firms with high CEO compensation may be followed by more analysts, while firms with low stock liquidity may be followed by fewer analysts. Moreover, the

similar results on testing the hypothesis when these variables are not winsorized.

[5] Since the highest correlation coefficient is significantly lower than 0.80, multicollinearity is less likely to be a substantive issue.

results suggest that board independence may be higher for older firms, but lower for firms with high CEO tenure.[6]

Insert Table 3

As a comparison with prior studies (e.g., Abbott and Parker, 2000; Beasley and Petroni, 2001), we present the main effect of board independence on auditor industry specialization in columns 3 and 4 in Table 4. Similar to prior studies, we find that board independence is positively associated with auditor industry specialization (*t*-statistic = 1.50, *p*-value < 0.10), suggesting that outside directors may have a demand for auditor industry specialization. Columns 5 and 6 in Table 4 show the main results on testing the hypothesis. We find that the coefficient on the interaction of board independence and analyst coverage is negative and significant (*t*-statistic = -2.59, *p*-value < 0.01), consistent with *H1*. Thus, auditor industry specialization is less positively associated with board independence for firms with high analyst coverage than for firms with low analyst coverage. The results suggest that analyst coverage may moderate outside directors' willingness or desire to hire industry specialist auditors. In addition, we find that the coefficients on *SIZE*, *BDSIZE*, and *CEOTEN* are significantly positive, suggesting that large firms, firms with large boards, and firms with long CEO tenure may have a higher demand for auditor industry specialization. We also find a negative and significant

[6] The results based on the correlation analysis should be cautiously interpreted because the confounding effect of other factors is not controlled for.

coefficient on *DEBT*, *ROA*, *SPREAD*, *AGE*, and *CEOCOM*, which indicates that firms with high debt ratio, more profitable firms, firms with high stock liquidity, older firms, and firms with high CEO compensation may have a lower demand for auditor industry specialization.

Insert Table 4

In equation (1), β_1 captures the effect of board independence on auditor industry specialization when firms are not followed by any analysts. ($\beta_1 + \beta_3$ **ANCOV*) captures the effect of board independence on auditor industry specialization for a given value of *ANCOV*. Thus, - β_3 **ANCOV*/β_1 reflects the extent to which the effect of board independence on auditor industry specialization is moderated by analyst coverage. If *ANCOV* takes the value of 13.41 (i.e., the mean of analyst coverage), then - β_3 **ANCOV*/β_1 is 74% (i.e., - (-0.042*13.41)/0.763), which means that on average, analyst coverage reduces 74% of the effect of board independence on auditor industry specialization. Therefore, the moderating effect of analyst coverage on outside directors' demand for industry specialist auditors is also economically significant.

To test the robustness of our results, we conduct additional analyses as follows. First, we test the hypothesis by dividing the full sample into two subsamples: (1) high analyst coverage subsample, which consists of firm-year observations whose analyst coverage is greater than the median of analyst coverage for a given year, and (2) low

analyst coverage subsample, which consists of firm-year observations whose analyst coverage is not greater than the median of analyst coverage for a given year. We estimate the following regression for the high analyst coverage subsample and the low analyst coverage subsample separately:

$$AISPE = \beta_0 + \beta_1 BDIND + \beta_2 SIZE + \beta_3 DEBT + \beta_4 ROA + \beta_5 FINAC + \beta_6 SPREAD + \beta_7 AGE + \beta_8 BDSIZE + \beta_9 BMATN + \beta_{10} CEOOWN + \beta_{11} CEOTEN + \beta_{12} CEOCOM + Year\ dummies + Industry\ dummies + \varepsilon \quad (2)$$

Columns 3 and 4 in Table 5 report the results of the high analyst coverage subsample. The coefficient on board independence is positive but not significant. The results of the low analyst coverage subsample are reported in columns 5 and 6 in Table 5. We find that the coefficient on board independence is positive and significant (t-statistic = 1.93, p-value < 0.05). Combined together, the results suggest that outside directors from firms with low analyst coverage have higher demand for auditor industry specialization, consistent with *H1*.

Insert Table 5

Second, we run two-stage regressions to control for the possible endogenous relationships among three governance mechanisms including auditor industry specialization, board independence, and analyst coverage. Since auditor industry specialization affects financial reporting quality, which may influence board composition

and analyst following, board independence and analyst coverage are likely to be endogenous variables in equation (1). To address this concern, we estimate the first-stage models as follows:

$$ANCOV = \alpha_0 + \alpha_1 EXPANCOV + \alpha_2 SIZE + \alpha_3 DEBT + \alpha_4 ROA + \alpha_5 FINAC + \alpha_6 SPREAD + \alpha_7 AGE + \alpha_8 BDSIZE + \alpha_9 BDATN + \alpha_{10} CEOOWN + \alpha_{11} CEOTEN + \alpha_{12} CEOCOM + Year\ dummies + Industry\ dummies + \varepsilon \quad (3)$$

$$BDIND = \alpha_0 + \alpha_1 LAGBDIND + \alpha_2 SIZE + \alpha_3 DEBT + \alpha_4 ROA + \alpha_5 FINAC + \alpha_6 SPREAD + \alpha_7 AGE + \alpha_8 BDSIZE + \alpha_9 BDATN + \alpha_{10} CEOOWN + \alpha_{11} CEOTEN + \alpha_{12} CEOCOM + Year\ dummies + Industry\ dummies + \varepsilon \quad (4)$$

In equations (3) and (4), *EXPANCOV* and *LAGBDIND* are instrumental variables. Following Yu (2008), *EXPANCOV* is expected analyst coverage, computed as follows:

$$EXPANCOV = \sum_{j=1}^{n} EXPANCOV_j \quad (5)$$

where $EXPANCOV_j$ is measured as the number of analysts who followed the company from broker j in year 1995 multiplied by the ratio of the size of broker j in year t to the size of broker j in year 1995. We use the lagged value of board independence (i.e., *LAGBDIND)* as an instrumental variable of board independence (Fisher, 1965). We also include control variables in equations (3) and (4) as those firm characteristics may affect the demand for governance mechanisms including analyst coverage and board independence. The Hausman's specification test indicates that the instrumental

variables are appropriate. After estimating equations (3) and (4), we estimate equation (1) by replacing *ANCOV* and *BDIND* with the fitted values of these variables from equations (3) and (4). Table 6, Panel A reports the results of the first-stage regressions. Table 6, Panel B presents the results of the second-stage regression. Similarly, we find that auditor industry specialization is less positively related to board independence for firms with high analyst coverage than for firms with low analyst coverage (*t*-statistic = -3.14, *p*-value < 0.01). Thus, the results after allowing for endogeneity still support our hypothesis. However, we note that there is a high autocorrelation in board independence (r = 0.85), which indicates that lagged board independence may not be a good instrument. We recognize that these results are suggestive rather than conclusive.

Insert Table 6

Third, we examine whether our results are sensitive to using audit committee independence instead of board independence.[7] Table 7 presents the results when equation (1) is estimated using audit committee independence, i.e., *ACIND*.[8] We also document a negative and significant coefficient on the interaction term of *ACIND* and *ANCOV* (*t*-statistic = -3.39, *p*-value < 0.01), consistent with the notion that outside

[7] This study focuses on board independence rather than audit committee independence (the proportion of independent directors on audit committees) because all U.S. listed firms should have fully independent audit committees after the enactment of Sarbanes-Oxley Act. Therefore, audit committee independence has less variation compared to board independence.

[8] The number of observations is reduced to 10,116 because the RiskMetrics Directors database does not provide the data of audit committees for years 1996 and 1997.

directors are more willing to hire industry specialist auditors when firms are followed by fewer analysts. Thus, our results are robust to using audit committee independence as a measure of outside directorship.

Insert Table 7

Fourth, we examine whether the results still hold if we use the market share measure of auditor industry specialization. The continuous market share measure 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 (Dunn and Mayhew, 2004). Like Abbott and Parker (2000), we also use the categorical variable to measure auditor industry specialization. Neal and Riley (2004) suggest that the market share cut-off for specialization should be 1.20 divided by the number of big accounting firms. As the number of big auditors changed over our sample period 1996 to 2006 (i.e., Big 6 auditors (1996-1997), Big 5 auditors (1998-2001), and Big 4 auditors (2002-2006)), the cut-off is 20% for years 1996 to 1997, 24% for years 1998 to 2001, and 30% for years 2002 to 2006. The categorical market share measure is coded "1" if the continuous market share measure is greater than the cut-off and "0" otherwise.

Columns 3 and 4 in Table 8 provide the results of estimating equation (1) using the continuous market share measure. Likewise, we document a negative and significant coefficient for the interaction of board independence and analyst coverage

(*t*-statistic = -1.97, *p*-value < 0.05). Columns 5 and 6 in Table 8 report the results of running the logistic regression by replacing the continuous measure with the categorical measure in equation (1). We find that the coefficient on *BDIND*ANCOV* is negative and significant (Wald χ^2 =2.31, *p*-value < 0.10). Therefore, the results based on the continuous and the categorical market share measures of auditor industry specialization are all consistent with the hypothesis.

Insert Table 8

Fifth, we include inside blockholding and institutional shareholding in equation (1). We collect inside blockholding from the Blockholders database which provides the data for years 1996 to 2001. We also collect institutional shareholding from the RiskMetrics Directors database which provides the data on institutional shareholding for years 1999 to 2001. After these two data sets are merged with the original data sets, the sample is reduced to 1,841 observations for years 1999 to 2001. Using the reduced sample, we estimate equation (1) after controlling for inside blockholding and institutional shareholding. We still find a negative and significant coefficient for *BDIND*ANCOV* (non-tabulated *t*-statistic = -2.51, *p*-value < 0.01).

Sixth, we estimate equation (1) using standard errors clustered by both firm and year to control for the correlations across firms and years. The results show that auditor industry specialization is less positively associated with board independence when firms

have high analyst coverage (non-tabulated *t*-statistic = -1.77, *p*-value < 0.05).

Seventh, we examine whether the results are driven by the size effect since analyst coverage is highly correlated with firm size ($r = 0.55$). We split the full sample into two subsamples based on median size. We find a negative and significant coefficient on *BDIND*ANCOV* for both the small size and the large size subsamples (non-tabulated *t*-statistic = -1.74, *p*-value < 0.05; *t*-statistic = -3.25, *p*-value < 0.01, respectively). Alternatively, we estimate equation (1) by removing *ANCOV* and *BDIND*ANCOV* but adding *BDIND*SIZE*. We find that the coefficient on *BDIND*SIZE* is significantly positive (non-tabulated *t*-statistic = 1.88, *p*-value < 0.05). Thus, although analyst coverage is highly correlated with firm size, the two variables affect outside directors' demand for specialist auditors in different directions. In other words, it is unlikely that our results are driven by the size effect.

Eighth, we test the hypothesis by developing an alternative proxy for analyst coverage. We employ the ratio of the number of firms in an industry followed by an analyst in a year to the total number of firms followed by that analyst in the same year to measure the analyst's industry expertise. Analyst coverage is computed as the sum of the ratio of all analysts who follow a firm. This measure incorporates analysts' variations in industry expertise. We still find that the coefficient on the interaction of board independence and analyst coverage is negative and significant (non-tabulated

t-statistic = -1.42, *p*-value < 0.10).

Finally, we examine whether the introduction of the Sarbanes-Oxley Act or the Regulation Fair Disclosure affects the moderating effect of analyst coverage on the relationship between auditor industry specialization and board independence. The dummy variable for the Sarbanes-Oxley Act is coded "1" in years 1996 to 2001 and "0" otherwise, while the dummy variable for the Regulation Fair Disclosure is coded "1" in years1996 to 1999 and "0" otherwise. We estimate equation (1) by including the two dummy variables and their interactions with *BDIND*, *ANCOV*, and *BDIND*ANCOV*. We find that no coefficients on these interactions are significant. Thus, the introduction of the Sarbanes-Oxley Act or the Regulation Fair Disclosure has no impact on the relationships among board independence, analyst coverage, and auditor industry specialization.

6. Conclusion

This study investigates the relationships among three corporate governance mechanisms: industry specialist auditors, outside directors, and financial analysts. Specifically, we examine whether the relationship between auditor industry specialization and board independence is moderated by analyst coverage. We find that outside directors of firms with high analyst coverage are less willing to hire industry specialist auditors than outside directors of firms with low analyst coverage. Our findings suggest

that analysts may somewhat compete with specialist auditors in monitoring financial reporting process.

This study also has limitations as follows. First, our results are limited to large firms because companies covered by the RiskMetrics Directors database are primarily drawn from S&P 500 and other large corporations. Since large companies are more salient in the capital market and are followed by more analysts than small companies, analysts may play a more important monitoring role for large firms than for small firms. Thus, it is unclear whether the moderating effect of analyst coverage can be generalized to small firms. Future research may use a sample of small firms to test our hypothesis. Second, it is still unclear which way is the best to deal with the endogeneity issue, especially for board governance. Like other corporate governance studies, this study faces the difficulty of choosing instruments. Future research may expend more effort on identifying the most appropriate instruments of endogenous governance mechanisms.

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Appendix
Variable definition

Variables	Definition
AISPE	= *auditor industry specialization*, measured as 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),
BDIND	= *board independence*, measured as the proportion of independent directors on the board,
ANCOV	= *analyst coverage*, measured as the total number of analysts who issued forecasts of year *t*+1's earnings per share for a firm during year *t* (Yu, 2008),
SIZE	= *size*, measured as the natural logarithm of total assets,
DEBT	= *debt ratio*, measured as long-term debt divided by total assets,
ROA	= *return on assets*, measured as income before extraordinary items divided by total assets,
FINAC	= *financing*, measured as the annual increase in long-term debt and common share capital divided by total assets,
SPREAD	= *bid-ask spread*, measured as the yearly median of daily spread, i.e., the difference between ask and bid price divided by the mid-point,
AGE	= *firm age*, measured as the number of years for which a firm has been included in the CRSP database,
BDSIZE	= *board size*, measured as the number of directors on the board,
BMATN	= *board meeting attendance*, measured as the proportion of directors on the board who attended less than 75% of board meetings,
CEOOWN	= *CEO ownership*, measured as the percentage of common shares owned by a CEO,
CEOTEN	= *CEO tenure*, measured as the number of years for which an employee has been the company's CEO,
CEOCOM	= *CEO compensation*, measured as the natural logarithm of a CEO's total compensation.

Table 1
Sample breakdown

Panel A. By year

Year	Frequency	Percent (%)
1996	698	5.94
1997	924	7.87
1998	1,001	8.52
1999	1,028	8.75
2000	1,092	9.3
2001	1,131	9.63
2002	1,118	9.52
2003	1,156	9.84
2004	1,185	10.09
2005	1,242	10.57
2006	1,173	9.98
Total	11,748	100.00

Panel B. By industry

Two-digit SIC code	Industry description	Frequency	Percent (%)
13	Oil and gas extraction	361	3.07
20	Food products	349	2.97
27	Printing, publishing, and allied products	246	2.09
28	Chemicals and allied products	901	7.67
33	Primary metal industries	261	2.22
35	Industrial machinery and equipment	762	6.49
36	Electrical and electronic equipment	995	8.47
37	Transportation equipment	403	3.43
38	Instruments and related products	624	5.31
49	Electric, gas, and sanitary services	791	6.73
50	Wholesale trade – durable goods	240	2.04
63	Insurance carriers	480	4.09
73	Business services	1,008	8.58
Others		4,327	36.81
Total		11,748	100.00

Table 2
Descriptive statistics

Variable	N	Mean	Median	Std	Q1	Q3
AISPE	11,748	0.04	0.03	0.04	0.01	0.05
BDIND	11,748	0.66	0.67	0.17	0.56	0.80
ANCOV	11,748	13.41	11.00	9.14	6.00	19.00
SIZE	11,748	7.60	7.42	1.58	6.45	8.58
DEBT	11,748	0.19	0.18	0.16	0.05	0.30
ROA	11,748	0.04	0.05	0.09	0.02	0.08
FINAC	11,748	0.03	0.00	0.06	0.00	0.04
SPREAD	11,748	0.01	0.00	0.01	0.00	0.01
AGE	11,748	25.45	20.00	19.40	11.00	34.00
BDSIZE	11,748	9.36	9.00	2.62	7.00	11.00
BMATN	11,748	0.02	0.00	0.05	0.00	0.00
CEOOWN	11,748	0.00	0.00	0.01	0.00	0.00
CEOTEN	11,748	7.95	6.00	7.16	3.00	11.00
CEOCOM	11,748	7.94	7.91	1.07	7.19	8.65

Table 3
Pearson correlations

Variable	*BDIND*	*ANCOV*	*SIZE*	*DEBT*	*ROA*	*FINAC*	*SPREAD*	*AGE*	*BDSIZE*	*BMATN*	*CEOOWN*	*CEOTEN*	*CEOCOM*
AISPE	0.13***	0.07***	0.27***	0.03***	-0.10***	-0.02**	-0.08***	0.12***	0.14***	-0.00	-0.01	-0.06***	0.04***
BDIND		0.07***	0.17***	0.03***	-0.01	-0.05***	-0.16***	0.25***	0.07***	-0.06***	0.02*	-0.17***	0.17***
ANCOV			0.55***	-0.09***	0.09***	-0.01	-0.23***	0.09***	0.14***	-0.00	-0.04***	-0.01	0.49***
SIZE				0.17***	0.05***	0.01	-0.23***	0.40***	0.57***	0.00	-0.03***	-0.09***	0.59***
DEBT					-0.20***	0.39***	0.17***	0.11***	0.15***	0.02***	-0.01	-0.07***	0.00
ROA						-0.06***	-0.16***	0.08***	0.05***	-0.02**	0.03***	0.06***	0.12***
FINAC							0.04***	-0.05***	-0.00	0.02**	0.01	-0.01	0.00
SPREAD								-0.04***	-0.01	0.08***	-0.09***	-0.02*	-0.27***
AGE									0.39***	-0.04***	-0.05***	-0.10***	0.20***
BDSIZE										0.08***	-0.05***	-0.09***	0.29***
BMATN											-0.02**	0.01	-0.01
CEOOWN												0.10***	-0.02**
CEOTEN													-0.07***

***, **, and * denote a significance at the level of 1%, 5%, and 10%, respectively (two-tailed tests).

Table 4

The effect of analyst coverage on the association between auditor industry specialization and board independence

Variable	Predicted sign	Coefficient	*t*-statistic	Coefficient	*t*-statistic
Intercept	?	-0.636	-2.47***	-0.996	-3.40***
BDIND	+	0.229	1.50*	0.763	2.97***
ANCOV	?	-0.024	-6.64***	0.003	0.28
*BDIND*ANCOV*	-			-0.042	-2.59***
SIZE	+	0.617	22.18***	0.622	22.30***
DEBT	-	-1.209	-6.41***	-1.234	-6.54***
ROA	+	-2.301	-8.21***	-2.299	-8.20***
FINAC	+	0.256	0.61	0.262	0.63
SPREAD	-	-12.833	-3.72***	-12.127	-3.50***
AGE	+	-0.013	-8.92***	-0.013	-8.83***
BDSIZE	+	0.047	3.94***	0.046	3.87***
BMATN	-	0.056	0.11	0.057	0.12
CEOOWN	?	9.578	2.27**	9.587	2.27**
CEOTEN	?	0.004	1.26	0.005	1.36*
CEOCOM	?	-0.208	-6.85***	-0.211	-6.94***
Year dummies			Yes		Yes
Industry dummies			Yes		Yes
N			11,748		11,748
F-statistic			484.60***		471.91***
Adj. R^2			59.71%		59.73%

The dependent variable is *AISPE* rescaled by 100 to simplify the display.

***, **, and * denote a significance at the level of 1%, 5%, and 10%, respectively (one-tailed tests).

Table 5
Results on split subsamples

		High analyst coverage		Low analyst coverage	
Variable	Predicted sign	Coefficient	*t*-statistic	Coefficient	*t*-statistic
Intercept	?	-1.757	-4.56***	0.805	2.16**
BDIND	+	0.033	0.15	0.394	1.93**
SIZE	+	0.565	15.79***	0.574	14.15***
DEBT	-	-0.797	-2.68***	-1.038	-4.25***
ROA	+	-2.843	-6.47***	-1.720	-4.71***
FINAC	+	0.528	0.82	-0.247	-0.45
SPREAD	-	-24.937	-3.58***	-9.089	-2.21**
AGE	+	-0.013	-6.39***	-0.011	-5.21***
BDSIZE	+	0.073	4.37***	0.010	0.57
BMATN	-	-0.308	-0.42	0.365	0.56
CEOOWN	?	13.495	1.88**	7.558	1.45*
CEOTEN	?	0.010	1.88**	-0.001	-0.23
CEOCOM	?	-0.096	-2.34***	-0.365	-8.08***
Year dummies			Yes		Yes
Industry dummies			Yes		Yes
N			5,649		6,099
F-statistic			223.19***		277.48***
Adj. R^2			57.93%		61.34%

The dependent variable is *AISPE* rescaled by 100 to simplify the display.
***, **, and * denote a significance at the level of 1%, 5%, and 10%, respectively (one-tailed tests).

Table 6

Two-stage regression

Panel A. First-stage regression

		Analyst coverage		Board independence	
Variable	Predicted sign	Coefficient	*t*-statistic	Coefficient	*t*-statistic
Intercept	?	-9.310	-19.51***	0.127	13.97***
EXPANCOV	+	0.676	95.58***		
LAGBDIND	+			0.787	139.26***
SIZE	+	1.345	24.50***	0.000	0.19
DEBT	-	-4.465	-11.85***	0.011	1.54*
ROA	+	2.358	4.15***	0.002	0.21
FINAC	+	4.088	4.79***	-0.021	-1.32*
SPREAD	-	-65.122	-9.22***	0.006	0.04
AGE	+	-0.037	-12.69***	0.000	4.58***
BDSIZE	+	-0.038	-1.56*	-0.001	-2.27**
BMATN	-	-2.162	-2.18**	-0.026	-1.39*
CEOOWN	?	-14.481	-1.72**	0.094	0.60
CEOTEN	?	0.046	6.70***	-0.001	-6.55***
CEOCOM	?	0.789	12.98***	0.004	3.60***
Year dummies			Yes		Yes
Industry dummies			Yes		Yes
N			9,680		9,680
F-statistic			838.43***		758.65***
Adj. R^2			74.63%		72.69%

Table 6 (continued)

Panel B. Second-stage regression

Variable	Predicted sign	Coefficient	*t*-statistic
Intercept	?	-1.737	-5.06***
BDIND_F	+	1.078	3.05***
ANCOV_F	?	0.024	1.50*
*BDIND_F*ANCOV_F*	-	-0.070	-3.14***
SIZE	+	0.513	16.35***
DEBT	-	-0.799	-4.11***
ROA	+	-1.781	-6.22***
FINAC	+	0.267	0.62
SPREAD	-	-10.446	-2.89***
AGE	+	-0.009	-5.64***
BDSIZE	+	0.017	1.41*
BMATN	-	0.296	0.59
CEOOWN	?	8.916	2.11**
CEOTEN	?	0.007	2.03**
CEOCOM	?	-0.074	-2.35***
Year dummies			Yes
Industry dummies			Yes
N			9,680
F-statistic			510.68***
Adj. R^2			65.47%

The dependent variables in the first-stage regression are *ANCOV* and *BDIND*. The dependent variable in the second-stage regression is *AISPE* rescaled by 100 to simplify the display. *EXPANCOV* is expected analyst coverage, computed as follows:

$$EXPANCOV = \sum_{j=1}^{n} EXPANCOV_j$$

where $EXPANCOV_j$ is measured as the number of analysts who followed the company from broker j in year 1995 multiplied by the ratio of the size of broker j in year t to the size of broker j in year 1995.
LAGBDIND is the lagged value of *BDIND*. *BDIND_F* and *ANCOV_F* are the fitted value of *BDIND* and *ANCOV* from the first stage regression, respectively.
***, **, and * denote a significance at the level of 1%, 5%, and 10%, respectively (one-tailed tests).

Table 7
Results on audit committee independence

Variable	Predicted sign	Coefficient	*t*-statistic
Intercept	?	-1.196	-3.36***
ACIND	+	0.686	2.65***
ANCOV	?	0.022	1.44*
*ACIND*ANCOV*	-	-0.055	-3.39***
SIZE	+	0.641	21.01***
DEBT	-	-1.414	-6.83***
ROA	?	-2.493	-8.16***
FINAC	+	0.316	0.68
SPREAD	-	-14.597	-3.73***
AGE	+	-0.013	-8.05***
BDSIZE	+	0.059	4.36***
BMATN	-	0.350	0.63
CEOOWN	?	10.945	2.43***
CEOTEN	?	0.003	0.83
CEOCOM	?	-0.219	-6.56***
Year dummies			Yes
Industry dummies			Yes
N			10,116
F-statistic			410.71***
Adj. R^2			58.64%

The dependent variable is *AISPE* rescaled by 100 to simplify the display. *ACIND* is audit committee independence, measured as the proportion of independent directors on audit committees.
*** and * denote a significance at the level of 1% and 10%, respectively (one-tailed tests).

Table 8
Results on market share measure of auditor industry specialization

		Continuous measure		Categorical measure	
Variable	Predicted sign	Coefficient	*t*-statistic	Coefficient	Wald χ^2
Intercept	?	12.889	8.84***	-2.242	83.82***
BDIND	+	3.320	2.60***	0.517	5.69***
ANCOV	?	0.145	2.59***	0.020	4.68**
*BDIND*ANCOV*	-	-0.158	-1.97**	-0.020	2.31*
SIZE	+	0.894	6.43***	0.063	7.53***
DEBT	-	-0.552	-0.59	0.013	0.01
ROA	?	-0.726	-0.52	-0.010	0.00
FINAC	+	-1.624	-0.78	-0.418	1.44
SPREAD	-	-17.615	-1.02	-6.603	5.11**
AGE	+	0.012	1.58*	0.001	0.79
BDSIZE	+	0.217	3.68***	0.024	6.09***
BMATN	-	-1.538	-0.63	-0.009	0.00
CEOOWN	?	-2.743	-0.13	5.320	2.32*
CEOTEN	?	-0.022	-1.30*	-0.009	10.15***
CEOCOM	?	0.408	2.69***	0.074	8.53***
Year dummies			Yes		Yes
Industry dummies			Yes		Yes
N			11,748		11,748
F-statistic			40.70***		
Adj. R^2			11.11%		
LR statistic					916.35***
-2 Log L					14,702.81

The continuous dependent variable is measured 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 (Dunn and Mayhew, 2004), rescaled by 100 to simplify the display. The categorical dependent variable is coded "1" if the continuous market share measure is greater than the cut-off and "0" otherwise, where the cut-off is 20% for years 1996 to 1997, 24% for years 1998 to 2001, and 30% for years 2002 to 2006.
***, **, and * denote a significance at the level of 1%, 5%, and 10%, respectively (one-tailed tests).