Auditor Industry Specialization and Audit Quality

The longitudinal effect of auditor industry specialization on audit quality

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Preface

To complete the master in Accounting, which I followed at Tilburg University, I wrote my master thesis on the longitudinal relation between auditor industry specialization and audit quality. I have studied at Tilburg University for four years, including three years for the bachelor Business Studies.

I especially would like to thank my supervisor, Sofie Vandenbogaerde, for her feedback and suggestions to improve my master thesis. Besides that, I also want to thank my family, Patrick, and friends for their support and interest during the master. With their encouragement I successfully completed my master thesis.

Daphne van Bergen

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Abstract

The current study investigates the association between auditor industry specialization and audit quality. Prior studies find a positive effect between those two items in the same year, but the limitation of those studies is that the effects of industry specialization require time to develop. Therefore, it might be that they will have a longitudinal effect. Extending the literature, this study focuses on the longitudinal effect of auditor industry specialization on the audit quality in the period 2004-2007. Industry specialization is measured using the market share approach with total assets as the base. For determining the audit quality, abnormal accruals are used based on the abnormal working capital accruals model of DeFond and Park (2001). The absolute level of abnormal working capital accruals of clients of industry specialist audit firms are compared with those of non-specialist audit firms. After controlling for variables related to abnormal accruals, regression results show that there is no significant longitudinal effect of auditor industry specialization on audit quality. The hypothesis is rejected, and the conclusion can be made that audit quality of clients of industry specialist audit firms is not significantly different in the upcoming year than those of non-specialist audit firms.

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1 Introduction

Audit firm industry specialization is becoming more important in the literature (Cahan et al. 2011). Willenborg (2002) indicates that audit firms benefit from specialization in 2 ways. First, benefits results due to enhanced audit effectiveness. Second, enhanced audit efficiency lead to benefits.

Prior studies investigate the link between industry specialization and audit quality, and find a positive relationship (e.g., Balsam et al. 2003, Reichelt and Wang 2010, Lowensohn et al. 2007). A reason for this positive relationship is the existence of industry expertise for industry specialist audit firms. To improve the evidence of the effect of experience of audit firms on performance, Moroney and Carey (2011) investigate the relative influence of industry- and task-based experience on auditor performance. They find that non-specialist auditors benefit from industry-based experience. As they use only mid-tier firms, their results are not generalizable to Big 4 firms, but it does seem that Big 4 firms have advantages from their industry experience and, on top of that also benefits from specialization. Moroney and Carey (2011) state that, measures for industry-based experience have to be more defined in future research to get more powerful results.

The current study extends the literature by investigating the longitudinal effect of industry specialization on audit quality. When the audit quality not only increases in the same year, but also in the upcoming year, knowledge about their clients increases, and therefore auditors can provide better audit quality. In the long run, due to increased knowledge about the industry, errors in the audit will be eliminated, resulting in an increased audit quality.

In this study industry specialization is determined based on the market share approach. Through the relative market share of a firm, with total assets as the base, a firm can be identified as an industry specialist. The sample used in this study is divided into 63 industries, where in each industry the audit firm with the largest market share is the industry specialist.

For measuring the audit quality of a firm, the abnormal working capital accruals model of DeFond and Park (2001) is used. This model measures the difference between reported working capital and the market's expectations of the normal working capital required to support current sales levels. The expectation is that this difference is the part of working capital accruals that is used to influence future earnings.

To test the hypothesis, a regression analysis is conducted with the absolute value of abnormal working capital accruals as the dependent variable, a dummy variable for industry specialization in year t-1 as the variable of interest, a dummy variable for industry specialization in year t, and several control variables. After controlling for variables related to abnormal accruals, regression results show that there is no significant longitudinal effect of

auditor industry specialization on audit quality. The hypothesis is rejected, and the conclusion can be made that audit quality of clients of industry specialist audit firms is not significantly different in the upcoming year than those of non-specialist audit firms.

The remainder of this paper is structured as follows: section 2 discusses the prior literature on auditor industry specialization and the relation with audit quality and prepares the hypothesis. In section 3, the method and data used in this research is outlined. The analyses of the data and the hypothesis are presented in section 4. Finally, section 5 contains the conclusion.

2 Literature

Dyer (1996) indicates that to develop a competitive advantage, a firm must differentiate themselves to be unique or specialized in something. Firms that are characterised by a high degree of inter-firm specialization are able to attain a competitive advantage. Physical and human asset-specific investments instead of general asset investments contribute to reach this competitive advantage and may also increase the firm's performance.
Another way to be unique is by making use of segment differentiation. The purpose of segment differentiation is to tailor products and services to better fit the needs of different groups of customers (Abell 1980). Customers are heterogeneous, so they need different products. Firms that make use of segment differentiation respond to the diversity of customer needs and this may result in a competitive advantage (Carpano et al. 1994).
As in all industries, the competition between auditors is very strong, so they need to differentiate themselves from competitors by using different strategies, and in this way also try to meet client needs. Audit firms need to find a way which leads to a better differentiation strategy because only differentiating in prices is not enough.

The market for audit services experiences an increase in industry-specialist audit firms. This may result in a trend toward specialization as an effort at product differentiation (Hogan and Jeter 1999). The importance that people place on industry specialization is increased during the years, e.g. 80 percent of companies viewed industry expertise or specialization as being an important factor in choosing an auditor (GAO 2003, 2008). To focus on firms in the same industry, audit firms align themselves with specific client characteristics. In that way, their industry-specialization becomes higher and therefore also their expertise, because industry-specialization is a component of audit expertise. Hogan and Jeter (1999) examine trends in industry specialization from 1976 to 1993. They give an example of Peat Marwick that only hiring industry-specialized professionals and focusing on the same industry results in serving clients optimally. Industry specialization of the audit firm is an useful way to differentiate because it will create opportunities to service a relatively large group of clients with similar needs (Dunn and Mayhew 2004).
Industry specialization may be measured as market share. Market leaders continued to increase their market share, so this suggests that investing in specialization results in returns to the audit firm. This can be seen as receiving higher fees, but also as other benefits from the increase in clients like more economies of scale and therefore lower costs. In the period investigated by Hoger and Jeter (1999), they find an increase in auditor concentration, as measured for specialization. This finding is also consistent with the hypothesis that the

increase in industry specialization results in benefits due to industry-specialists. An alternative interpretation of the increase in market share of audit firms in certain industries is that those specialist audit firms provide higher quality services, and therefore clients prefer to employ those specialists instead of non-specialists (Hogan and Jeter 1999).

The importance of industry-specialist audit firms increases because it results in several benefits, not only for the audit firm but also for their clients. Danos and Eichenseher (1982) suggest that an increase in the level of specialization of an audit firm, measured by market share, results in greater economies of scale for the audit firm. Specialization is also associated with audit fees. People mostly perceive that industry-specialist audit firms provide better quality services, and therefore have higher audit fees. Palmrose (1986) uses industry specialization as a control variable in examining determinants of audit fees. She finds that audit fees of industry-specialist audit firms are higher if they provide better quality services, but no direct association is found between audit fees and specialization. The study of Lowensohn et al. (2007) shows that the quality advantage, offered by auditor industry-specialists, does not result in higher costs to the client because of the result of economies of scale due to specialization (Neal and Riley 2004; Chan 1999). Mayhew and Wilkins (2003) show that the strong competition in the audit market leads to the sharing of the cost advantage, due to economies of scale, for audit firms with their clients, therefore lower audit fees than expected arise.

Another benefit of industry specialization is the increase in disclosure quality the audit firms provide (Dunn and Mayhew 2004). Furthermore, a benefit is that industry-specialist audit firms gain more industry-specific knowledge than non-specialist audit firms. Prior research shows that industry-specialists are able to use this knowledge to provide more effective audits as evidenced by higher earnings quality, which is a proxy of audit quality (Balsam et al., 2003; Gramling et al., 2000). Industry-specialists have more industry expertise creating by sharing best practices and learning from serving the same industry clients. Therefore, this enables them to identify misstatements more effectively.

Prior studies show a positive relationship between auditor industry specialization and audit quality in the same year (e.g., Balsam et al. 2003, Reichelt and Wang 2010, Lowensohn et al. 2007). Reichelt and Wang (2010) show a sample with national and city specialists and non-specialists. They determine the relation between specialization and audit quality through the magnitude of abnormal accruals using the Jones (1991) abnormal accruals model, and through tolerance of aggressive earnings management by measuring the propensity for meeting or beating analysts' earnings forecasts by one penny per share. Lower abnormal accruals indicate that earnings quality is higher, which is a proxy of audit quality. Industry

specialists are less likely to meet or beat analysts' earnings forecasts by one cent per share, what indicates that industry specialization is important for auditors to provide higher audit quality by constraining earnings management. The overall results suggest that the existence of industry expertise is associated with higher audit quality. The relation between industry specialization and audit quality is also tested in the study of Krishnan (2003), where two measures for measuring industry specialization are used, portfolio share and industry market share. The method used in this study to determine audit quality is a cross-sectional variation of the Jones (1991) accruals estimation model. As above, in the study of Reichelt and Wang (2010) and in DeFond and Jiambalvo (1994) this variation of the Jones (1991) model is frequently used, because prior research shows that this is the best measure of the discretionary portion of total accruals (Bartov et al. 2000).

A proxy for specialization is auditor expertise, and is based on training and practical experience gained from auditing in a particular industry (Gramling and Stone, 2001).

Balsam et al. (2003); Reichelt and Wang (2010), and Lowensohn et al. (2007) find that when auditors have a large group of clients in the same industry, their expertise increases, and this leads to better audit quality for the client in the same year. DeAngelo (1981) defines audit quality as the probability that an auditor will both discover and report an error in a client's accounting system. In the public sector, GAO (1986) defines audit quality as compliance with professional standards and contractual terms for the audit under consideration. Audit firms with industry expertise in the client's business are more likely to detect irregularities and misrepresentations, and therefore provide a higher audit quality (Gul et al. 2009). In this way audit firms meet their client needs, because clients always want the best quality for their firm.

Most studies focus on the relation between specialization and audit quality in the same year (Reichelt and Wang 2010; Krishnan 2003). As mentioned in Krishnan (2003), only focusing on annual data can lead to an upward bias in t-statistics due to cross-sectional correlation in regression residuals (Bernard 1987).

As already mentioned, prior studies mostly use cross-sectional measures to determine the relation between industry-specialist audit firms and the audit quality. Interesting to investigate is whether the experience an auditor gained in year t-1 will affect the audit quality in that industry even stronger in year t. When the audit quality not only increases in the same year, but also in the upcoming year, the benefits for clients will increase. Therefore, it is probable that clients want to invest more in industry-specialist audit firms. Bonner and Lewis (1990) show that more experienced auditors, on average, have more knowledge and ability. Auditors obtain client-specific knowledge by providing audits (Beck and Wu 2006). Each period, their beliefs about clients' characteristics are updated and become more precise over

time. Because of the increased knowledge about their clients, auditors can provide better audit quality. In this study, they observe this learning effect by using the Bayesian method. The learning effect has a positive relation with audit quality (Simunic 1984; Morgan and Stocken 1998; King and Schwartz 1999; Solomon et al. 1999; Low 2004). Auditors learn how their clients work, for example how clients distribute their earnings. In the long run, due to increased knowledge about the client, errors in the audit will be eliminated, resulting in an increased audit quality.

On the other hand, the incremental learning effect reduces over time (Beck and Wu, 2006).
Furthermore, Lim and Tan (2010) investigate the association between auditor tenure, auditor specialization and fee dependence. They show that auditor tenure is positively associated with auditor specialization. A longer tenure results in increased expertise, because the auditor can gain a better understanding of the client's characteristics.
The longitudinal effect of auditor industry specialization on the audit quality can be measured by using a longitudinal research approach. This kind of research has several benefits in comparison with a cross-sectional research. It may help to establish causality, can help minimize the problems encountered when process is inferred from cross-sectional data in other kinds of organizational studies as well, or at least may make it more difficult to make incorrect inferences (Kimberly, 1976).
Neal and Riley (2004) suggest that industry-specific knowledge and audit technologies require time to develop and, once obtained, are likely to persist for at least some period into the future. To capture the temporal quality of specialized knowledge, the study of Lowensohn et al. (2007) uses a longitudinal variable. Using this knowledge, the impact of industry-specialist audit firms on audit quality may have a longitudinal effect.

In summary, the discussion above proves that industry-specialist audit firms provide better audit quality in the same year related to non-specialist audit firms, and it suggests that the audit quality will be better in the upcoming year. The following hypothesis will be tested:

H1 *Audit quality in year (t) is higher for clients employing industry-specialist audit firms in year (t-1) than for clients of non-specialist audit firms in year (t-1).*

3 Research design

3.1 Industry specialist audit firm definition

As industry specialization is not directly observable, prior studies use several proxies (e.g. market share and portfolio share) to measure it. Most measures are based on the market share of a firm, because industry expertise is obtained by repetition of the audit task in similar settings and therefore people perceive that auditing a large share of a certain industry indicates expertise (Balsam et al. 2003). Palmrose (1986) identifies industry specialists as "the largest supplier in each industry, as well as the second- and third-largest suppliers in industries in which readily observable differences existed between the second and the third or between the third and the remaining suppliers." In this study, industry specialization (IS) is measured by the market share approach using total assets as the base. This approach assumes that by comparing the relative market shares of the accounting firms in an industry, industry specific knowledge can be gathered. The firm with the largest market share has most knowledge about that particular industry, so in this study the audit firm with the largest market share is indicated as the industry specialist. Firms are grouped into industries based on their two-digit SIC code.

3.2 Abnormal accruals model

Similar to industry specialization, also audit quality is not directly observable. Therefore, audit quality is estimated based on financial statement quality. Financial statement quality can be proxied by abnormal accruals (Becker et al 1998; Jones 1991; DeFond et al. 1998). The Jones models, which are based on the accounting information of all firms in a certain two-digit SIC code, are widely used in prior literature to estimate abnormal accruals. However, another method to estimate abnormal accruals is developed by DeFond and Park (2001). The DeFond and Park (2001) model uses abnormal working capital accruals estimated by firm-specific accounting information only. The advantage of the DeFond and Park (2001) model is that they use firm-specific information instead of average information per industry. Therefore, the abnormal working capital accruals model of DeFond and Park (2001) is the base for determining the audit quality in this study. This model measures the difference between reported working capital and the market's expectations of the normal working capital required to support current sales levels. The expectation is that this difference is the part of working capital accruals that is used to influence future earnings.

The following model is used to estimate the abnormal working capital accruals:

$$AWCA_{it} = WC_{it} - \left(\frac{WC_{it-1}}{S_{it-1}}\right) * S_{it}$$

Where for sample firm i at year t:

$AWCA_{it}$ = abnormal working capital accruals in the current year;

WC_{it} = working capital in the current year, measured as (Current Assets – Cash and Short-term investments) – (Current liabilities – Short-term debt);

WC_{it-1} = working capital in the previous year;

S_{it-1} = sales turnover in the previous year;

S_{it} = sales turnover in the current year.

3.3 Regression model

To determine the relationship between audit quality and industry specialization, the absolute amount of abnormal working capital accruals scaled by total assets is used for representing the managerial discretion. The model for testing this relationship comprising a variable for earnings management, |AWCA|, the industry specialist variables, IS_{it-1} and IS_{it}, and a set of control variables based on prior studies (Reichelt and Wang 2010; Cahan et al. 2011). In the model also industry dummies are included, but are not shown here to keep it comprehensible.

The following model is estimated to test the hypothesis:

$$|AWCA|_{it} = \beta_0 + \beta_1 IS_{it-1} + \beta_2 IS_{it} + \beta_3 SIZE_{it} + \beta_4 CFO_{it} + \beta_5 LEV_{it} + \beta_6 LOSS_{it} + \beta_7 MB_{it} + \beta_8 LIT_{it} + \beta_9 ALTMAN_{it} + \beta_{10} B4_{it}$$

|AWCA| is the dependent variable and is measured using the abnormal working capital accruals model of DeFond and Park (2001) as mentioned earlier. For using this variable in the regression model, the absolute value is taken and it is scaled by total assets. The test variable is industry specialization, IS_{it-1}, which is 1 as the firm is audited in the previous year by an industry specialist firm, and is 0 otherwise. When a firm is audited by an industry specialist in the previous year, it is expected that the abnormal working capital accruals are lower, because then accruals-based earnings management is constrained. Earnings management is a proxy of audit quality, and when earnings management is lower, audit

quality will increase. In that way the expected correlation between the industry specialist variable (t-1) and abnormal working capital accruals is negative. The other industry specialist variable IS_{it} is 1 as the firm is audited in the current year by an industry specialist firm, and is 0 otherwise. As already mentioned in the literature, the expected relation between industry specialization and audit quality in the same year is positive, so lower abnormal working capital accruals are expected. The sign of the variable IS_{it} is expected to be negative.

Several control variables are included in the regression model. The control variable SIZE is added in the regression model to control for the effect that larger firms prefer income-decreasing accounting choices (Vander Bauwhede et al. 2003). Prior literature suggests that SIZE will be negatively correlated with |AWCA| (Watts and Zimmerman 1986). Therefore, the expected sign of SIZE is negative. The next control variable is operating cash flows (CFO). This variable controls for the misspecification in the tests of earnings management for firms with extreme financial performance. Based on Dechow et al. (1995) and Young (1999), it is expected that the control variable CFO will be negatively associated with abnormal accruals. To control for earnings management through abnormal accruals in highly levered firms, the control variable LEV is introduced. High leverage is related to debt covenants, and violation of debt covenants is related to abnormal accruals management. Therefore, high leverage can be an incentive for income-increasing accruals management (Becker et al. 1998, Watts and Zimmerman, 1986). Beneish and Press (1995) associate high leverage with financial distress. DeAngelo et al. (1994) suggest that firms facing financial distress have more negative accruals related to contractual renegotiations that lead to incentives to reduce their earnings. Therefore, the control variable LEV is expected to be positive. Firms that face a loss are expected to have lower abnormal accruals (Cahan et al. 2011). The expected sign of the control variable LOSS is negative, because it is not possible anymore to avoid the recognition of a loss by managing earnings. According to Matsumoto (2002) firms with higher growth opportunities and higher litigation risk have more earnings management because they have greater incentives to precisely meet expectations. The control variables for litigation risk (LIT) and growth opportunities (MB) are expected to be positively associated with abnormal accruals. The Altman score measures the level of bankruptcy risk, the lower the score, the greater the bankruptcy risk. Reichelt and Wang (2010) expect a negative association between abnormal accruals and the control variable ALTMAN. In prior studies of Becker et al. (1998) and Francis et al. (1999) Big Six auditors (now considered as BIG 4 auditors) deliver higher audit quality than non-Big Six auditors, and therefore less earnings management through abnormal accruals occurs. Firms having a Big 4 auditor have fewer tendencies to manage their earnings. In that way, a negative sign is expected in the regression model for the control variable BIG4.

A summary of the variables in the regression model are listed in Table 1. A short description is given along with the expected sign the variable will take in the regression model.

Table 1: Summary of the variables in regression model

Variables	Description	Expected sign
$\|AWCA\|_{it}$	absolute value of abnormal working capital accruals	
IS_{it-1}	dummy variable obtains a value 1 if the firm is audited in the previous year by an industry specialist firm, and 0 otherwise	−
IS_{it}	dummy variable obtains a value 1 if the firm is audited in the current year by an industry specialist firm, and 0 otherwise	−
$SIZE_{it}$	natural logarithm of market value of common equity at the end of the fiscal year	−
CFO_{it}	operating cash flow scaled by total assets at the beginning of the fiscal year	−
LEV_{it}	total long-term debt scaled by total assets	−
$LOSS_{it}$	1 if net income < 0, and 0 otherwise	−
MB_{it}	market value of equity divided by book value of equity	+
LIT_{it}	1 if the company operates in a high litigation industry (SIC codes of 2833-2836, 3570-3577, 3600-3674, 5200-5961, and 7370), and 0 otherwise	+
$ALTMAN_{it}$	Altman's (1983) Z-score to measure bankruptcy risk	−
$B4_{it}$	1 as the firm is audited by a Big 4 firm, and is 0 otherwise	−

3.3 Sample selection and data

The sample contains data for the period 2004-2007. Only for determining the industry specialist, data is obtained for the year 2003. The Sarbanes-Oxley act is introduced in 2002, so the period after this introduction is taken into account in this study. After 2003, no important changes in accounting regulations have occurred until the financial crisis began in 2008. Because the crisis had impact on the firms' performance, the period obtained for this study is till the year before the crisis, 2007.

For the sample, all US listed firms from the database Compustat are included. As noticed in DeFond and Park (1997), financial institutions (SIC 6) and unclassified firms (SIC 99) are deleted from the sample because the use of the abnormal accruals model is problematic. After deleting those industries, an initial sample of 22,508 firm-year observations is identified for the years from 2004 to 2007. Based on their two-digit SIC code, firms are categorized into 63 industries. 4,487 firm-year observations are deleted from the sample, because information lacks to determine abnormal working capital accruals. Furthermore, 1,891 firm-year observations are deleted from the sample because information on the control variables was unavailable. After deducting those missing values from the initial sample, the final sample consists of 16,130 firm-year observations. Table 2 presents a summary of the sample composition.

Table 2: Sample composition

Description	Firm-years
Initial sample	31,792
Less: SIC 6 and SIC 99	9,284
Less: missing variables necessary to calculate AWCA	4,487
Less: missing variables necessary to calculate control variables	1,891
Final sample	**16,130**

4 Findings

4.1 Descriptive statistics

Descriptive statistics for the variables of the regression model are provided in Table 3. Note that all continuous variables are winsorized at 1% and 99% to minimize the effect of outliers1.

The dependent variable, |AWCA|, has a mean value of 0.17 and the median is 0.03. The variable of interest, industry specialist (IS_{it-1}) has a mean of 0.2 which indicates that 20% of the sample observations has an industry specialist as auditor in the previous year. This is a logical result because each of the 63 industries has only one industry-specialist audit firm.
The mean of the variable LEV is 0.17, which indicates that 17% of the firm-year observations is financed with debt. A further 36% incurs a loss in the firm-year observations, which is a relative high number. The mean of the litigation variable shows that over 26% of the firm-year observations is operating in a high litigation industry. The observations of the Altman score vary a lot, from -189 till almost 31. Therefore, the average Altman score in the sample is negative, which suggests a high probability of bankruptcy. An interesting result of the descriptive statistics is that almost 68% of the firm-year observations is audited by a Big4 auditor.

Table 3: Descriptive statistics

(N = 16,130)

Variables	Mean	Median	Minimum	Maximum	Std. Deviation
|AWCA|	0.1710	0.0306	0.0005	5.6685	0.6752
IS_t-1	0.2003	0	0	1	0.4002
LN_SIZE	5.2472	5.3651	-1.3768	11.0409	2.6809
CFO	-0.0448	0.0681	-3.0205	0.3591	0.4518
LEV	0.1677	0.0912	0	1.3750	0.2316
LOSS	0.3573	0	0	1	0.4792
MB	1.9921	1.5143	-13.2072	24.1110	3.7728
LIT	0.2610	0	0	1	0.4392
ALTMAN	-1.0698	2.5830	-189.4271	30.8473	24.4267
B4	0.6796	1	0	1	0.4666

1 The variable IS_{it} is deleted from the model because of the high correlation with the variable of interest IS_{it-1}. The results for both variables are almost the same due to less variation.

4.2 Univariate analysis

To have a first indication of the results relating to the hypothesis, a t-test is conducted. Table 4 presents the results of this test. The mean of |AWCA| in the subsample with non-industry specialist observations (0.2021) is higher than in the subsample with industry-specialist observations (0.0468), and this difference is significant (t=11.7392). This result gives a first indication that firms with a non-industry specialist audit firm in the previous year have higher abnormal working capital accruals, and therefore have lower audit quality this year, than clients of non-industry specialist audit firms in the previous year. However, as control variables are not taken into account, conclusions should be drawn with prudence. The control variables all are significant, except for litigation (LIT). In the non-specialist sample, almost 40% of the firm-year observations facing a loss, against almost 22% in the sample with industry specialists. The Altman score is also considerably higher in the sample with industry specialists than in the non-specialist sample, which indicates that the probability of bankruptcy in the industry-specialist sample is lower. An important result shown in Table 4 is that the mean of B4 in the sample with industry-specialists is 1. This implies that all industry-specialists are Big4 audit firms.

Table 4: Univariate analysis

Variables	IS_{it-1} = 0	IS_{it-1} = 1	t-stat
	N = 12,900	***N = 3,230***	
|AWCA|	0.2021	0.0468	11.7392*
LN_SIZE	4.8505	6.8315	-39.3143*
CFO	-0.0729	0.0673	-15.8957*
LEV	0.1651	0.1780	-2.8244*
LOSS	0.3926	0.2161	18.9296*
MB	1.9522	2.1515	-2.6864*
LIT	0.2610	0.2610	0.0020
ALTMAN	-2.2421	3.6122	-12.2372*
B4	0.5994	1	-46.4611*

*, **, *** significant at the 1 percent, 5 percent, and 10 percent level, respectively, two-tailed.
$\boldsymbol{IS_{it-1}}$ = 0 is the subsample with non-industry specialist observations
$\boldsymbol{IS_{it-1}}$ = 1 is the subsample with industry-specialist observations

4.3 Correlation analysis

Table 5 provides a Spearman correlation matrix between the absolute value of abnormal working capital accruals, industry specialization in the previous year, and several control variables. The dependent variable |AWCA| is negatively correlated with the variable of interest, IS_{it-1}. The correlation is -0.169 and significant, which is consistent with the hypothesis that firms with an industry specialist audit firm in the previous year constrain accruals-based earnings management. So these firms have lower abnormal accruals, which indicates a higher audit quality. The control variables SIZE, CFO, LEV, LIT, ALTMAN, and B4 all have the predicted direction with respect to their correlation with the absolute value of abnormal working capital accruals, supporting the expectations mentioned in section 3.3. Only the variables LOSS, which is positive and MB, which is negative, have not their predicted direction. The correlations in this model all are reasonable with the highest value of -0.629, suggesting that multicollinearity is not a problem.

Table 5: Spearman Correlation Matrix

Analysis of Absolute Value of Abnormal Working Capital Accruals model *(N = 16,103)*

Variables	*|AWCA|*	*IS_PRIORYEAR*	*LN_SIZE*	*CFO*	*LEV*	*LOSS*	*MB*	*LIT*	*ALTMAN*	*B4*
|AWCA|	**1.000**	**-0.169***	**-0.467***	**-0.304***	**-0.180***	**0.311***	**-0.133***	**0.056***	**-0.224***	**-0.348***
IS_PRIORYEAR		**1.000**	**0.301***	**0.134***	**0.089***	**-0.147***	**0.075***	**0.000**	**0.085***	**0.344***
LN_SIZE			**1.000**	**0.490***	**0.267***	**-0.494***	**0.380***	**-0.031***	**0.328***	**0.627***
CFO				**1.000**	**0.057***	**-0.629***	**0.218***	**-0.088***	**0.437***	**0.313***
LEV					**1.000**	**-0.096***	**-0.081***	**-0.142***	**-0.355***	**0.175***
LOSS						**1.000**	**-0.146***	**0.125***	**-0.439***	**-0.307***
MB							**1.000**	**0.072***	**0.359***	**0.175***
LIT								**1.000**	**0.043***	**0.001**
ALTMAN									**1.000**	**0.205***
B4										**1.000**

*, **, *** significant at the 1 percent, 5 percent, and 10 percent level, respectively, two-tailed.

4.4 Multivariate analysis

The results for the multivariate analysis with the absolute value of abnormal working capital accruals as the dependent variable are reported in Table 6. The F-value of the model is 200,258 and is significant, which indicates that the model is useful. The adjusted R^2 for the model is 0.467, which indicates that 46.7% of the variation in |AWCA| is explained by the model.

Contrary to the prediction, the coefficient of the industry specialization variable, IS_{it-1}, is positively correlated with the absolute value of abnormal working capital accruals |AWCA|. However, this relation is insignificant, and therefore no relation between industry specialization in the previous year and abnormal working capital accruals in the current year exists. Therefore, the hypothesis is rejected.

The control variables SIZE is negatively correlated with |AWCA| (-0.014) and significant, so as expected, larger firms have less abnormal accruals than smaller firms, and therefore higher audit quality. CFO is also negatively correlated with |AWCA| and significant. Highly levered firms have less incentives to manage earnings with abnormal accruals, related to the significant negatively correlation between LEV and abnormal working capital accruals. The control variable LOSS is significantly correlated with |AWCA| (-0.045). Therefore, loss-making firms facing less earnings management due to abnormal accruals. As predicted, the variable MB has a significantly positive relation with |AWCA| but this relation is very small (0.004). The Altman score measures the bankruptcy risk for firms, the lower the score, the greater the bankruptcy risk. As expected, ALTMAN has a negative relationship with |AWCA| (-0.016) and therefore firms with a higher Altman score, so lower probability of heading a bankruptcy, have lower abnormal accruals. The last significant control variable B4 is negatively correlated with |AWCA| which is consistent with the prediction that having a Big4 as auditor, audit quality will be higher, so abnormal accruals will be lower. The variable LIT is not significant.

As already mentioned, the variable industry specialization in the current year, IS_{it}, is deleted from the model. The correlation between IS_{it-1} and IS_{it} is almost 1, so both variables will have probably the same relation with the absolute value of abnormal working capital accruals. This study is interested in the effect of industry specialization in the previous year on audit quality, so therefore only the variable IS_{it-1} is included in the model.

Table 6: Multivariate Analysis

Dependent variable is the Absolute Value of Abnormal Working Capital Accruals *(N=16,130)*

	Coefficient	p-value
Intercept	0.294	0.000*
IS_PRIORYEAR	0.002	0.827
LN_SIZE	-0.014	0.000*
CFO	-0.198	0.000*
LEV	-0.122	0.000*
LOSS	-0.045	0.000*
MB	0.004	0.000*
LIT	0.003	0.855
ALTMAN	-0.016	0.000*
B4	-0.046	0.000*
INDUSTRY DUMMIES	*included*	
F-value	200.258	0.000*
Adjusted R^2	0.467	

*, **, *** significant at the 1 percent, 5 percent, and 10 percent level, respectively, two-tailed.
Industry dummies are included in the model, but have no effect on the other coefficients in the model.

4.5 Robustness tests

As |AWCA| is scaled by total assets, it is almost impossible to have a value of abnormal accruals above 1, otherwise the amount of the absolute value of abnormal accruals will be the value of AWCA times the total assets which lead to a huge amount of abnormal accruals. Because this can affect the results, based on Francis and Yu (2009), an additional test is conducted for the dependent variable, abnormal working capital accruals. The absolute value of abnormal working capital accruals is winsorized at +1.

A negative relation is expected between industry specialization, IS_{it-1}, and the absolute value of abnormal working capital accruals, |AWCA|. The results of the multivariate analysis of the additional test, presented in Table 7, show that the test variable, IS_{it-1}, is still insignificant. Therefore, a conclusion of the relationship between industry specialization in previous year and the audit quality in the current year cannot be given.

Table 7: Multivariate Analysis

Dependent variable is the absolute value of Abnormal Working Capital Accruals *(N=16,130)*

	Coefficient	p-value
Intercept	0.171	0.000*
IS_PRIORYEAR	0.001	0.854
LN_SIZE	-0.011	0.000*
CFO	-0.100	0.000*
LEV	-0.028	0.000*
LOSS	0.004	0.163
MB	0.000	0.170
LIT	0.002	0.374
ALTMAN	-0.003	0.000*
B4	-0.032	0.000*
F-value	1589.983	0.000*
Adjusted R^2	0.470	

*, **, *** significant at the 1 percent, 5 percent, and 10 percent level, respectively, two-tailed.

Another test is conducted to measure the relation between industry specialization and abnormal working capital accruals in another way. As in Balsam et al. (2003), the sample of abnormal working capital accruals is divided in two subsamples, a positive abnormal accruals-sample and a negative abnormal accruals-sample. In both samples the absolute value of abnormal working capital accruals is used. The prediction is that the variable industry specialization in the previous year, $IS_{it-1,}$ will be negatively correlated with the variable absolute value of abnormal working capital accruals, |AWCA|, in both positive- and negative abnormal accruals-sample. Table 8 provides the regression results of the full model with as dependent variable |AWCA|, the subsample with negative |AWCA|, and the subsample with positive |AWCA|. The variable of interest, IS_{it-1}, still is insignificant in both models. Furthermore, dividing the abnormal working capital accruals in a negative and a positive sample brings no new insights with it.

Table 8: Multivariate Analysis

Regression results of the full sample, negative subsample |AWCA|, and positive subsample |AWCA|

Dependent variable	|AWCA| *(N=16,130)*		Negative |AWCA| *(N=8,082)*		Positive |AWCA| *(N=8,048)*	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Intercept	0.294	0.000*	0.244	0.000*	0.302	0.000*
IS (t-1)	0.002	0.827	0.000	0.973	0.007	0.645
LN_SIZE	-0.014	0.000*	-0.011	0.000*	-0.015	0.000*
CFO	-0.198	0.000*	-0.127	0.000*	-0.276	0.000*
LEV	-0.122	0.000*	-0.155	0.000*	-0.089	0.001*
LOSS	-0.045	0.000*	-0.039	0.002*	-0.042	0.005*
MB	0.004	0.000*	0.004	0.004*	0.003	0.075***
LIT	0.003	0.855	-0.024	0.039**	0.008	0.547
ALTMAN	-0.016	0.000*	-0.017	0.000*	-0.14	0.000*
B4	-0.046	0.000*	-0.024	0.084***	-0.062	0.000*
F-value	200.258	0.000*	1292.051	0.000*	433.556	0.000*
Adjusted R^2	0.467		0.590		0.326	

*, **, *** significant at the 1 percent, 5 percent, and 10 percent level, respectively, two-tailed.

5 Conclusion

Previous studies show a positive relationship between auditor industry specialization and audit quality both measured in the same year (e.g., Balsam et al. 2003, Reichelt and Wang 2010, Lowensohn et al. 2007). A reason for this positive relationship is the existence of industry expertise for industry specialist audit firms. This study extends the literature by investigating the longitudinal effect of industry specialization on audit quality. More specific, this study examines whether the audit quality delivered by an industry specialist audit firm also increases in the upcoming year. Because of the increased knowledge about their clients, auditors can provide better audit quality which eliminate errors in the audit and so audit quality will increase.

Both industry specialization and audit quality are difficult to observe, so proxies are used. Industry specialization is measured as the relative market share of the audit firm, based on their total assets. The firm with the greatest market share within a particular industry is indicated as industry specialist. As the observations are divided into 63 industries, the same amount of industry specialists is identified. Audit quality is measured by abnormal working capital accruals, AWCA, based on the model of DeFond and Park (2001). The model, explained in the research design section, included the variable industry specialization in the current year. In the analyses of the study, this variable is excluded from the model because of a high correlation with the industry specialization variable of the previous year.

After controlling for variables related to abnormal working capital accruals, regression results show that there is no significant longitudinal effect of auditor industry specialization on audit quality. A positive effect was expected between industry specialization in the current year and audit quality in the next year, but this hypothesis is rejected. The conclusion can be made that audit quality of clients of industry specialist audit firms is not significantly different in the upcoming year than those of non-specialist audit firms.

This study is important to know the longitudinal effect of industry specialization on audit quality. Because audit quality is the same for clients employing industry specialists and those of non-specialists in the previous year, the effect of industry specialization lasts for only one year. Being an industry specialist in a particular industry in one year, has a positive effect on audit quality of their clients in that year as prior literature states, but has no effect on audit quality in the next year contrary to the expectation. In the short term, audit quality will increase, but clients want also an increase in the upcoming years. Industry specialization might not be the right strategy to create a longitudinal increase in audit quality. Therefore, audit firms should focus on industry specialization in the current year to attract clients, and should focus on other strategies in the upcoming years to have an increasing line in the audit

quality of their clients to keep those clients. When the audit quality is high, clients probably want to hold the same audit firm for the upcoming years. High audit quality is associated with less earnings management, so with the expectation of this study, banks should prefer clients of industry specialists. However, the conclusion of this study is important for banks, because now they know that there is no need to prefer clients of industry specialists over those of non-specialists when for example issuing debt. A positive effect was expected between industry specialization and audit quality. This gives reason for regulatory bodies to shift the focus on clients of non-specialists, because the audit quality of those clients might be lower than of clients of specialists. And lower audit quality is associated with earnings management. The conclusion of this research is for regulatory bodies the reason to keep their attention on both clients, and make no difference between clients of industry specialists and those of non-specialists.

The proxy for measuring industry specialization can be a limitation in this study. A possible shortcoming of the market share approach is that audit firms, specialized in a small industry generating too small earnings, do not qualify to become an industry specialist. Second, large audit firms invest heavily in highly competitive industries, therefore they have already a large market share in those industries (Neal and Riley 2004). Krishnan (2003) suggests that the market share approach is a noisier measure of industry specialization because it exhibits more variation. Portfolio share as the measure for industry specialization might be a better measure because it includes also the differentiation efforts of audit firms. However, also negative issues related to this measure.

Another limitation of this study is making use of a relatively old sample. This is done because of the impact of the crisis on the performance of firms. During the crisis, firms have a higher probability to go bankrupt. For example, the Altman's score will be lower for these firms, and because of the negatively relationship with abnormal working capital accruals, the audit quality will be lower. The variables will have different values in the crisis years against non-crisis years. Therefore, the results in a sample including crisis years, will be different than using a sample with non-crisis years, and so these results are not comparable.

Deleting the industry specialization variable of year t, as mentioned earlier, might be a limitation in this study. Investigating a longer time span, will increase the variation between industry specialization in t and in t-1, and might result in better conclusions.

Future research should focus on a sample with recent years, and furthermore, a refinement of the measures for industry specialization might lead to better results.

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Appendices

Appendix A

The Altman's Z-score is used as control variable in the regression model. The measure used for determining the Altman's Z-score is based on Grice and Ingram (2001), and is as follows:

$$Z - Score = 1.2A + 1.4B + 3.3C + 0.6D + 0.999E$$

Where:

A = $Working\ capital/Total\ assets$

B = $Retained\ earnings/Total\ assets$

C = $Earnings\ before\ interest\ and\ tax/Total\ assets$

D = $Market\ value\ of\ equity/Book\ value\ of\ total\ debt$

E = $Sales/Total\ assets$