# The effect of auditor industry specialization on audit quality on a firm-, office- and partner level in Germany

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*Abstract*

In this study, I investigate the effect of auditor industry expertise on audit quality. Auditor industry expertise I measure on the firm-, the city- and the partner level. This is done by measuring those three units of analysis stand alone and concurrently in the same regression by using the joint national-city framework. Audit quality I proxy with discretionary accruals utilizing two different discretionary accrual models. Based on all firms listed on Xetra in the Prime Standard, I find evidence for industry expertise being especially accumulated on the firm and office level. The model with the highest number of significant results suggests that an auditor who is only an industry leader on the firm level but not on the city level results in decreased discretionary working capital accruals in the amount of 1.5% scaled by total assets. An auditor who is only a city level industry specialist results in decreased working capital accruals in the amount of 3.2% relative to total assets. I also find some evidence for the existence of a positive relation between partner level industry experience and audit quality.

# O efeito da especialização da indústria de auditoria na qualidade da auditoria a nível de empresa, escritório e parceiro na Alemanha

*Abstrato*

Neste estudo, investigo o efeito dos conhecimentos especializados da indústria de auditoria na qualidade da auditoria. Medo os conhecimentos especializados da indústria de auditoria ao nível da empresa, da cidade e do parceiro. Isto é feito medindo essas três unidades de análise isoladamente e simultaneamente na mesma regressão, utilizando o quadro conjunto cidade-nacional. A qualidade de auditoria I é avaliada com acréscimos discricionários, utilizando dois modelos diferentes de acréscimos discricionários. Com base em todas as empresas listadas em Xetra no Prime Standard, encontro provas de que os conhecimentos da indústria são especialmente acumulados a nível da empresa e do escritório. O modelo com o maior número de resultados significativos sugere que um auditor que é apenas um líder da indústria ao nível da empresa, mas não ao nível da cidade, resulta numa diminuição dos acréscimos discricionários de capital de exploração no montante de 1,5% escalonado pelo activo total. Um auditor que é apenas um especialista da indústria a nível municipal resulta numa diminuição dos acréscimos do capital de exploração no montante de 3,2% em relação ao total dos activos. Também encontro algumas provas da existência de uma relação positiva entre a experiência da indústria a nível de parceiros e a qualidade da auditoria.

# Introduction

Early research conducted in the field of auditor industry specialization mainly focused on the audit firm or even a group of audit firms as the unit of analysis (Eichenseher and Danos, 1981; Shockley and Holt, 1983). Induced by high profile accounting scandals such as the one of Enron and WorldCom, higher data availability on the office and partner level and audit firms increasing their market share in certain industries either organically or through mergers such as Ernst & Young and Deloitte & Touche in 1989, researchers investigated the linkage between industry specialisation and audit quality on those smaller units of analysis (Reichelt and Wang, 2010; Minutti-Meza, 2013; Garcia-Blandon and Argiles-Bosch, 2018; Anissa, Mukhlasin and Petronila, 2019; Kharuddin, Basioudis and Farooque, 2020). The findings suggest that industry specific knowledge is an important factor when it comes to the judgement of an auditor. They also imply that this knowledge is not completely transferred among offices and not carried over from one partner to the other within one office. Consequently, offices or partners with high industry expertise might be able to identify and assess financial misrepresentations better than other offices and partners within the same office, respectively. The circumstance that audit phenomena have not been broadly explored on the city and partner level as well as that recent findings imply that audit quality might significantly depend on city/partner level characteristics, several researchers believe that this area should be further investigated (DeFond and Francis, 2005; Krishnan, 2005).

Incentivized through the findings of researchers who investigated the effect of auditor industry specialization on audit quality on the office and partner level, the circumstance that this area is relatively underexplored and the believe of multiple researchers for its future research potential, I investigate the effect of auditor industry specialization on the audit quality for publicly listed companies in Germany on the firm, the office and the partner level. Pushing the analysis down to those units is made possible through certain provisions enforced through German regulators. Article 322 of the German commercial code (Handelsgesetzbuch) requires the auditor to state the address of the auditor which makes it possible to collect data on the office level. The auditing standard “IDW EPS 400 n.F.” laid out by the German institute of auditors (Institut der Wirtschaftsprüfer) specify that the audit opinion has to have an own chapter titled “responsible auditor” (verantwortlicher Wirtschaftsprüfer) which has to entail the name of the engagement partner which makes it possible to collect data on the partner level. Beside Germany, where engagement partners have to state their name in the audit opinion if the respective client

constitutes a public-interest-entity, until recently only Taiwan, Sweden, Australia and China require engagement partners to put down their name in a certain section of the audit report or other form (Garcia-Blandon and Argiles-Bosch, 2018). In the U.S. the PCAOB adopted a new set of rules in 2015 which require auditors to file a form to the board containing the name of the engagement partner and has taken effect in 2017. This trend of regulators and standard setters of obliging the engagement partner to disclose his/her name will also enhance the capability of researchers to investigate partner specific factors in the future.

In this study I make use of the joint national city framework proposed by Ferguson et al. (2003) and extend it to the partner level using the same methodology. Using the methodology of Ferguson et al. (2003) makes it possible to better capture the individual effects of industry specialization on the firm, the office and the partner level vis-à-vis testing the effects on those three levels stand alone. Audit quality I define through two different variables: discretionary accruals and accrual estimation error. Using multiple audit quality variables increases the robustness of and the insights from my research. To the best of my knowledge this is the first research which investigates the joint and individual effects of auditor industry specialization on audit quality for publicly listed companies in Germany on the firm, the office and the partner level.

Based on a final sample of 752 firm-year observations, I find that firm- and city level industry expertise have a significant impact on audit quality. Based on the model with the highest number of significant findings as well as the most significant findings (measured by p-value) an auditor who is an industry leader on the city level but not on the firm level results on average in an absolute decrease of discretionary working capital accruals in the amount of 3.2% of total assets. An auditor who is an industry leader on the firm but not on the city level results on average in decreased discretionary working capital accruals in the amount of 1.5% of total assets.

The rest of this paper is organized as the following. The next chapter reviews pertinent literature, followed by the hypothesis development, the variable selection, the data collection, some descriptive statistics, the results, the sensitivity analysis, the discussion and the conclusion.

## Literature review and hypothesis development

Based on the results of prior research industry specialization should help the auditor to detect material misstatements, accounting fraud and management attempts to manage earnings (Balsam *et al.*, 2003; Sun and Liu, 2013). In other words, having multiple audit mandates for companies in the same industry should foster the auditor's competence of identifying and assessing material financial misrepresentations. Building up industry specific knowledge is laid out in the International Standard on Auditing 315 (IAASB, 2019) and specialization is listed as one of the top five most pressing priorities within the context of "The CPA vision project and beyond" (AICPA, 1998). This underpins the importance of accumulating industry expertise for an auditor from the standard setter's/regulator's perspective. Also, when considering the auditor's firm-structure it becomes evident how crucial it is to accumulate industry related knowledge. In 1993 Peat Marwick was the first audit firm along the big 5 which underwent a restructuring towards being organized into industry lines (Emerson, 1993). During the mid and late 1990s the other big audit firms followed Peat Markwick's example (Hogan and Jeter, 1999).

### How has research in the field of industry expertise and audit quality developed over the last decades?

Early research on industry specialization in the 1980s and 1990s mainly focused on the firm level as the unit of analysis (DeAngelo, 1981; Eichenseher and Danos, 1981; Palmrose, 1986). During that time research on industry specialization was not conducted as frequent as it is done today and with major audit firms structural shift of being organized into industry lines and accounting scandals undergoing public scrutiny, the interest in industry specialization as a determinant of audit quality rose.

Induced by prominent accounting debacles such as the one of Enron and Waste Management, Krishnan (2005) investigated whether Arthur Andersen's Houston office allowed its clients more leeway for aggressive reporting vis-à-vis other offices of Arthur Andersen or other Big 6 audit firm offices. She concludes that indeed the toleration of those misrepresentations were an office-specific problem rather than a firm-wide issue. To better understand how city-level and firm-level industry expertise impacts audit quality, Ferguson et al. (2003) established the joint national-city framework which is aimed to better capture the individual effects of firm-wide and city-specific industry expertise. In their research, Ferguson et al. (2003) find that in fact there exists a higher audit fee premium on the office level than on the firm level and that national

leadership rankings are most likely driven by certain offices rather than whole firms. Among others, those findings incentivized other researchers to investigate the relation between firm-wide/city-specific industry expertise and the quality of services provided by auditors by using the joint national-city framework (Reichelt and Wang, 2010; Kim *et al.*, 2015; Kharuddin *et al.*, 2020).

To focus on smaller units of analysis such as the city or partner level was also encouraged by several researchers as it was believed that this area was relatively underexplored (DeFond and Francis, 2005; Krishnan, 2005). Due to the recent development of higher data availability, it was made possible to push the analysis down to the partner level even though in some countries domestic audit laws require engagement partners to state their names in the audit report already since multiple decades. Among others, those countries include Taiwan and Spain in which engagement partner name disclosure is obligatory since 1983 and 1988, respectively. In the UK, engagement partners have to state their names in the audit report since 2008. In the U.S. and in Germany mandatory partner name disclosure came into effect in 2017. Despite the fact that audit laws of respective countries enabled doing research on industry specialization on the partner-level since multiple decades, sincere interest in this field began to develop over the last two decades (Chi and Chin, 2011; Goodwin and Wu, 2014; Garcia-Blandon and Argiles-Bosch, 2018; Kharuddin *et al.*, 2019). The findings made on the partner level shed new light on the importance of firm-, city- and partner level industry expertise. Some of the recent studies state that it is indeed the partner level industry expertise which results in high quality audits rather than industry expertise accumulated firm-wide (Chin and Chi, 2009; Kharuddin *et al.*, 2019).

## Which methods have been utilized to explore the effect of industry expertise on audit quality?

### a) Methods to measure audit quality

Before exploring the various methods based on which audit quality can be measured, it is important to note that there exists no universal definition of audit quality. The definition of audit quality depends significantly on the stakeholder group asked and even within a group, audit quality can be defined in multiple ways. Regulators, shareholders, employees, auditors and managers might define audit quality very differently. Shareholders might argue that high quality audits are those which prevent material misstatements in the disclosed financials. Regulators might perceive audit quality as high as long as they are in line with accepted

accounting principles and the auditor might believe his audit being of high quality as long as he completed all tasks outlined in the audit firms audit procedure. Within the context of this research I put myself in the shoes of financial statement users and define audit quality as high if the disclosed financials give a true and fair view in all material aspects within the scope of the respective financial reporting framework (in this case IFRS).

One way to categorize audit quality methods is based on the source of information on which the method is built upon. On the basis of prior literature three overarching source categories emerge: 1) financial statements 2) perception of capital markets 3) auditors and regulators.

Among others, prior literature used the magnitude of discretionary accruals to explore whether industry specialist clients engage in less earnings management (Becker *et al.*, 1998; Balsam *et al.*, 2003; Krishnan, 2003; Reichelt and Wang, 2010; Chen *et al.*, 2011; Chi and Chin, 2011; DeBoskey and Jiang, 2012; Kharuddin *et al.*, 2020), the incidence of financial restatements to investigate whether industry specialist auditors can pressure management to restate respective financials (Romanus *et al.*, 2008; Chin and Chi, 2009) and the magnitude of asset impairments to explore whether higher asset impairments are reported if the auditor is an industry specialist (Stein, 2019).

In the second category researchers used cumulative abnormal returns around earning announcement dates to measure the effect of industry specialization on earning announcements (Balsam, Krishnan and Yang, 2003; Kwon *et al.*, 2007), stock returns to measure whether bad news are timely reported if the auditor is an industry specialist (Lim and Tan, 2009), the AIMR disclosure quality score to measure the effect of industry specialists on the quality of disclosed financials (Dunn and Mayhew, 2004), the absolute forecast accuracy of analyst forecasts and the dispersion of those forecasts to measure whether non-industry specialist clients meet or beat analyst forecasts (Behn *et al.*, 2008; Payne, 2008; Reichelt and Wang, 2010; Xie *et al.,* 2012), stock returns to measure the effect of switches from an industry specialist auditor to a non-specialist auditor (Knechel *et al.*, 2007) and stock returns to measure the effect of industry specialists on the value of cash holdings (Kim *et al.*, 2015).

In the third category researchers utilized the number of violations of GAAS reporting standards to measure the effect of auditor industry specialization on GAAS compliance (O'Keefe *et al.*, 1994), allegations of violations of the Rule 10b-5 of the 1934 security exchange act to investigate whether auditor industry expertise results in less fraudulent reporting (Carcello and Nagy, 2004), auditor retention to explore whether auditor industry experts can better retain their

clients than their non-expert counterparts (Hegazy and Hegazy, 2018) and the time span needed to issue an audit report to explore whether industry specialists are more timey in issuing an audit report (Whitworth and Lambert, 2014).

In this paper, I solely rely on the source of financial statements to determine the respective quality of the audit. Specifically, I use two measures of discretionary accruals to measure audit quality (see chapter model specification).

b) Methods to measure industry specialization

Prior researchers defined industry specialization in various ways and nearly all researchers proxied industry expertise by market share. Market share itself, however, was defined in multiple fashions. Some researchers used weighted market share measures such as client sales (Krishnan, 2003; Romanus *et al.*, 2008; Lim and Tan, 2009; Kharuddin *et al.*,2020), client assets (Carcello and Nagy, 2004; Behn *et al.*, 2008; Xie *et al.*, 2012) or audit fees (Reichelt and Wang, 2010; Whitworth and Lambert, 2014; Kim *et al.*, 2015). Most of prior studies used client sales or client assets as weighted market share measure as the most common data base used (Compustat) does not contain audit fees. Audit fees were only taken as weighted market share measure if audit fee data were manually collected (Kharuddin *et al.,* 2020) or if the Audit Analytics database was used (Reichelt and Wang, 2010; Whitworth and Lambert, 2014; Kim *et al.*, 2015).

Unweighted measures of market share mainly encompass the number of clients an auditor serves. Researchers main argument to use an unweighted market share measure mainly rests on the uneven distribution of the total amount of audit fees in the market. In most markets a few large firms combine a great amount of audit fees. To illustrate: In my research I manually collected audit fee data on 206 firms listed on Xetra in the prime standard (I deleted some of the firms to arrive at my final sample). The seven biggest firms measured by audit fees, which are Siemens, Daimler, Volkswagen, Deutsche Telekom, E.ON, RWE and Deutsche Post, combine 37% of audit fees of all 206 firms. In other words: 3% of firms combine more than 1/3 of all audit fees. Consequently, researchers argue an unweighted measure might better proxy the true degree of industry expertise of an auditor.

Further, industry expertise can be either calculated by a dichotomous dummy or a continuous variable. Most researchers use a dummy to decide whether an auditor represents an industry

leader or not. Consequently, they define certain criteria based on which an auditor is classified as an industry leader. Frequently used criteria are 1) cut-off values, either as an absolute figure or relative to other market participants, which set the percentage value of market share an auditor has to combine on himself to be classified as an industry leader 2) being the biggest market player measured by market share 3) differences in market share among the biggest audit firms such as the requirement to combine at least 10% or more market share on oneself as the next biggest audit firm or 4) any combination of the above outlined methods. Continuous variables are either a relative market share or an absolute market share measure. Whitworth and Lambert (2014), for example, use the natural logarithm of audit fees in a particular industry as their market share measure.

Ultimately, market share measures can either be represented by regarding the whole market or only a single audit firm. Measures regarding the whole market measure a firm's relative market share compared to market shares of all other audit firms in a certain industry. Measures regarding only a single firm compare the share a respective audit firm has in a certain industry with the share this audit firm has in all other industries. That means that the single firm measure is an indicator of how much a single firm focuses on a certain industry compared to other industries in which the firm serves clients.

## Which control variables have been used by prior researchers?

Control variables differ significantly based on which audit quality model is used. Control variables used for event studies to measure the effect of market reactions, for instance, differ significantly of those used to measure the magnitude of discretionary accruals. As I solely use discretionary accrual models in this paper, I focus on control variables used in discretionary accrual models.

The most common control variables are directly derived or extracted from financial statements of respective companies. Control variables used in nearly all prior research papers include: total assets, cash flow from operation, leverage, a dummy variable indicating whether the company incurred a loss in a given period and total accruals. Those variables themselves, however, are measured in various ways. Total accruals, for instance, are sometimes measured based on its absolute value (Becker *et al.*, 1998; Balsam *et al.*, 2003; Krishnan, 2003; Kwon *et al.*, 2007) and are sometimes scaled to total assets from the preceding year (Reynolds and Francis, 2001; Kharuddin *et al.*, 2020). The same holds for cash flow from operations. Whereas (Reynolds and

Francis, 2001; Balsam *et al.*, 2003; Chen *et al.*, 2006; Chi and Chin, 2011; Kharuddin *et al.*, 2020) scale operating cash flow to total assets (Becker *et al.*, 1998) use the absolute value. Leverage is nearly consistently computed by total debt divided by total assets. A small variation constitutes (Balsam *et al.*, 2003) who use long-term debt instead of total debt. And a greater deviation from the common computation is undertaken by (Becker *et al.*, 1998) who use a dummy for high leverage companies. Total accruals are either measured by scaling them to total assets (Reynolds and Francis, 2001; Krishnan, 2003; Chi and Chin, 2011; Kharuddin *et al.*, 2020), by taking their absolute value (Becker *et al.*, 1998; Balsam *et al.*, 2003) or by taking the logarithm of them (Kwon *et al.*, 2007).

Some researchers also included a range of corporate governance control variables such as percentage of independent directors on the board, proportion of directors with financial expertise on the audit committee or number of audit committee meetings per year (Chen *et al.*, 2011; Kharuddin *et al.*, 2020).

Another line of research also includes control variables derived from capital markets. Those variables include trading volume, market to book ratio or number of shares (Becker *et al.*, 1998; Krishnan, 2003; Kwon *et al.*, 2007; Chen *et al.*, 2011)

## Which findings have been made on the firm-, city- and partner level?

### a) Firm level

Most of prior research investigating the effect of industry expertise on audit quality was undertaken on the firm level. Researchers report that firm-wide industry expertise results in reduced discretionary accruals (Becker *et al.*, 1998; Balsam *et al.* 2003; Krishnan, 2003; Zhou and Elder, 2005; Chen *et al.* 2006; Kwon *et al.* 2007; Chen *et al.*, 2011; DeBoskey and Jiang, 2012; Kharuddin *et al.* 2020), more timely loss recognition (Krishnan, 2005; Lim and Tan, 2009), increased GAAS compliance (O'Keefe *et al.* 1994), greater clients' earnings ability to predict future cash flow (Gramling *et al.*, 2001), higher analysts' ranking of disclosure quality (Dunn and Mayhew, 2004), fewer enforcement releases that alleged a violation of rule 10b-5 of the 1934 Securities Exchange Act (Carcello and Nagy, 2002, 2004), fewer accounting restatements (Romanus et al. 2008), less dispersion of analysts' forecasts (Behn *et al.* 2008; Xie *et al.* 2012), more dispersion of analysts' forecasts (Payne, 2008), higher retention of the audit firm (Hegazy and Hegazy, 2018) and positive market reaction after a firm switches from a non-industry specialist auditor to a specialist one (Knechel *et al.* 2007). Payne (2008) argues that

increased dispersion of forecast errors is a sign of the industry specialist's ability to restrict earnings management. Behn *et al.* (2008) argue that less forecast dispersion results from better forecast performance of the analyst due to the presence of the industry specialist auditor. Consequently, there is common consensus that firm level industry expertise results in increased audit quality with the only contradiction being Payne (2008) and Behn *et al.* (2008).

b) City level

On the city level, researchers state that auditors' industry expertise leads to less dispersion of analysts' forecasts (Xie *et al.* 2012), reduced discretionary accruals (Kharuddin *et al.* 2020), higher market value of cash holdings (Kim *et al.* 2015), larger asset impairments (Stein, 2019) and more timely reporting (Whitworth and Lambert, 2014). According to Reichelt and Wang (2010) firms report the lowest abnormal accruals when the respective auditor is an industry specialist on both the firm and the city level. Kharrudin *et al.* (2018) present similar findings as they show that audit fee premiums in the UK can only be collected from an auditor if he is an industry leader on the firm and city level. Ferguson et al. (2003) report that there exists a higher audit fee premium on the office level than on the firm level. Further, they report that national leadership rankings are mostly driven by certain offices.

c) Partner level

Research undertaken on the partner level brought along the most novel results as various researchers report that firm-wide industry expertise is non-existent when partner-level industry expertise is controlled for. Cahan and Sun (2015) report that overall audit experience of a partner is negatively correlated with discretionary accruals. Chi and Chin (2011) find that industry expertise on the firm and partner level results in less discretionary accruals in the Taiwanese market. Owhoso *et al.* (2001) investigate the role of industry expertise of managers and seniors with respect to detecting errors in the context of reviewing other auditors' work. The researchers find that managers especially contribute to the audit by identifying more conceptual errors and seniors more mechanical errors. Those findings only hold when the managers and seniors review work of auditors who conducted an audit in the industry of the manager's/senior's expertise. Other researchers find that an audit fee premium on the firm level does not exist when industry expertise on the partner level is controlled for (Goodwin and Wu,

2014; Kharuddin *et al.*, 2019). Similar findings were reported by Chin and Chi (2009) who state that it is only the partner level industry expertise which results in a smaller likelihood of a client making accounting restatements.

Based on the findings of prior research I hypothesize that stand alone there exists a firm, city and partner level effect.

> *H1: Individually, firm, city and partner level industry expertise are positively related with audit quality*

Due to the findings of prior researchers in the field of joint national and city leadership I hypothesize that there exists a joint national city leadership effect.

> *H2: If an audit firm is an industry leader on both the firm- and city level, the audit will have high audit quality*

Based on the findings on the partner level I hypothesize that a joint leadership on the firm, city and partner level will have a positive effect on audit quality.

> *H3: If an audit firm is an industry leader on the firm-, the city- and the partner level, the audit will have high audit quality*

## Sample selection and data collection

The sample of firms used in this research comprises all companies listed on Xetra (Frankfurter Wertpapierbörse). The list of firms is directly extracted from the official website of Xetra and contains 498 companies which equates to 1,992 firm-year observations. From this list I deduct all companies listed on the exchange segments “General Standard” and “Scale” which results in 1,204 firm-year observations. Further, I exclude all banks, financial services and insurance companies which leads to 1,024 firm-year observations. In the first step of the two-step regression model of AEE five parameters have to be estimated per year and industry. Consequently, it is required that each industry has at least five observations per year. As a result, I eliminate all industries with less than five observations per year. This leads to 968 remaining firm-year observations. As some of the firms have their preference shares as well as their common shares listed on Xetra, I delete all double listed companies. All firm financial data I collect through Thomson Reuter Datastream. If not all financial data is extractable of Datastream, I eliminate the respective firm. Auditor data including audit firm, audit office,

engagement partner, signature date, audit fees and non-audit fees I collect manually from annual reports. Firms not providing all annual reports from 2015 to 2018 I eliminate. This results in a final sample of 752 firm year observations. Table 1 provides an overview about the sample selection procedure.

**Table 1: Sample selection**

| Description | Explanation[a] | Number of observations |
|---|---|---|
| All firms listed on Xetra | Includes Prime Standard (1,204), General Standard (592) & Scale (196) | 1,992 |
| Less exchange segments | Excludes General Standard (592) and Scale (196) | -788 |
| Less financial firms | Excludes banks, financial services and insurance companies | -180 |
| Less industries including 5 or less firms based on Xetra industry classification | Excludes the following industries: Basic Resources (12), Utilities (12), Construction (12) and Food & Beverages (4) | -40 |
| Less industries including 5 or less firms based on ICB industry classification | Excludes the following industry: Consumer Staples (16) | -16 |
| Less firms not providing all annual reports from 2015 to 2018 | Excludes firms providing group reports from 2016, 2017 or 2018 onwards | -132 |
| Less double listed firms | Excludes firms (32) which have their preference shares and common shares listed on Xetra | -32 |
| Less firms for which Datastream is not providing all necessary data | Excludes firms (52) for which financial data such as total assets, income, cash flow from operations, etc. is not available | -52 |
| **Final sample size** | | **752** |

[a] number in brackets constitute firm-year observations

# Model specification

In this research I use two different audit quality models: 1) Accrual estimation error (AEE) and 2) Discretionary Accruals (DAC). Both models aim to capture the magnitude of discretionary accruals.

## Accrual Estimation Error

The first version of the Accrual Estimation Error model I use in the paper was developed by Dechow and Dichev (2002). Their idea was that all non-discretionary components of working capital including receivables, payables, inventory and tax accruals are determined by cash flows from the prior, the current and the following year. Cash received ex ante, for example, leads to the establishment of a liability which has to be settled in the following year if the liability is a component of working capital. Cash received in the current year might originate in a sale of inventory and thus results in a reduction of working capital. Cash received ex post should result in the establishment of receivables if cash is not received on a sale of inventories. So, in theory all non-discretionary components of working capital should be explainable by prior, current and following year cash flows. Thus, changes in working capital could be defined by:

$$\Delta WC_t = \partial_0 + \partial_1 CFO_{t-1} + \partial_2 CFO_t + \partial_3 CFO_{t+1} + \varepsilon_t$$

Where $\Delta WC_t$ constitutes changes in accounts receivables, accounts payables, inventory and tax payables in year t. $CFO$ depicts cash flow from operations either from the prior, the current or the following year. $\varepsilon_t$ represents the absolute amount of discretionary accruals in time t. This model was extended by McNichols (2002) who aims to link the amount of total accruals to the external economic circumstances a firm faces based on the Jones model (1991) by including the change of sales and the change in property, plant and equipment. In other words, an adverse change in the economic condition of a firm results in reduced sales which in turn reduces the total amount of accruals including discretionary and non-discretionary components. Property, plant and equipment controls for the change in depreciation reflected in inventories. As a result, McNichols came up with the following model:

$$\Delta WC_t = \partial_0 + \partial_1 CFO_{t-1} + \partial_2 CFO_t + \partial_3 CFO_{t+1} + \partial_4 \Delta SALES_t + \partial_5 PPE_t + \varepsilon_t$$

$\Delta SALES_t$ constitutes the change in sales in year t. $PPE_t$ represents the gross amount of property, plant and equipment in year t. All variables are scaled by total assets of the prior year. In this paper, I use the model of Dechow and Dichev (2002) modified by McNichols (2002) as it better captures the absolute amount of discretionary accruals by including the overall performance of the firm. As the economic circumstances and working capital requirements differ throughout time and industry, I compute the parameters per year and industry. As shown later in the sensitivity analysis section, I use two different industry classification schemes. For each classification scheme the parameters are separately estimated using OLS which results in 44 regressions for AEE. The error term serves as the proxy for AEE. The following model I use to

ultimately compute the effect of industry specialization on audit quality using the AEE as audit quality proxy:

$$AEE = \partial_0 + \partial_1 ISA + \partial_2 LEV + \partial_3 BLOCK + \partial_4 SIZE + \partial_5 ALTMAN + \partial_6 CFFO + \partial_7 LTAC + \partial_8 LOSS + \partial_9 GROWTH + \partial_{10} TAC + \partial_{11} CIMP + \partial_{12} FEES + \partial_{13} NFEES + \varepsilon$$

## Discretionary Accrual Model

The first version of the Discretionary Accrual model (DAC) I use in this paper was established by Jones (1991) which also contributed to the AEE model as described earlier. The model aims to incorporate the external economic circumstances of a firm and is constituted by:

$$TA_t = \partial_1 1_t + \partial_2 \Delta SALES_t + \partial_3 PPE_t + \varepsilon_t$$

Where $TA_t$ represents total accruals in year t, $\Delta SALES_t$ change in revenues in year t, $PPE_t$ gross amount of property, plant and equipment in year t and $\varepsilon_t$ the error term in year t. All variables including $1_t$ are scaled by total assets of the prior year. This model was extended by Kothari *et al*. (2005) and includes return on assets to not only include the overall level of sales but also the profitability of the firm. Further, an intercept was included to increase the accuracy of the model. The Kothari *et al*. (2005) model consequently takes the following form:

$$TA_t = \partial_0 + \partial_1 1_t + \partial_2 \Delta SALES_t + \partial_3 PPE_t + \partial_3 ROA_t + \varepsilon_t$$

Where $\partial_0$ depicts the intercept and $ROA_t$ the return on assets in year t. Similar as with the AEE model, I calculate the parameters using OLS per year and industry which results in a total of 44 regressions. Thereafter, for each firm-year observation total accruals are estimated based on respective parameters. The magnitude of discretionary accruals is represented by the difference of actual total accruals and predicted total accruals lagged by total assets from the prior year (DAC). As parameters were estimated based on all firm-year observations including those which engage in earnings management to a greater degree, parameter estimations are biased and contain a component of discretionary accruals. In other words, the prediction based on the respective parameters contains the average portion of discretionary accruals. Consequently, the differential between actual and predicted accruals is on average positive for firm-year observations which have higher than average discretionary accruals and negative for those which have lower than average discretionary accruals. The following model I use to calculate the effect of industry specialization on audit quality using DAC as discretionary accrual model:

$$DAC = \partial_0 + \partial_1 ISA + \partial_2 LEV + \partial_3 BLOCK + \partial_4 SIZE + \partial_5 ALTMAN + \partial_6 CFFO + \partial_7 LTAC + \partial_8 LOSS + \partial_9 GROWTH + \partial_{10} TAC + \partial_{11} CIMP + \partial_{12} FEES + \partial_{13} NFEES + \varepsilon$$

## Industry leadership

For defining industry leadership I use a modified cut-off approach based on the one established by Neal and Riley (1986). Neal and Riley (1986) defines an audit firm as industry leader if the audit firm has a bigger market share than 1.2 times the inverse of the Big N auditors. To illustrate: If there are four dominant auditors in an industry the cut-off would be 1.2 x (1/4) = 30%. However, as the number of auditors in a given industry varies significantly in my sample, I decided to modify the model of Neal and Riley (1986). Based on the Xetra industry classification the software industry, for instance, entails companies audited by 15 different auditors whereas in the telecommunication industry only four auditors are active. Thus, I decided to classify an auditor as industry specialist if the audit firm has a greater market share than 1.2 times the invers of the number of audit firms active in any given industry. For the telecommunication industry this method results in a market share threshold of 30% (1.2 x (1/4)), for the software industry in a market share threshold of 8%. Consequently, the utilized method in this paper is significantly more liberal in categorizing an audit firm as industry leader. As it can be seen in the "descriptive statistics" section, however, even this liberal industry leadership definition method mostly results in only the Big 4 audit firms, audit firm offices or engagement partners being categorized as industry leaders. All market share data are computed based on audit fees.

To measure the effect of industry specialization on audit quality, several dummies are created which are used in respective regression models. The dummy equals 1 if the market share threshold as outlines above is exceeded. Otherwise the dummy equals zero. Firm level industry leadership is computed based on the total audit fees an audit firm collects in an industry relative to all audit fees collected in a respective industry in a given year on a national level. City level industry leadership is computed based on the aggregate audit fees an audit firm office earns relative to all audit fees collected in that industry in a respective industry in a given year on a national level. Partner level industry leadership is defined by total audit fees a partner collects compared to all audit fees collected in an industry in a given year on a national level. The cut-off approach used in this paper is adjusted for city- and partner level industry expertise. That means that instead of using the number of active audit firms in a given industry, the number of

offices having mandates in that industry is taken instead. Same holds for the partner level. All industry leadership computations are calculated per year.

## Variable selection

The set of control variables used in this paper is based on the range of control variables used by pertinent research discussed in the literature review. I control for variables of the two following categories: company characteristics and auditor characteristics. I originally planned to also include corporate governance characteristics such as audit committee independence, frequency of audit committee meetings, audit committee experience and board independence but unfortunately Datastream does not provide a sufficient amount of data for all firm-year observations. Consequently, I abstained from using any corporate governance control variables. Table 2 contains all audit quality, industry specialist auditor and control variables used in this paper.

### Company characteristics

I control for a set of company characteristics including company size (SIZE), leverage (LEV), bankruptcy risk (ALTMAN), current year total accruals (TAC), lagged total accruals (LTAC), cash flow from operations (CFFO), bottom line losses (LOSS), growth opportunities (GROWTH) and large holdings from shareholders (BLOCK). Dechow and Dichev (2002) state that large firms are less likely to make estimation errors in their stated accruals as large firms have on average more stable operations. They also state that having a diversified business contributes to mitigating the effect of estimation errors. Myers *et al.* (2003) report that firm size is positively related to earnings quality. DeFond and Jiambalvo (1994) find that prior to the year in which a debt covenant violation is discovered, abnormal accruals are positive. Augustia *et al.* (2020) find no relationship between bankruptcy risk measured by the Altman Z score (1968 model) and earnings management measured by discretionary accruals. Heninger (2001) find a positive relation between total accruals and auditor litigation. Francis and Krishnan (1999) state that lower accruals are associated with higher auditor conservatism and thus higher audit quality. Kharuddin et al. (2020) report that lagged accruals are used to capture reversal effects over time. Menon and Williams (2004) report that operating cash flow as a proxy for performance has a significant impact on the level of abnormal accruals. Kothari et al. (2005) state that accruals are correlated with contemporaneous and historical performance. Mosebach and Simko (2010) find that loss making firms report higher levels of discretionary accruals vis-

à-vis their profitable counterparts for the periods in which losses are reported. Skinner and Sloan (2002) state that growth stocks have an incentive to manipulate their earnings as not hitting the forecasted numbers results in a lower stock price. Wang (2006) reports that founding family ownership is associated with higher reporting quality. Similarly, it can be expected from larger shareholders that they are better able to pressure management to issue high quality financial reports.

## Auditor characteristics

Auditor characteristics I control for are audit fees (FEES), non-audit fees (NFEES) and client importance (CIMP). Antle *et al.* (2006) find evidence that higher fees result in higher abnormal accruals. Frankel *et al.* (2002) report that audit fees are negatively associated with earnings management while non-audit fees are positively related to discretionary accruals. Basioudis and Francis (2007) find that audit firm industry leaders demand higher audit fees for the better services they provide. Cahan *et al.* (2008) find no relationship between non-audit fees and discretionary accruals. However, the researcher report that the auditor's independence might be compromised when non-audit fees and client importance are high. Frankel *et al.* (2002) report that audit fees are negatively associated with earnings management while non-audit fees are positively related to discretionary accruals. Singh *et al.* (2019) find that fees of non-audit services are positively related to discretionary accruals if the audit-tenure is short for the respective engagement. Chung and Kallapur (2003) find no relation between abnormal accruals and any type of client importance measure. Kharuddin *et al.* (2020) find that higher client importance is associated with less discretionary accruals.

**Table 2: Variable definition**

| Variable name | Variable abbr. | Variable defined by |
|---|---|---|
| ***Audit quality*** | | |
| Accrual Estimation Error | AEE | Degree of discretionary accruals based on the model proposed by Kothari (2005) |
| Discretionary Accruals | DAC | Degree of discretionary accruals based on the model proposed by McNichols (2002) |
| ***ISA (Industry Speciallist Auditor)*** | | |

| | | |
|---|---|---|
| National level industry leader | NAT | Dummy variable, 1 if audit firm has a relatively high market share in a respective industry on a national level, 0 otherwise |
| City level industry leader | CIT | Dummy variable, 1 if audit firm office has a relatively high market share in a respective industry on a national level, 0 otherwise |
| Partner level industry leader | PAR | Dummy variable, 1 if audit firm partner has a relatively high market share in a respective industry on a national level, 0 otherwise |
| National and city level industry leader | JOINT (NC) | Dummy variable, 1 if audit firm and audit firm office have a relatively high market share in a respective industry on a national level, 0 otherwise |
| National level industry leader only | NATO | Dummy variable, 1 if only the audit firm has a relatively high market share in a respective industry on a national level, 0 otherwise |
| City level industry leader only | CITO | Dummy variable, 1 if only the audit firm office has a relatively high market share in a respective industry on a national level, 0 otherwise |
| National, city and partner level industry leader | JOINT (NCP) | Dummy variable, 1 if audit firm, audit firm office and audit firm partner have a relatively high market share in a respective industry on a national level, 0 otherwise |
| National level industry leader only | NATO | Dummy variable, 1 if only the audit firm has a relatively high market share in a respective industry on a national level, 0 otherwise |
| City level industry leader only | CITO | Dummy variable, 1 if only the audit firm office has a relatively high market share in a respective industry on a national level, 0 otherwise |
| Partner level industry leader only | PARO | Dummy variable, 1 if only the audit firm partner has a relatively high market share in a respective industry on a national level, 0 otherwise |
| ***Control*** | | |
| Leverage | LEV | book value of liabilities scaled by book value of total assets |
| Block-holdings | BLOCK | share hold by investors who individually hold at least 5% of the equity |
| Company size | SIZE | natural logarithm of book value of total assets |
| Bankrupcty risk | ALTMAN | Altman's Z score (model from 1983) |
| Cash flow from operations | CFFO | Cash flow from operations scaled by total assets |
| Lagged total accruals | LTAC | Net income from continuing operatings in year t-1 minus operating cash flow in year t-1 divided by total assets in year t-2 |
| Bottom-line losses | LOSS | dummy variable, 1 if loss is reported, 0 otherwise |

| | | |
|---|---|---|
| Growth opportunities | GROWTH | Market to book ratio |
| Total accruals | TAC | income from continuing operations in year t minus operating cash flow in year t scaled by total assets in year t-1 |
| Client importance | CIMP | Audit and non-audit fees earned by one client scaled by total fees an office earned |
| Audit fees | FEES | natural logarithm of audit fees |
| Non-audit fees | NFEES | natural logarithm of non-audit fees |

# Descriptive statistics

## Overall German audit market structure between 2015 and 2018

As most other audit markets around the world, the German audit market is very concentrated around a few big firms. The big 4 audit firms PwC, KPMG, EY and Deloitte collect on average 97% of all audit fees across all industries over the time span from 2015 to 2018 while second tier and third tier audit firms collect 2% and 1% of total audit fees, respectively. Those results are shown in Panel B of table 3. PwC and KPMG alone collect 73% of all audit fees as depicted in Panel A of table 3. Panel C of table 3 depicts the five biggest audit firms per industry based on the average collected audit fees over the years 2015 to 2018. As it can be seen PwC, KPMG and EY are without exception always either the biggest or the second biggest audit firm across all industries based on audit fees. This is important to note as I primary define industry leadership based on audit fees and apply the cut-off approach as described in the chapter model specification. By applying a cut-off value of 1.2 the threshold of being classified as an industry leader in the technology and chemicals industry is 13% and 24%, respectively. As it can be seen in Panel C, the market share of Deloitte in the technology and chemicals industry is 11% in each case. That means that based on audit fees and a cut-off value of 1.2 only PwC, KPMG and EY can be classified as industry leaders on the firm-level.

As already outlined in the literature review, the high concentration of market share of the Big 4 audit firms is not a result of the high number of audit mandates the Big 4 audit firms combine on themselves but rather a result of the Big 4 audit firms auditing the biggest firms measured by audit fees or client sales. To illustrate: Each of the 23 DAX30 firms, which are all DAX30 constituents remaining of the DAX30 after the sample selection procedure was undertaken, are audited by one of the Big 4 audit firms. Those 23 firms combine 57% of audit fees of the 206 firms for which audit fee data was collected. In comparison: measured by the number of audit

mandates, the Big 4 audit firms only combine 19% of all audit mandates on themselves based on all the firms I collected audit fee data on.

The same asymmetric distribution of audit fees holds true on the city and partner level. Based on audit fees as market share measure, market shares concentrate on single offices and partners. The biggest offices of PwC, KPMG, Deloitte and EY individually are Dusseldorf for PwC and Munich for KPMG, Deloitte and EY. In the same order they individually collect 32%, 23%, 41% and 53% of audit firms relative to total audit fees collected by the entire firm while in total having 14, 16, 7 and 12 domestic offices. Based on the standard cut-off value of 1.2 only Big 4 audit firms are categorized as office level industry leaders except BDO which is one of the industry leaders in the software industry on the office level.

The partners who individually collects the highest amount of audit fees of the Big 4 audit firms are Mr. Hübner, Mr. Thümler, Mr. Beine and Mr. Spannagl stated in the same audit firm order as above. Compared to total audit fees of the audit firm, they collect 14%, 18%, 19% and 40% of audit fees mainly through one or two audit mandates. Based on audit fees the single biggest audit mandates of those four engagement partners are Volkswagen, Daimler, Bayer and Siemens. The number of partners of PwC, KPMG, Deloitte and EY are 58, 62, 24 and 55. Similar to the office level only partners of Big 4 audit firms are classified as industry leaders based on a cut-off value of 1.2. The only exception to this is a partner of BDO for the software industry.

## Development of the German audit market structure from 2015 to 2018

Based on audit fees the German audit market grew 5.9% across all industries and audit firms. Audit fees from Big 4 clients grew by the same amount whereas audit fees of second and third tier audit firms grew by 5.1% and 6.2%, respectively. Based on the number of audit mandates Big 4 audit firms reduced their market share by 0.21% and second and third tier audit firms increased their market share by 0.01%. Consequently, it can be said that that market shares of the Big 4, second and third tier audit firms remained rather constant over that time.

Since 2016, however, auditor rotation in Germany became mandatory. Each ten years a firm has to put the respective audit mandate out for tender and each 20 years the audit firm has to change. From 2015 to 2018 PwC was the only Big 4 audit firm which lost audit mandates, which already lead to an auditor change between 2015 and 2018, among the DAX30 companies in my sample to another Big 4 auditor firm.

## Table 3: Distribution of audit fees per year and industry nationally

***Panel A: Yearly distribution of audit fees and market shares of audit firms in Germany***

| | 2015 | | 2016 | | 2017 | | 2018 | | Average | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Audit firm** | **€'000** | **%** | **€'000** | **%** | **€'000** | **%** | **€'000** | **%** | **€'000** | **%** |
| PwC | 113,655 | 44.0% | 120,212 | 45.1% | 115,632 | 40.9% | 121,125 | 39.5% | 117,656 | 42.4% |
| KPMG | 76,686 | 29.7% | 78,502 | 29.4% | 91,754 | 32.5% | 100,907 | 32.9% | 86,962 | 31.1% |
| EY | 49,909 | 19.3% | 49,267 | 18.5% | 53,460 | 18.9% | 58,320 | 19.0% | 52,739 | 18.9% |
| Deloitte | 9,410 | 3.6% | 9,785 | 3.7% | 11,636 | 4.1% | 15,630 | 5.1% | 11,615 | 4.1% |
| BDO AG | 2,975 | 1.2% | 2,522 | 0.9% | 3,138 | 1.1% | 2,696 | 0.9% | 2,833 | 1.0% |
| Ebner Stolz | 1,868 | 0.7% | 2,028 | 0.8% | 2,095 | 0.7% | 2,923 | 1.0% | 2,229 | 0.8% |
| Warth & Klein Grant Thornton | 603 | 0.2% | 641 | 0.2% | 1,005 | 0.4% | 973 | 0.3% | 806 | 0.3% |
| Mazars | 712 | 0.3% | 757 | 0.3% | 836 | 0.3% | 856 | 0.3% | 790 | 0.3% |
| Baker Tilly | 349 | 0.1% | 589 | 0.2% | 842 | 0.3% | 806 | 0.3% | 647 | 0.2% |
| S&P GmbH | 368 | 0.1% | 301 | 0.1% | 311 | 0.1% | 360 | 0.1% | 335 | 0.1% |
| Rödl & Partner | 48 | 0.0% | 453 | 0.2% | 329 | 0.1% | 376 | 0.1% | 302 | 0.1% |
| RSM | 338 | 0.1% | 50 | 0.0% | 310 | 0.1% | 308 | 0.1% | 252 | 0.1% |
| PKF Deutschland | 195 | 0.1% | 200 | 0.1% | 300 | 0.1% | 305 | 0.1% | 250 | 0.1% |
| Bauer Schätz Hasenclever | 157 | 0.1% | 189 | 0.1% | 199 | 0.1% | 225 | 0.1% | 193 | 0.1% |
| BTU Treuhand | 188 | 0.1% | 190 | 0.1% | 185 | 0.1% | 182 | 0.1% | 186 | 0.1% |
| Breidenbach und Partner | 150 | 0.1% | 150 | 0.1% | 169 | 0.1% | 175 | 0.1% | 161 | 0.1% |
| Best Audit | 162 | 0.1% | 163 | 0.1% | 132 | 0.0% | 0 | 0.0% | 114 | 0.0% |
| KPWT Kirschner | 67 | 0.0% | 68 | 0.0% | 68 | 0.0% | 68 | 0.0% | 68 | 0.0% |
| PKF Fasselt Schlage | 35 | 0.0% | 60 | 0.0% | 83 | 0.0% | 84 | 0.0% | 66 | 0.0% |
| Binder, Hillebrecht & Partner | 119 | 0.0% | 120 | 0.0% | 0 | 0.0% | 0 | 0.0% | 60 | 0.0% |
| Metropol Audit | 52 | 0.0% | 52 | 0.0% | 57 | 0.0% | 62 | 0.0% | 56 | 0.0% |
| Dr. Stückmann und Partner | 0 | 0.0% | 132 | 0.0% | 0 | 0.0% | 0 | 0.0% | 33 | 0.0% |
| Moore Stephens Treuhand Kurpfalz | 60 | 0.0% | 62 | 0.0% | 0 | 0.0% | 0 | 0.0% | 31 | 0.0% |
| Rupp & Epple | 63 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 16 | 0.0% |

***Panel B: Yearly distribution of audit fees and market shares of audit firm categories in Germany***

| | 2015 | | 2016 | | 2017 | | 2018 | | Average | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Audit firm category** | **€'000** | **%** | **€'000** | **%** | **€'000** | **%** | **€'000** | **%** | **€'000** | **%** |
| Big 4 | 249,660 | 97% | 257,766 | 97% | 272,482 | 97% | 295,982 | 97% | 268,973 | 97% |
| Second tier | 4,843 | 2% | 4,550 | 2% | 5,233 | 2% | 5,619 | 2% | 5,061 | 2% |
| Third tier | 3,317 | 1% | 3,823 | 1% | 3,984 | 1% | 3,974 | 1% | 3,775 | 1% |

***Panel C: National industry specialist based on market shares in Germany[a]***

| | #1 | | #2 | | #3 | | #4 | | #5 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Industry as defined by Xetra** | **firm** | **%** | **firm** | **%** | **firm** | **%** | **firm** | **%** | **firm** | **%** |
| Telecommunication | PwC | 89% | EY | 8% | BDO AG | 2% | Ebner Stolz | 0% | N/A | |
| Industrial | EY | 47% | PwC | 24% | KPMG | 16% | Deloitte | 7% | Ebner Stolz | 2% |
| Pharma & Healthcare | KPMG | 68% | EY | 14% | PwC | 7% | Deloitte | 4% | BDO AG | 2% |
| Consumer | KPMG | 45% | EY | 25% | PwC | 16% | Deloitte | 8% | BDO AG | 5% |
| Technology | KPMG | 45% | PwC | 24% | Deloitte | 11% | EY | 6% | BDO AG | 5% |
| Automobile | KPMG | 59% | PwC | 36% | EY | 5% | Baker Tilly | 0% | N/A | |
| Software | EY | 48% | KPMG | 27% | PwC | 11% | BDO AG | 7% | PKF | 1% |
| Chemicals | PwC | 47% | KPMG | 38% | Deloitte | 11% | EY | 3% | Warth & Klein | 1% |
| Retail | KPMG | 77% | EY | 8% | PwC | 7% | Ebner Stolz | 4% | Deloitte | 2% |
| Media | KPMG | 65% | EY | 21% | PwC | 7% | Mazars | 3% | Ebner Stolz | 3% |
| Transportation & Logistics | PwC | 86% | KPMG | 9% | Mazars | 2% | Deloitte | 2% | EY | 1% |

[a] market shares depicted in the table are computed as average market shares over the time period 2015 to 218

Since 2017 Bayer, one of the biggest German chemical companies, is audited by Deloitte and since 2018 Covestro, also a big chemical company, is audited by KPMG. In 2016, Deloitte collected a total of 700.000€ in audit fees from companies in the chemical industry in my sample. Due to the new auditor mandate of Bayer, auditor fees collected by Deloitte in the chemical industry jumped to 6.800.000€ of which 6.000.000€ are attributable to Bayer. Due to the auditor rotation requirement it is likely that industry leaderships of the Big 4 audit firms based on audit fee market share will shift from one respective Big 4 audit firm to another. The auditor change of Bayer in 2017 from PwC to Deloitte is an example of how significant the amount of audit fees collected by an audit firm in a certain industry can be from one year to the next.

## Descriptive statistics of variables used in audit quality models

In table 4, I provide descriptive statistics of the variables used in respective audit quality models including means, medians, standard variations, minimums and maximums. I winsorized all variables by cutting of the extreme values which are further away than 1.96 standard variations to the left or right side on respective distributions. The Altman Z score I winsorized at 1.28 standard distributions on positive end due to extreme values.

**Table 4: Descriptive statistics**

| Variable | Mean | Median | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| AEE | 0.000 | 0.000 | 0.062 | -0.144 | 0.163 |
| DAC | 0.000 | -0.001 | 0.047 | -0.111 | 0.106 |
| LEV | 0.275 | 0.259 | 0.213 | 0.000 | 0.745 |
| BLOCK | 0.602 | 0.600 | 0.247 | 0.110 | 1.000 |
| SIZE | 13.437 | 13.076 | 2.205 | 9.521 | 18.622 |
| ALTMAN | 11.424 | 4.397 | 16.490 | -5.867 | 54.358 |
| CFFO | 0.079 | 0.092 | 0.120 | -0.361 | 0.304 |
| LTAC | -0.035 | -0.027 | 0.054 | -0.184 | 0.080 |
| LOSS | 0.201 | 0.000 | 0.401 | 0.000 | 1.000 |
| GROWTH | 3.153 | 2.385 | 2.590 | 0.000 | 11.740 |
| TAC | -0.035 | -0.027 | 0.054 | -0.189 | 0.073 |
| FEES | 6.065 | 5.903 | 1.264 | 4.094 | 9.210 |
| NFEES | 4.111 | 4.575 | 2.399 | 0.000 | 8.700 |
| CIMP | 0.116 | 0.063 | 0.126 | 0.001 | 0.524 |

### Pearson correlation coefficient

Table 5 provides a correlation matrix of all variables used in the audit quality models employed. By being conservative and defining a correlation as high if the Pearson correlation coefficient is above 0.7, four correlations in the correlation matrix are categorized as high. The respective correlation pairs are F – D, I – E, J – G and U – Q. The first three pairs can be disregarded as they are not used in the same regressions. U represents total accruals and Q represents cash flow from operations. This correlation could indeed pose a multicollinearity issue. Nearly all research undertaken on audit quality, however, which utilizes the discretionary accrual models I use in this paper use both variables in respective models. Consequently, I decided to abstain from eliminating one of the variables.

## Results

The results of the models I run are shown in table 6. As described in the chapter "model specification" I employ two different audit quality models which are both based on a discretionary accrual measure. Both models, the Accrual Estimation Error model (AEE) and the Discretionary Accrual model (DAC), estimate the portion of discretionary accruals based on the difference between actual accruals and predicted accruals. The AEE model I use in this paper was established by Dechow and Dichev (2002) and modified by McNichols (2002). The DAC model was constructed by Jones (1991) and modified by Kothari *et al.* (2005). Both models have been used in prior literature to assess the quality of audits whereas the discretionary accrual model has been more frequently applied in the past. In each model I use the same set of control variables which are listed in table 2. For each of the audit quality models I run five different OLS regressions. In the first three regressions I test whether firm-, city- and partner level industry expertise stand-alone do affect audit quality whereas model 1 (M1) includes a firm level, model 2 (M2) a city level and model 3 (M3) a partner level dummy for auditor industry specialization. In model 4 (M4), I utilize the joint national city framework developed by Ferguson *et al*. (2003). This model concurrently tests whether auditors who are industry leaders on the national level but not on the city level, the city level but not on the national level or on the national and city level have an impact on audit quality. Consequently, this model employs three dummies, one for national, one for city and for national-city industry leadership. Model 5 (M5) is an extension of M4. This model tests the impact of national-, city-, partner- and national-city-partner industry leadership using the same methodology as outlined for M4. How the industry leadership dummies are constructed is explained in the chapter "model specification".

**Table 5: Pearson correlation coefficiants**

| Variable name | Variable abbr. | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AEE | A | 1.00 | | | | | | | | | | | |
| DAC | B | 0.15 | 1.00 | | | | | | | | | | |
| NAT | C | -0.05 | -0.03 | 1.00 | | | | | | | | | |
| CIT | D | 0.01 | 0.02 | 0.42 | 1.00 | | | | | | | | |
| PAR | E | -0.02 | 0.05 | 0.26 | 0.61 | 1.00 | | | | | | | |
| JOINT (NC) | F | 0.03 | 0.00 | 0.52 | 0.92 | 0.53 | 1.00 | | | | | | |
| NATO | G | -0.08 | -0.04 | 0.59 | -0.42 | -0.22 | -0.39 | 1.00 | | | | | |
| CITO | H | -0.04 | 0.04 | -0.20 | 0.29 | 0.24 | -0.11 | -0.12 | 1.00 | | | | |
| JOINT (NCP) | I | -0.01 | 0.01 | 0.33 | 0.59 | 0.88 | 0.64 | -0.25 | -0.07 | 1.00 | | | |
| NATO | J | -0.08 | -0.05 | 0.58 | -0.41 | -0.27 | -0.38 | 0.98 | -0.12 | -0.24 | 1.00 | | |
| CITO | K | -0.05 | 0.00 | -0.12 | 0.18 | -0.05 | -0.06 | -0.07 | 0.61 | -0.04 | -0.07 | 1.00 | |
| PARO | L | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| LEV | M | -0.02 | 0.02 | -0.06 | 0.06 | 0.06 | 0.07 | -0.13 | -0.03 | 0.07 | -0.13 | -0.03 | 0.00 |
| BLOCK | N | -0.01 | 0.06 | 0.05 | 0.13 | 0.22 | 0.11 | -0.05 | 0.05 | 0.20 | -0.04 | -0.05 | 0.00 |
| SIZE | O | -0.02 | 0.03 | 0.36 | 0.57 | 0.50 | 0.58 | -0.16 | 0.05 | 0.52 | -0.17 | 0.02 | 0.00 |
| ALTMAN | P | -0.01 | 0.01 | -0.05 | -0.05 | -0.04 | -0.04 | -0.02 | -0.02 | -0.04 | -0.02 | -0.01 | 0.00 |
| CFFO | Q | -0.03 | -0.06 | 0.02 | 0.01 | 0.01 | 0.02 | 0.00 | -0.01 | 0.01 | 0.00 | -0.01 | 0.00 |
| LTAC | R | 0.01 | 0.01 | 0.05 | 0.05 | 0.03 | 0.04 | 0.01 | 0.01 | 0.02 | 0.01 | 0.00 | 0.00 |
| LOSS | S | -0.04 | -0.02 | -0.13 | -0.14 | -0.15 | -0.17 | 0.02 | 0.06 | -0.15 | 0.03 | 0.10 | 0.00 |
| GROWTH | T | -0.04 | -0.11 | 0.06 | -0.04 | -0.04 | -0.01 | 0.08 | -0.07 | -0.04 | 0.07 | -0.04 | 0.00 |
| TAC | U | 0.00 | 0.03 | 0.05 | 0.05 | 0.03 | 0.04 | 0.02 | 0.01 | 0.02 | 0.01 | 0.00 | 0.00 |
| FEES | V | -0.02 | 0.05 | 0.40 | 0.63 | 0.58 | 0.62 | -0.15 | 0.08 | 0.59 | -0.16 | 0.03 | 0.00 |
| NFEES | W | 0.00 | 0.07 | 0.27 | 0.42 | 0.37 | 0.41 | -0.09 | 0.05 | 0.37 | -0.10 | 0.00 | 0.00 |
| CIMP | X | 0.08 | 0.05 | -0.32 | -0.22 | -0.04 | -0.22 | -0.14 | -0.02 | -0.05 | -0.13 | -0.07 | 0.00 |

| Variable name | Variable abbreviation | M | N | O | P | Q | R | S | T | U | V | W | X |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LEV | M | 1.00 | | | | | | | | | | | |
| BLOCK | N | 0.06 | 1.00 | | | | | | | | | | |
| SIZE | O | 0.13 | 0.13 | 1.00 | | | | | | | | | |
| ALTMAN | P | -0.07 | 0.05 | -0.03 | 1.00 | | | | | | | | |
| CFFO | Q | 0.01 | 0.03 | 0.09 | 0.01 | 1.00 | | | | | | | |
| LTAC | R | 0.00 | -0.04 | 0.07 | 0.01 | 0.00 | 1.00 | | | | | | |
| LOSS | S | 0.02 | -0.03 | -0.37 | 0.03 | -0.17 | -0.03 | 1.00 | | | | | |
| GROWTH | T | -0.12 | -0.05 | -0.14 | 0.02 | 0.02 | 0.01 | -0.06 | 1.00 | | | | |
| TAC | U | 0.01 | -0.04 | 0.07 | 0.01 | -0.89 | 0.02 | -0.12 | 0.05 | 1.00 | | | |
| FEES | V | 0.14 | 0.18 | 0.91 | -0.05 | 0.03 | 0.06 | -0.26 | -0.12 | 0.07 | 1.00 | | |
| NFEES | W | 0.14 | 0.19 | 0.60 | 0.00 | 0.04 | 0.02 | -0.15 | -0.16 | -0.01 | 0.63 | 1.00 | |
| CIMP | X | 0.00 | -0.02 | -0.09 | -0.02 | 0.02 | 0.01 | -0.05 | -0.07 | 0.00 | -0.11 | -0.05 | 1.00 |

In table 6 all p-values are assigned based on a two-tailed test as the different predictions in signs would make one-tailed p-values assignments unclear. My formulated hypotheses, however, require a one-tailed test. Consequently, I bolded all ISA variables which are significant disregarding the significance level in table 6. In all five AEE models I find that most of the industry specialist variables are negatively correlated with discretionary accruals except the joint national-city industry variable in M4. CIT in M2 (0.1>p) and NATO in M5 are significant (0.05>p). NATO in M4 and CITO in M5 are close to be significant (0.1>p). In the DAC model, however, none of ISA variables are significant and there is also no pattern in sign recognizable.

In addition to the standard case on which the above presented results are based on, I conducted a set robustness checks to better validate the findings of this research. Those robustness checks I present in the next chapter. Thereafter follows a discussion in which I compare my findings to those of research undertaken in the past.

# Sensitivity analysis

To increase the robustness of my findings I conducted a sensitivity analysis which comprises the following components: 1) alternative industry classification scheme 2) alternative market share measures 3) alternative industry specialization measures 4) reduced controls 4) combination of market share measure and industry classification scheme. All alternative measures are computed for the AEE and the DAC model. Table 7 shows the results of the sensitivity analysis.

## 1) Alternative industry classification scheme

The industry classification scheme I use in the standard scenario is provided directly from the official Xetra website. Additionally, I use the industry classification scheme "Industry Classification Benchmark" which is currently used as industry classification scheme of STOXX and FTSE international. Industry classification for each firm-year observation I extract from Datastream. As the 88 OLS regressions which were needed to estimate the parameters in the first step of the AEE and DAC model are industry and year specific, I recalculate the parameters needed in the AEE and DAC model based on ICB industry classification scheme. This results in 56 OLS regressions.

## Table 6: Regression results[a]

| N = 752 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Predicted sign** | | **AEE** | | | | | **DAC** | | | |
| **(+/-)** | | **M1** | **M2** | **M3** | **M4** | **M5** | **M1** | **M2** | **M3** | **M4** | **M5** |
| **Independent variables** | | **Coef (t-stat)** | **Coef (t-stat)** | **Coef (t-stat)** | **Coef (t-stat)** | **Coef (t-stat)** | **Coef (t-stat)** | **Coef (t-stat)** | **Coef (t-stat)** | **Coef (t-stat)** | **Coef (t-stat)** |
| ***ISA*** | | | | | | | | | | | |
| NAT | - | -0.002 | | | | | -0.003 | | | | |
| | | (-0.381) | | | | | (-0.647) | | | | |
| CIT | - | | **0.011** | | | | | 0.000 | | | |
| | | | **(-1.448)** | | | | | (0.009) | | | |
| PAR | - | | | -0.005 | | | | | 0.002 | | |
| | | | | (-0.569) | | | | | (0.281) | | |
| JOINT (NC) | - | | | | 0.009 | | | | | -0.003 | |
| | | | | | (1.005) | | | | | (-0.403) | |
| NATO | - | | | | -0.009 | | | | | -0.002 | -0.004 |
| | | | | | (-1.257) | | | | | (-0.343) | (-0.798) |
| CITO | - | | | | -0.013 | | | | | 0.009 | 0.005 |
| | | | | | (-0.788) | | | | | (0.695) | (0.251) |
| JOINT (NCP) | - | | | | | -0.008 | | | | | -0.007 |
| | | | | | | (-0.77) | | | | | (-0.887) |
| NATO | - | | | | | **-0.012** | | | | | -0.004 |
| | | | | | | **(-1.987)**** | | | | | (-0.798) |
| CITO | - | | | | | -0.031 | | | | | 0.005 |
| | | | | | | (-1.238) | | | | | (0.251) |
| PARO | - | | | | | N/A | | | | | N/A |
| | | | | | | N/A | | | | | N/A |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Control*** | | | | | | | | | | | |
| LEV | - | -0.003 | -0.002 | -0.003 | -0.004 | -0.004 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| | | (-0.483) | (-0.372) | (-0.451) | (-0.636) | (-0.728) | (0.196) | (0.285) | (0.293) | (0.273) | (0.2) |
| BLOCK | + | -0.005 | -0.005 | -0.004 | -0.005 | -0.005 | 0.010 | 0.010 | 0.009 | 0.009 | 0.011 |
| | | (-0.438) | (-0.46) | (-0.352) | (-0.419) | (-0.42) | (1.147) | (1.154) | (1.106) | (1.121) | (1.25) |
| SIZE | - | 0.000 | 0.000 | 0.000 | -0.001 | -0.001 | -0.002 | -0.002 | -0.002 | -0.002 | -0.002 |
| | | (-0.067) | (-0.076) | (-0.082) | (-0.274) | (-0.203) | (-0.786) | (-0.757) | (-0.739) | (-0.716) | (-0.829) |
| ALTMAN | + | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | | (0.044) | (0.124) | (0.058) | (0.012) | (-0.049) | (0.445) | (0.487) | (0.493) | (0.478) | (0.447) |
| CFFO | - | -0.054 | -0.056 | -0.055 | -0.051 | -0.051 | -0.035 | -0.036 | -0.036 | -0.036 | -0.036 |
| | | (-2.689)*** | (-2.786)*** | (-2.754)*** | (-2.487)** | (-2.513)** | (-2.271)** | (-2.343)** | (-2.336)** | (-2.341)** | (-2.328)** |
| LTAC | + | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| | | (0.307) | (0.266) | (0.297) | (0.327) | (0.333) | (0.272) | (0.248) | (0.246) | (0.254) | (0.259) |
| LOSS | + | -0.023 | -0.024 | -0.023 | -0.022 | -0.021 | -0.013 | -0.013 | -0.013 | -0.014 | -0.013 |
| | | (-2.587)*** | (-2.664)*** | (-2.608)*** | (-2.462)** | (-2.402)** | (-1.944)* | (-1.955)* | (-1.95)* | (-2.01)** | (-1.982)** |
| GROWTH | + | -0.001 | -0.001 | -0.001 | -0.001 | -0.001 | -0.001 | -0.001 | -0.001 | -0.001 | -0.001 |
| | | (-0.602) | (-0.677) | (-0.608) | (-0.751) | (-0.658) | (-2.235)** | (-2.283)** | (-2.293)** | (-2.181)** | (-2.22)** |
| TAC | + | -0.047 | -0.048 | -0.048 | -0.043 | -0.043 | -0.025 | -0.026 | -0.026 | -0.027 | -0.026 |
| | | (-2.508)** | (-2.609)*** | (-2.574)** | (-2.305)** | (-2.332)** | (-1.81)* | (-1.883)* | (-1.875)* | (-1.885)* | (-1.87)* |
| FEES | - | 0.000 | -0.003 | 0.000 | -0.002 | 0.001 | 0.004 | 0.003 | 0.003 | 0.004 | 0.004 |
| | | (-0.06) | (-0.518) | (0.053) | (-0.334) | (0.095) | (0.926) | (0.789) | (0.693) | (0.828) | (1.031) |
| NFEES | - | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| | | (0.147) | (0.048) | (0.119) | (0.138) | (0.156) | (0.716) | (0.666) | (0.666) | (0.692) | (0.679) |
| CIMP | - | 0.035 | 0.042 | 0.038 | 0.037 | 0.030 | 0.014 | 0.017 | 0.016 | 0.015 | 0.015 |
| | | (1.906)* | (2.356)** | (2.143)** | (1.985)** | (1.708)* | (0.99) | (1.227) | (1.236) | (1.036) | (1.136) |
| INTERCEPT | | 0.013 | 0.025 | 0.009 | 0.031 | 0.018 | 0.001 | 0.002 | 0.003 | 0.001 | -0.001 |
| | | (0.604) | (1.06) | (0.383) | (1.317) | (0.756) | (0.09) | (0.096) | (0.187) | (0.029) | (-0.042) |

[a] figures in bold depict ISA variables which are significant disregarding the p-value based on a one-tailed test. * represents 0.1>p, ** represents 0.05>p and *** represents 0.01>p based on a two-tailed test

### 2) Alternative market share measures

Prior research utilized various proxies to measure market share. In the standard scenario I use audit fee data which I manually collected from respective annual reports. As an alternative market share measure, I use audit firm client sales. Client sale data, as all other company financials, I extract from Datastream. Market shares based on sales are equally computed as on audit fees (see chapter "model specification").

### 3) Alternative industry specialization measures

As described in the "model specification" section, I base my industry specialization measure on the one developed by Neal and Riley (1986). As explained, the industry specialization methodology I use results in a more liberal industry specialist definition for some industries. Thus, I increase the cut-off value to 1.8. This results in less audit firms being categorized as industry leaders. To investigate whether the results would change if the industry specialist definition would be more liberal, I also set the cut-off value to 0.8.

### 4) Reduced controls

As different researchers utilized diverse sets of control variables for the same dependent variable, I decided to run an extra regression for AEE and DAC in which I employ only those control variables which are nearly used in all prior research papers. The most common set of control variables include: total assets, cash flow from operation, leverage, a dummy variable indicating whether the company incurred a loss in a given period and total accruals.

### 5) Combinations of market share measure and industry classification scheme

Further, I combine the alternative market share measure and the alternative industry classification scheme. That means, for a cut-off value of 1.2, the industry classification scheme set to ICB and the market share being computed based on sales rather than audit fees, I re-calculate the ISA variables.

## Discussion

As outlined in the results section the only significant findings in the standard scenario which sets the cut-off value to 1.2, uses the Xetra industry classification scheme and utilizes audit fees as market share measure only the AEE model leads to significant results. Based on a one-tailed test CIT in M2 (0.1>p) and NATO in M5 (0.05>p) are significantly negative. Those results

imply that regarding the city level alone city level industry leaders result in discretionary working capital accruals are decreased in the absolute amount of 1.1% relative to total assets. Industry specialists who are only industry leaders on the firm level but not on the city or partner level results in absolute decreased discretionary working capital accruals of 1.2% compared to total assets. Even though the results of city only level industry leadership in AEE M5 are not significant (0.1>p) they exhibit the highest magnitude of discretionary accrual decrease (3.1% of total assets).

The application of a higher cut-off value of 1.8, alternative measures of market share and the reduction of control variables provide further insights in the context of the AEE model. Applying a cut-off value of 1.8 in the AEE model, ceteris paribus, lead to a significant positive effect in two of the models of industry leaders on the magnitude of discretionary accruals. As those are the only positive relationships of industry expertise on discretionary accruals reported in my research beside one positive result in the DAC model compared to a total of 14 negative results, I further investigated the underlying reasons for it. Compared to the standard results reported, in which CIT is significantly negative and JOINT (NC) not significantly positive, stand alone increasing the cut-off to 1.8 resulted in CIT and JOINT (NC) being significantly positive (0.1>p). As increasing the cut-off value results in less audit firms being categorized as industry leaders, I examined the data and found that the number of companies being audited by industry leaders decreased form 57 in the 1.2 cut-off case to 47 in the 1.8 cut-off case in AEE M2. That means those audit offices which audited those ten companies which were excluded in the 1.8 cut-off must have contributed positively to audit quality. Interestingly, six of the ten companies were audited by audit offices located in Frankfurt: two belonged to EY, one to Deloitte and three to PwC. The other four audit offices were located in Düsseldorf, Mannheim, Hamburg and Berlin. That might suggest that audit offices located in Frankfurt might improve audit quality significantly. In the AEE model in which the measure of market shares were changed from audit fees to sales, partner level industry expertise seems to be more important. Stand alone partner level industry expertise results in an absolute decrease of 1.9% of discretionary accruals relative to total assets. The reduction of control variables in the AEE model resulted in the highest number of and highest magnitude of significant results. Reducing the control variables to total assets, cash flow from operation, leverage, a dummy variable indicating whether the company incurred a loss in a given period and total accruals resulted in NATO (0.05>p) and CITO (0.1>p) in M4 as well as NATO (0.01>p) and CITO (0.5>p) in M5 being significantly positive.

Those results contradict with a range of prior research. A range of researchers report that firm level industry leaders result in higher audit quality proxied by lower levels of discretionary accruals (Kwon *et al.*, 2007; Prawitt *et al.*, 2009; Minutti-Meza, 2013). If it is assumed that industry specialist charge higher audit fees for the higher quality services they provide, my findings also stand in contrast with Kharuddin and Basioudis (2018) who report that is the joint national-city leadership which results in a fee premium. Those results are similar to Chin and Chi (2009) who report that it is the joint firm-partner level industry leadership which leads to more frequent financial restatements.

Some support (in the context of applying sales as market share in the AEE) of my findings is provided by Chi and Chin (2011) who state that industry specialists on the partner level alone or in conjunction with firm level specialists are more likely to issue a modified audit opinion. Other researchers who report that city level industry leadership alone increases audit quality proxied by lower discretionary accruals support my findings (Reichelt and Wang, 2010; Minutti-Meza, 2013; Sun and Liu, 2013).

# Conclusion

In this study I investigate the effect of industry specialization on audit quality for the German market from 2015 to 2018 on the firm-, the city- and the partner level. Based on a sample of 752 firm-year observations I document that industry specialization has the most significant effect on the firm- and city level. This effect seems to be highest in magnitude if the audit firm alone or the audit firm office alone is an industry specialist. For the existence of a partner level industry specialization affect some evidence has been found. My findings are accompanied by a comprehensive sensitivity analysis. Those results extend the current literature and confirms the findings of research undertaken in the past. Those findings also imply that there exist synergy effects between audit firm offices and also within offices. However, as some evidence has been found for partner level industry expertise being negatively correlated with discretionary accruals, my findings suggest that industry expertise is not fully transferred among staff persons among audit firms and audit offices.

My research also poses two major limitations. Firstly, could the quality of my findings be improved by choosing an unweighted measure to determine market share instead of employing a weighted one.

## Table 7: Results of sensitivity analysis[a]

***Panel A: Results of sensitivity analysis - Accrual Estimation Error (AEE)***

| **N = 752** | **M1** | **M2** | **M3** | **M4** | | | **M5** | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **NAT** | **CIT** | **PAR** | **JOINT[a]** | **NATO** | **CITO** | **JOINT[b]** | **NATO** | **CITO** | **PARO** |
| **Change in** | **Coef (t-stat)** | **Coef (t-stat)** | **Coef (t-stat)** | **Coef (t-stat)** | **Coef (t-stat)** | **Coef (t-stat)** | **Coef (t-stat)** | **Coef (t-stat)** | **Coef (t-stat)** | **Coef (t-stat)** |
| ***Cut-off*** | | | | | | | | | | |
| Cut-off NAT: 0.8 | -0.007 | 0.005 | -0.007 | -0.002 | **-0.014** | -0.009 | -0.007 | **-0.013** | -0.001 | N/A |
| Cut-off CIT: 0.8 | (-1.098) | (0.72) | (-0.82) | (-0.223) | **(-1.79)*** | (-0.641) | (-0.798) | **(-1.98)**** | (-0.064) | N/A |
| Cut-off PAR: 0.8 | | | | | | | | | | |
| Industry clas.: Xetra | | | | | | | | | | |
| Market share: Fees | | | | | | | | | | |
| ***Cut-off*** | | | | | | | | | | |
| Cut-off NAT: 1.8 | 0.004 | **0.015** | -0.008 | **0.017** | -0.002 | -0.006 | -0.005 | -0.007 | -0.004 | N/A |
| Cut-off CIT: 1.8 | (0.587) | **(1.832)*** | (-0.764) | **(1.81)*** | (-0.353) | (-0.31) | (-0.465) | (-1.071) | (-0.174) | N/A |
| Cut-off PAR: 1.8 | | | | | | | | | | |
| Industry clas.: Xetra | | | | | | | | | | |
| Market share: Fees | | | | | | | | | | |
| ***Industry clas.*** | | | | | | | | | | |
| Cut-off NAT: 1.2 | 0.000 | 0.003 | -0.011 | 0.003 | 0.000 | 0.004 | -0.008 | -0.002 | 0.012 | N/A |
| Cut-off CIT: 1.2 | (0.012) | (0.373) | (-1.062) | (0.263) | (-0.033) | (0.236) | (-0.747) | (-0.207) | (0.561) | N/A |
| Cut-off PAR: 1.2 | | | | | | | | | | |
| Industry clas.: ICB | | | | | | | | | | |
| Market share: Fees | | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Market share*** | | | | | | | | | | |
| Cut-off NAT: 1.2 | 0.001 | 0.004 | **-0.019** | 0.005 | -0.002 | -0.017 | **-0.020** | -0.007 | -0.018 | N/A |
| Cut-off CIT: 1.2 | (0.149) | (0.498) | **(-1.987)**** | (0.539) | (-0.262) | (-0.807) | **(-1.997)**** | (-1.028) | (-0.734) | N/A |
| Cut-off PAR: 1.2 | | | | | | | | | | |
| Industry clas.: Xetra | | | | | | | | | | |
| Market share: Sales | | | | | | | | | | |
| | | | | | | | | | | |
| ***Industry clas./market share*** | | | | | | | | | | |
| Cut-off NAT: 1.2 | 0.002 | 0.008 | **-0.014** | 0.010 | 0.002 | 0.008 | -0.013 | -0.002 | 0.002 | N/A |
| Cut-off CIT: 1.2 | (0.383) | (1.047) | **(-1.373)*** | (0.992) | (0.256) | (0.566) | (-1.153) | (-0.347) | (0.117) | N/A |
| Cut-off PAR: 1.2 | | | | | | | | | | |
| Industry clas.: ICB | | | | | | | | | | |
| Market share: Sales | | | | | | | | | | |
| | | | | | | | | | | |
| ***Reduced controls*** | | | | | | | | | | |
| Cut-off NAT: 1.2 | -0.007 | 0.005 | -0.005 | 0.002 | **-0.014** | **-0.021** | -0.009 | **-0.015** | **-0.042** | N/A |
| Cut-off CIT: 1.2 | (-1.192) | (0.695) | (-0.584) | (0.194) | **(-2.115)**** | **(-1.327)*** | (-0.879) | **(-2.398)***** | **(-1.668)**** | N/A |
| Cut-off PAR: 1.2 | | | | | | | | | | |
| Industry clas.: Xetra | | | | | | | | | | |
| Market share: Fees | | | | | | | | | | |

| *Panel B: Results of sensitivity analysis for Discretionary Accrual (DAC)* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **M1** | **M2** | **M3** | | **M4** | | **M5** | | | |
| **N = 752** | **NAT** | **CIT** | **PAR** | **JOINT[a]** | **NATO** | **CITO** | **JOINT[b]** | **NATO** | **CITO** | **PARO** |
| | **Coef** | **Coef** | **Coef** | **Coef** | **Coef** | **Coef** | **Coef** | **Coef** | **Coef** | **Coef** |
| **Change in** | **(t-stat)** | **(t-stat)** | **(t-stat)** | **(t-stat)** | **(t-stat)** | **(t-stat)** | **(t-stat)** | **(t-stat)** | **(t-stat)** | **(t-stat)** |
| ***Cut-off*** | | | | | | | | | | |
| Cut-off NAT: 0.8 | -0.001 | 0.002 | 0.000 | 0.002 | 0.000 | 0.008 | -0.005 | -0.003 | 0.006 | N/A |
| Cut-off CIT: 0.8 | (-0.149) | (0.43) | (0.019) | (0.234) | (0.056) | (0.763) | (-0.701) | (-0.668) | (0.495) | N/A |
| Cut-off PAR: 0.8 | | | | | | | | | | |
| Industry clas.: Xetra | | | | | | | | | | |
| Market share: Fees | | | | | | | | | | |
| ***Cut-off*** | | | | | | | | | | |
| Cut-off NAT: 1.8 | -0.005 | -0.007 | -0.004 | -0.010 | -0.004 | -0.004 | -0.008 | -0.004 | 0.012 | N/A |
| Cut-off CIT: 1.8 | (-1.127) | (-1.129) | (-0.454) | (-1.389) | (-0.76) | (-0.306) | (-0.861) | (-0.742) | (0.732) | N/A |
| Cut-off PAR: 1.8 | | | | | | | | | | |
| Industry clas.: Xetra | | | | | | | | | | |
| Market share: Fees | | | | | | | | | | |
| ***Industry clas.*** | | | | | | | | | | |
| Cut-off NAT: 1.2 | -0.002 | -0.003 | -0.010 | -0.006 | 0.003 | **0.018** | -0.009 | 0.004 | 0.020 | N/A |
| Cut-off CIT: 1.2 | (-0.312) | (-0.483) | (-1.238) | (-0.749) | (0.475) | **(1.384)*** | (-1.081) | (0.794) | (1.266) | N/A |
| Cut-off PAR: 1.2 | | | | | | | | | | |
| Industry clas.: ICB | | | | | | | | | | |
| Market share: Fees | | | | | | | | | | |
| ***Market share*** | | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cut-off NAT: 1.2 | -0.002 | -0.002 | 0.004 | -0.003 | -0.002 | -0.005 | -0.002 | -0.003 | -0.009 | N/A |
| Cut-off CIT: 1.2 | (-0.438) | (-0.408) | (0.566) | (-0.502) | (-0.39) | (-0.319) | (-0.303) | (-0.648) | (-0.473) | N/A |
| Cut-off PAR: 1.2 | | | | | | | | | | |
| Industry clas.: Xetra | | | | | | | | | | |
| Market share: Sales | | | | | | | | | | |
| | | | | | | | | | | |
| ***Industry clas./market share*** | | | | | | | | | | |
| Cut-off NAT: 1.2 | **-0.008** | -0.008 | 0.010 | **-0.014** | **-0.009** | -0.013 | 0.012 | -0.001 | -0.015 | N/A |
| Cut-off CIT: 1.2 | **(-1.489)*** | (-1.213) | (1.135) | **(-1.627)*** | **(-1.476)*** | (-1.061) | (1.218) | (-0.127) | (-1.127) | N/A |
| Cut-off PAR: 1.2 | | | | | | | | | | |
| Industry clas.: ICB | | | | | | | | | | |
| Market share: Sales | | | | | | | | | | |
| | | | | | | | | | | |
| ***Reduced controls*** | -0.005 | -0.001 | 0.005 | -0.005 | -0.004 | 0.008 | -0.004 | -0.005 | -0.001 | N/A |
| Cut-off NAT: 1.2 | (-1.061) | (-0.147) | (0.711) | (-0.719) | (-0.73) | (0.692) | (-0.536) | (-1.036) | (-0.054) | N/A |
| Cut-off CIT: 1.2 | | | | | | | | | | |
| Cut-off PAR: 1.2 | | | | | | | | | | |
| Industry clas.: Xetra | | | | | | | | | | |
| Market share: Fees | | | | | | | | | | |

[a] * represents 0.1>p, ** represents 0.05>p and *** represents 0.01>p based on a one-tailed test

In this study, I use audit fees and audit firm client sales to determine market shares of respective audit firms. As audit fees and sales heavily concentrate around only a few firms, industry specialists based on my chosen methods are almost solely Big 4 audit firms. Secondly, could the sample of firm-year observations be increased as my study is limited to firms listed on the Prime Standard. Extending the sample, to for example the General Standard and Scale, would have two major benefits. The first benefit would that more non-Big 4 audit firms are included in the sample. This would shed more light on the smaller auditors in the market as research on the Big 4 is already plentiful available. The second benefit would be that the robustness of the findings are improved as my sensitivity analysis has shown that dropping some audit firm industry specialists in a modified regression results in significantly different results.

Taken my findings and my research limitations together, so I believe, there is great future research potential in the field of smaller units of analysis such as the office- and partner level and the employment of both weighted and unweighted market share measures. In this study, I manually collected audit fee data from annual reports. As time always poses a constraint and audit client sales and audit fees are probably in most contexts highly correlated (in my sample r=0.85), it might be more feasible for future researchers to proxy audit fees by client sales or assets if pertinent databases which contain audit fee data are not accessible.

Further, I would like to encourage future researchers to explore the underlying mechanics of industry expertise attainment a retention in a more detailed fashion. Prior research utilizing financial statement, capital market, auditor and regulator data is already plentiful available and the existence of a positive relation between firm-, the city- and partner level industry expertise and audit quality has been established in various settings. However, how industry expertise is attained by an engagement partner and how it is retained is little understood. Recent findings on the partner level suggest that significant findings on the firm level made in the past might be actually attributable to the partner rather than to the firm. Taken together, research on the mechanics of industry expertise attainment and retention does not only potentially enhance our understanding of the success factors of the audit profession as a whole but also has great chances to do so.

# References


AICPA (1998) 'The CPA Vision Project and Beyond'. Available at: https://www.aicpa.org/research/cpahorizons2025/cpavisionproject.html (Accessed: 13 August 2020).

Anissa, N., Mukhlasin and Petronila, T. A. (2019) 'Audit quality and real earnings management: An analysis based on auditor industry specialization and client importance', *International Journal of Management, Accounting & Economics*, 6(6), pp. 436–453.

Antle, R. *et al.* (2006) 'The joint determination of audit fees, non-audit fees, and abnormal accruals', *Review of Quantitative Finance and Accounting*, 27(3), pp. 235–266.

Augustia, D., Muhammad, P. A. and Permatasari, Y. (2020) 'Earnings management, business strategy, and bankruptcy risk: evidence from Indonesia', *Heliyon*, 6(2), pp. 1–9.

Balsam, S., Krishnan, J. and Yang, J. S. (2003) 'Auditor Industry Specialization and Earnings Quality', *Auditing: A Journal of Practice & Theory*, 22(2), pp. 71–97.

Basioudis, I. G. and Francis, J. R. (2007) 'Big 4 Audit Fee Premiums for National and Office-Level Industry Leadership in the United Kingdom', *Auditing: A Journal of Practice & Theory*, 26(2), pp. 143–166.

Becker, C. L. *et al.* (1998) 'The effect of audit quality on earnings management', *Contemporary Accounting Research*, 15(1), pp. 1–24.

Behn, B. K., Choi, J.-H. and Kang, T. (2008) 'Audit quality and properties of analyst earnings forecast', *The Accounting Review*, 83(2), pp. 327–349.

Cahan, S. *et al.* (2008) 'Non-audit fees, long-term auditor–client relationships and earnings management', *Accounting and Finance*, 48(2), pp. 181–207.

Cahan, S. F. and Sun, J. (2015) 'The effect of audit experience on audit fees and audit quality', *Journal of Accounting, Auditing & Finance*, 30(1), pp. 78–100.

Carcello, J. and Nagy, A. (2004) 'Client size, auditor specialization and fraudulent financial reporting', *Managerial Auditing Journal*, 19(5), pp. 651–668.

Carcello, J. V. and Nagy, A. L. (2002) 'Auditor industry specialization and fraudulent financial reporting', *Proceedings of the 2002 Deloitte & Touche/University of Kansas Symposium on Auditing Problems*.

Chen, H. *et al.* (2011) 'Effects of audit quality on earnings management and cost of equity capital: Evidence from China', *Contemporary Accounting Research*, 28(3), pp. 892–925.

Chen, K. Y., Wu, S.-Y. and Zhou, J. (2006) 'Auditor brand name, industry specialisation, and earnings management: evidence from Taiwanese companies', *International Journal of Accounting, Auditing, and Performance Evaluation*, 3(2), pp. 147–181.

Chi, H.-Y. and Chin, C.-L. (2011) 'Firm versus partner measures of auditor industry expertise and effects on auditor quality', *Auditing: A Journal of Practice & Theory*, 30(2), pp. 201–229.

Chin, C.-L. and Chi, H.-Y. (2009) 'Reducing restatements with increased industry expertise', *Contemporary Accounting Research*, 26(3), pp. 729–765.

Chung, H. and Kallapur, S. (2003) 'Client importance, nonaudit services, and abnormal accruals', *The Accounting Review*, 78(4), pp. 931–955.

DeAngelo, L. E. (1981) 'Auditor size and audit quality', *Journal of Accounting and Economics*, 3(3), pp. 183–199.

DeBoskey, D. G. and Jiang, W. (2012) 'Earnings management and auditor specialization in the post-sox era: An examination of the banking industry', *Journal of Banking & Finance*, 36(2), pp. 613–623.

Dechow, P. M. and Dichev, I. D. (2002) 'The quality of accruals and earnings: The role of accrual estimation errors', *The Accounting Review*, 77(1), pp. 35–59.

DeFond, M. L. and Francis, J. R. (2005) 'Audit Research after Sarbanes Oxley', *Auditing: A Journal of Practice & Theory*, 24(1), pp. 5–30.

DeFond, M. L. and Jiambalvo, J. (1994) 'Debt covenant violation and manipulation of accruals', *Journal of Accounting and Economics*, 17(1), pp. 145–176.

Dunn, K. A. and Mayhew, B. W. (2004) 'Audit Firm Industry Specialization and Client Disclosure Quality', *Review of Accounting Studies*, 9(1), pp. 35–58.

Eichenseher, J. W. and Danos, P. (1981) 'The analysis of industry-specific auditor concentration: Towards an explanatory model', *The Accounting Review*, 56(3), pp. 479–492.

Emerson, J. (1993) 'KPMG Peat Marwick: Setting the new practice framework standard', *Professional Services Review*, 1.

Ferguson, A., Francis, J. R. and Stokes, D. J. (2003) 'The effects of firm-wide and office-level industry expertise on audit pricing', *The Accounting Review*, 78(2), pp. 429–448.

Francis, J. R. and Krishnan, J. (1999) 'Accounting accruals and auditor reporting conservatism', *Contemporary Accounting Research*, 16(1), pp. 135–165.

Frankel, R. M., Johnson, M. F. and Nelson, K. K. (2002) 'The relation between auditors' fees for nonaudit services and earnings management', *The Accounting Review*, 77(1), pp. 77–105.

Garcia-Blandon, J. and Argiles-Bosch, J. M. (2018) 'Audit partner industry specialization and audit quality: Evidence from Spain', *International Journal of Auditing*, 22(1), pp. 98–108.

Goodwin, J. and Wu, D. (2014) 'Is the effect of industry expertise on audit pricing an office-level or a partner-level phenomenon?', *Review of Accounting Studies*, 19(4), pp. 1532–1578.

Gramling, A., Johnson, V. and Khurana, I. (2001) 'The association between audit firm industry experience and financial reporting quality', *working paper, Georgia State University, Atlanta, GA.*

Hegazy, K. and Hegazy, M. (2018) 'Audit firms and industry specialization in an emerging economy. Are we witnessing changing environments or a dominant market?', *Journal of Accounting & Organizational Change*, 14(3), pp. 338–362.

Heninger, W. G. (2001) 'The association between auditor litigation and abnormal accruals', *The Accounting Review*, 26(1), pp. 111–126.

Hogan, C. E. and Jeter, D. C. (1999) 'Industry specialization by auditors', *Auditing: A Journal of Practice & Theory*, 18(1), pp. 1–17.

IAASB (2019) 'International Standard on Auditing 315 (revised 2019)'.

Jones, J. (1991) 'Earnings Management During Import Relief Investigations', *Journal of Accounting Research*, 29(2), pp. 193–228.

Kharuddin, K. A. M., Basioudis, I. G. and Farooque, O. A. (2020) 'Effects of the Big 4 National and City-Level Industry Expertise on Earnings and Audit Quality in the United Kingdom', *Journal of Accounting, Auditing and Taxation*, tba.(tba.), p. tba.

Kharuddin, K. and Basioudis, I. G. (2018) 'Big 4 audit fee premiums for national- and city-specific industry leadership in the UK: Additional evidence', *International Journal of Auditing*, 22(1), pp. 65–82.

Kharuddin, K., Basioudis, I. G. and Hay, D. (2019) 'Partner industry specialization and audit pricing in the United Kingdom', *Journal of International Accounting, Auditing and Taxation*, 35(1), pp. 57–70.

Kim, J.-B., Lee, J. J. and Park, J. C. (2015) 'Audit Quality and the Market Value of Cash Holdings: The Case of Office-Level Auditor Industry Specialization', *Auditing: A Journal of Practice & Theory*, 34(2), pp. 27–57.

Knechel, W. R., Naiker, V. and Pacheco, G. (2007) 'Does auditor industry specialization matter? evidence from market reaction to auditor switches', *Auditing: A Journal of Practice & Theory*, 26(1), pp. 19–45.

Kothari, S. P., Leone, A. J. and Wasley, C. E. (2005) 'Performance matched discretionary accrual measures', *Journal of Accounting and Economics*, 39(1), pp. 163–197.

Krishnan, G. V. (2003) 'Does Big 6 auditor industry expertise constrain earnings management?', *Accounting Horizons*, 17(1), pp. 1–16.

Krishnan, G. V. (2005) 'Did Houston Clients of Arthur Andersen Recognize Publicly Available Bad News in a Timely Fashion?', *Contemporary Accounting Research*, 22(1), pp. 165–193.

Kwon, S. Y., Lim, C. Y. and Tan, P. M.-S. (2007) 'Legal systems and earnings quality: The role of auditor industry specialization', *Auditing: A Journal of Practice & Theory*, 26(2), pp. 25–55.

Lim, C. Y. and Tan, P. (2009) 'Control divergence, timeliness in loss recognition, and the role of industry specialization: Evidence from around the world', *Journal of Accounting, Auditing and Finance*, 24(2), pp. 295–332.

McNichols, M. (2002) 'Discussion of the quality of accruals and earnings: The role of accrual estimation errors', *The Accounting Review*, 77(1), pp. 61–69.

Menon, K. and Williams, D. D. (2004) 'Former audit partners and abnormal accruals', *Accounting Review*, 79(4), pp. 1095–1118.

Minutti-Meza, M. (2013) 'Does Auditor Industry Specialization Improve Audit Quality?', *Journal of Accounting Research*, 51(4), pp. 779–817.

Mosebach, M. and Simko, P. (2010) 'Discretionary accruals and the emergence of profitabiltiy', *Journal of Accounting, Auditing & Finance*, 25(3), pp. 351–374.

Myers, J. N., Myers, L. A. and Omer, T. C. (2003) 'Exploring the term of the auditor-client relationship and the quality of earnings: A case for mandatory auditor rotation?', *The Accounting Review*, 78(3), pp. 779–799.

Neal, T. and Riley, R. (1986) 'Auditor industry specialist research design', *Auditing: A Journal of Practice & Theory*, 24(1), pp. 97–110.

O'Keefe, T. B., King, R. D. and Gaver, K. M. (1994) 'Audit fees, industry specialization, and compliance with GAAS reporting standards', *Auditing: A Journal of Practice & Theory*, 13(2), pp. 41–55.

Owhoso, V. E., Messier, W. F. and Lynch, J. G. (2001) 'Error detection by industry-specialized teams during sequential audit review', *Journal of Accounting Research*, 40(3), pp. 883–900.

Palmrose, Z. (1986) 'Audit fees and auditor size: Further evidence', *Journal of Accounting Research*, 24(1), pp. 97–110.

Payne, J. L. (2008) 'The influence of audit firm specialization on analysts' forecast errors', *Auditing: A Journal of Practice & Theory*, 27(2), pp. 109–136.

Prawitt, D. F., Smith, J. L. and Wood, D. A. (2009) 'Internal audit quality and earnings management', *Accounting Review*, 84(4), pp. 1255–1280.

Reichelt, K. J. and Wang, D. (2010) 'National and office-specific measures of auditor industry expertise and effects on audit quality', *Journal of Accounting Research*, 48(3), pp. 647–686.

Reynolds, J. K. and Francis, J. R. (2001) 'Does size matter? The influence of large clients on office-level auditor reporting decisions', *Journal of Accounting and Economics*, 30(3), pp. 375–400.

Romanus, R. N., Maher, J. J. and Fleming, D. M. (2008) 'Auditor industry specialization, auditor changes, and accounting restatements', *Accounting Horizons*, 22(4), pp. 389–413.

Shockley, R. A. and Holt, R. N. (1983) 'A Behavioral Investigation of Supplier Differentiation in the Market for Audit Services', *Journal of Accounting Research*, 21(2), pp. 545–564.

Singh, A. *et al.* (2019) 'Independent and joint effects of audit partner tenure and non-audit fees on audit quality', *Journal of Contemporary Accounting & Economics*, 15(2), pp. 186–205.

Skinner, D. J. and Sloan, R. G. (2002) 'Earnings surprises, growth expectations, and stock returns or don't let an earnings torpedo sink your portfolio', *Review of Accounting Studies*, 7(2), pp. 289–312.

Stein, S. E. (2019) 'Auditor industry specialization and accounting estimates: Evidence from asset impairments', *Auditing: A Journal of Practice & Theory*, 38(2), pp. 207–234.

Sun, J. and Liu, G. (2013) 'Auditor industry specialization, board governance, and earnings-management', *Managerial Auditing Journal*, 28(1), pp. 45–64.

Wang, D. (2006) ‘Founding family ownership and earnings quality’, *Journal of Accounting Research*, 44(3), pp. 619–656.

Whitworth, J. D. and Lambert, T. A. (2014) ‘Office-level characteristics of the Big 4 and audit report timeliness’, *Auditing: A Journal of Practice & Theory*, 33(3), pp. 129–152.

Xie, Y., Zhang, Y. and Zhou, J. (2012) ‘National level, city level auditor industry specialization and analyst forecast properties’, *International Journal of Auditing*, 16(3), pp. 248–267.

Zhou, J. and Elder, R. (2005) ‘Audit firm size, industry specialization and earnings management by initial public offering firms’, *Managerial Auditing Journal*, 20(1), pp. 86–104.