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The impact of corporate governance on auditor choice: evidence from Germany

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Abstract Statutory audits are only beneficial if the appropriate audit quality is both provided and perceived by the users of audited financial statements. On the one hand, Big 4 audit firms are commonly viewed as producing high quality audits. On the other hand, regulators complain about the high market share of Big 4 audit firms. In this context, it is of interest to examine the drivers of a Big 4 audit firm selection. Despite extensive prior research, there is still a lack of findings form Continental European countries and on the impact of corporate governance on auditor choice. This paper on hand is intended to fill the related research gap. Thus, our study identifies variables that determine the auditor choice of large German listed companies. Based on a sample of 432 firm-year observations for the period 2010–2014, our logistic regression analysis suggests that the corporate governance structure influences auditor choice significantly. Notably, the annual meeting frequency of the audit committee and the size of the supervisory board are positively associated with the engagement of a Big 4 audit firm. However, the meeting frequency of the supervisory board and the compliance to the German corporate governance code are negatively related to the choice of a Big 4 auditor. Additionally, the proportion of female supervisory board members does not exert a significant impact. The results remain stable when the DAX30 observations, for which statutory audits are exclusively performed by Big 4 audit firms, are excluded. The main contribution of our paper is, that it sheds light on the impact of corporate governance variables not analyzed by prior research, like supervisory board characteristics, deviations from a corporate governance code, or the female quota, in a Continental European setting,

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and that it mainly indicates a complementary relationship. Despite the peculiarities of the German setting, the two-tier corporate governance system and the low level of investor protection, the findings of our study are not only relevant for Germany, since many other Continental European countries are characterized by a similar environment. The study's findings are of particular interest for regulators when addressing audit market structure problems.

Keywords Auditor choice · Big 4 · Corporate governance · Germany

1 Introduction

External auditing and assurance services are key contributors to financial stability, trust, and market confidence, and constitute control mechanisms for protecting shareholders and investors from agency risk (Newman et al. 2008). The purpose of an audit is to lend higher credibility to financial reports by verifying the accounting information prepared by management. This purpose can only be fulfilled when an audit is of adequate quality. According to the generally accepted definition of DeAngelo (1981a), audit quality is the market-assessed joint probability that a given auditor will both discover a breach in the clients' accounting system and report it.

In contrast to the traditional view that statutory audits performed on companies are homogeneous across audit firms, Big 4 audit firms are widely viewed as producing higher quality audits than their non-Big 4 counterparts. DeAngelo (1981a) argues that client-specific quasi-rents flow to the incumbent auditor. Larger audit firms have more clients, i.e. more quasi-rents to lose, and thus a higher incentive to perform high quality audits. Moreover, Big 4 audit firms devote considerable resources to developing a reputation for high quality, earn quasi-rents from it, and have incentives to maintain high quality in order to retain their brand-name reputation (Firth and Smith 1992). Prior archival studies also provide evidence that Big 4 audit firms deliver better audit services (Francis 2004). Furthermore, Francis et al. (2013) have recently provided evidence of an overall audit quality improvement in countries with a higher share of Big 4 audits.

High quality audits reduce information asymmetries and agency conflicts between the client firm and its shareholders and creditors. Thus, providers of capital trust financial information more if it is audited by Big 4 auditors, which in turn decreases the cost of capital. Finally, high-quality audits serve as useful corporate governance mechanisms (Watts and Zimmerman 1986). The engagement of a Big 4 audit firm is therefore a possible approach for mitigating agency costs and signaling the credibility of information about firms.

A substantial amount of literature has explored determinants of auditor choice. According to several studies, it can be assumed that with growing company size, along with increasing internationalization, the tendency towards Big N audit firms increases (Gassen and Skaife 2009; Guedhami et al. 2014; Ho and Kang 2013). Furthermore, the existence of blockholders, as well as when a company can be defined as belonging to a family, can be regarded as substitutes for Big N audits, as

the blockholders have sufficient influence within the company and thus can rely on their own supervision (Ashbaugh and Warfield 2003; Guedhami et al. 2009; Ho and Kang 2013; Lin and Liu 2009). While prior research has studied the impact of financial indicators or company ownership structure, few studies have examined the effect of corporate governance on company propensity towards choosing a Big 4 audit firm. None of them has observed the European market, although the differences in corporate governance structure between Anglo-American, Chinese, and emerging countries on the one hand, and the Continental European countries on the other hand require separate analyses. In addition, there is a lack of research on the German market, although the German two-tier corporate governance system, with a separation of powers between the management and supervisory boards along with lower investor protection, in particular the strong limitation of auditor liability, might lead to specific findings. Furthermore, private debt holders are the major capital providers (Hackethal et al. 2005) and the ownership structure of German companies is highly concentrated (Franks and Mayer 2001). The particularities of the German setting could potentially affect the demand for audits as a monitoring mechanism. Due to the heterogeneous market characteristics throughout the European Union, "market trends therefore need to be analyzed on a country-by-country basis, rather than at a 'regional' European level", which might cause further problems concerning EU-wide regulations (Le Vourc'h and Morand 2011). Despite the particularities of the Germans setting, it is representative for many other mainly Continental European countries.

This study analyzes the relationship between the quality of corporate governance and the demand for high quality audits. It assumes that Big 4 audit firms provide a higher audit quality, respectively have a corresponding reputation, and identifies factors, with special regard to corporate governance characteristics, leading to the choice of Big 4 audit firms in Germany, by examining companies listed in the German HDAX between 2010 and 2014. Particular focus will be placed on the influence of the size and the activity level of the company's audit committee, as well as its supervisory board. In the context of the recent debate on a legal quota for women's representation in German supervisory boards, the impact of female supervisory board members will be analyzed as well. The study also examines whether the extent of a company's compliance with the German Corporate Governance Code (GCGC) has an influence on its auditor choice. The code provides guidelines designed to create a framework for sound corporate governance, despite not being legally binding. Consequently, compliance with this code should enhance the company's corporate governance quality, and might therefore affect its auditor choice. The set of parameters used in the regression analysis will include several control variables which, given the findings of recent studies, can be regarded as highly influential.

The results of this study indicate that each variable used to describe the quality of corporate governance, except the proportion of female supervisory board members, has a highly or moderately significant influence on the companies' auditor choice. Especially the meeting frequency of the companies' audit committee, the size of the supervisory board, and the compliance to the GCGC strongly influences the supervisory board's decision to choose Big 4 audit firms. Whereas a complementary

effect of the supervisory board's meeting frequency was expected, the results indicate that it reduces the internal demand for Big 4 audit firms and can therefore be regarded as having a substitutional effect on auditor choice.

This study contributes in the following ways. Firstly, it sheds light on the interrelationship between internal and external control. In principle, a complementary, i.e. good corporate governance demands a high audit quality, as well as a substitutional, i.e. good corporate governance replaces a high audit quality and vice versa, effect is possible. The majority of our findings indicates a complementary relationship. Secondly, previous research on auditor choice was mainly conducted in the US and other Anglo-Saxon countries. Therefore, there is a lack of work on Continental European markets. Using a sample from Germany, we narrow this research gap by providing useful insights into the relevant particularities and their effects on the German market. Thereby, supervisory board variables are analyzed for the first time. Thirdly, there is a lack of empirical evidence on the effects of corporate governance on auditor choice in Europe. Thus, our study is unique in that it examines the effects of the German corporate governance system on auditor choice. In this context, a new variable "number of deviations from the GCGC" is applied. Additionally, the study examines the impact of women on supervisory boards, providing a basis for further research. Above that, this is the first auditor choice study which uses the portion of performance-based compensation to proxy the degree of agency conflicts. Moreover, current results on auditor choice for a period after the financial and economic crisis, as well as the recent reform process by the European Commission, are presented. Lastly, we provide further insight into the self-selection problem in auditor choice. Our findings should be of interest for policy makers and regulators who are involved in configuring the audit market and who assume responsibility for market structure, competition, and choice. In particular, they contribute to the related ongoing debate in the European Union.

The remainder of this paper is structured as follows. Section 2 provides a theoretical background. Section 3 presents an overview of prior research. Section 4 discusses particularities of the German setting and develops the study's hypotheses. The fifth section presents the sample, tests, and results of the study. Finally, Sect. 6 summarizes, concludes, and points out the study's limitations.

2 Theoretical background

Agency theory describes conflicts caused by the separation of ownership and management. In this context, the main purpose of the audit is to limit hidden actions by the company's managers (Brown et al. 2013), which occur due to information asymmetries. As managers have better information, they might be tempted to pursue their personal interests (so-called moral hazard problem). Supervisory bodies strive to minimize such hidden actions and have to rely on independent audits to reduce information asymmetries (Carmichael 1976; Chow et al. 1988). The greater the extent of conflict between management and owners, the higher the economic cost of information asymmetries. If such high agency costs exist, corporate governance mechanisms for monitoring management in general, and audits in particular, will

become more important (Ashbaugh and Warfield 2003). Firth and Smith (1992) argue that the existence of high agency costs creates a demand for high quality audits. Consequently, companies might then be more willing to engage Big 4 audit firms in order to minimize risks associated with the internal distribution of information and authority.

The assurance hypothesis describes the effect of high quality audits on the reliability of company financial statements. Due to information asymmetries, investors have to rely on the information provided by the company and are unable to control their correctness. Therefore, company's financial statements are audited by independent auditors (Blocher et al. 1988). As auditor reports are quite standardized, Firth and Smith (1992), as well as Firth (1993), argue that the auditor's brand name is the only way to enhance the credibility of the report to the investors.

According to the insurance hypothesis (Menon and Williams 1994), the auditor serves as an insurer against damages caused by clients' incorrect financial information. Particularly in the case of financially distressed companies, the auditor is usually more solvent and thus the primary target of civil actions. Consequently, larger auditors are preferred (Broye and Weill 2008).

Given that Big 4 audit firms are associated with higher accounting information quality, a Big 4 audit reduces the investor's risks (Boone et al. 2010; Brown et al. 2013; Firth 1993). For example, Blau et al. (2013) show that short-selling activity increases in response to announcements of auditor downgrades. This indicates that investors expect falling share prices if a company switches from a Big 4 to a non-Big 4 audit firm. In addition, Chou et al. (2014) point out that firms audited by Big 4 auditors are able to attract more foreign investments than those audited by non-Big 4 firms. Furthermore, Ashbaugh and Warfield (2003) state that creditors prefer audit market leaders over smaller international audit companies. Hence, the perceived quality of the company's financial statements is strongly influenced by the brand name and reputation of the auditor.

Bigger audit firms are often linked to higher audit quality, which might explain their high market share (DeAngelo 1981b; Lawrence et al. 2011; Moizer 1997). However, audit quality is not directly observable and research has to apply proxies like restatements, litigation, or discretionary accruals. A study by Becker et al. (1998) indicates that non-Big 6 auditor clients report higher discretionary accruals than Big 6 auditor clients. Furthermore, Lennox (1999) shows that large audit firms provide significantly more accurate audit reports than smaller competitors. In a later study, Lennox and Pittman (2010) present evidence that Big 5 auditor clients are, on average, about four times less likely to commit accounting fraud. The literature discusses three main possible explanations for these findings.

According to DeAngelo (1981a), new auditors must bear technological start-up costs and transaction costs occur with auditor changes. As a consequence, an incumbent auditor receives audit fees that exceed audit costs (quasi-rents). The existence of client-specific quasi-rents leads to competition among auditors to become the incumbent auditor, which drives fees below cost in the initial period (low balling). Thus, the auditor makes an investment and expects future pay-offs. This investment will fail if the audit engagement is not renewed. As a consequence, the client could put the auditor under pressure by threatening with the termination of

the contract, which in turn endangers auditor independence and audit quality. On the other hand, the auditor also receives quasi-rents from other clients and if misconduct or a lack of independence become public, the auditor could lose quasi-rents from other clients. The larger the number of clients, the higher the risk of losing quasi-rents from other audit clients, the less auditor incentive to behave opportunistically, and the lower the threat to auditor independence. Big audit firms usually have more clients. Thus, they have less incentives to act dependently, in order to retain their clients and therefore are assumed to provide a higher audit quality (DeAngelo 1981b).

In addition, Firth and Smith (1992), as well as Firth and Liau-Tan (1998), argue that higher audit quality may be derived from a better auditor reputation. The greater the number of clients, the higher the possible reputation damage for the auditor will be if clients' expectations are not met. Consequently, bigger audit firms have greater incentives to avoid misconduct so as to sustain their reputation (Nelson et al. 2008). Alternatively, Dye (1993) suggests that large audit firms have a higher litigation risk and hence a strong inducement to ensure audit quality.

Lastly, Lennox (1999) states that large audit firms may have greater expertise than their smaller competitors. Since large audit firms have more skilled staff and are represented in a greater number of markets, they possess more specialized knowledge, e.g. for complex audit mandates. Dunn and Mayhew (2004), Knechel et al. (2013), as well as Lowensohn et al. (2007), indicate that market- or industry-specialized auditors provide a significantly higher audit quality.

However, studies related to audit quality reveal ambiguous findings. In contrast to the previously presented studies, Boone et al. (2010), Jeong and Rho (2004), as well as Lawrence et al. (2011) fail to reveal a significant difference between the quality provided by Big 4 and non-Big 4 audit firms. Nevertheless, these contradictory findings may result from different quality indicators and the absence of a unitary definition of audit quality (Knechel et al. 2013). In addition, the self-selection problem could have biased related results (e.g. Minutti-Meza 2013).[1]

In the context of auditor choice, factual audit quality is less relevant then the perceptions of audit quality by those parties who engage the auditor. In the German institutional environment, the supervisory board engages the auditor. To the best of our knowledge, there is no prior research which investigates the impact of auditor size on supervisory board members' perceptions of audit quality.

3 Prior research

Since this study focuses on the impact of corporate governance mechanisms, the following literature review provides an overview on the current state of the art of auditor choice research with a special focus on studies analyzing the effect of corporate governance on the companies' auditor choice.

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[1] More recent research addresses the self-section bias by applying e.g. the Heckman two-stage approach, propensity score matching, or a (firm) fixed-effects regression procedure (see e.g. Kim et al. 2011). However, different econometric models applied may also cause different results.

The characteristics of internal corporate governance mechanisms are supposed to have an effect on the demand for external governance services like the statutory audit. Ho and Kang (2013) provide evidence that the companies' audit committee's size, the experience of its members, as well as its meeting frequency have a significant positive effect on the propensity to choose a Big 4 audit firm. Contrary, the total number of board members does not seem to influence companies' auditor choice (Cheng and Leung 2012). In the same vein, studies by Cohen et al. (2004) and Turley and Zaman (2004) question the overall impact of audit committees on corporate governance quality. Additionally, Cheng and Leung (2012) report a significantly and highly positive effect of female chairmen on the companies' decision towards Big 4 auditors. This is in line with findings presented by Adams and Ferreira (2009) and Srinidhi et al. (2011), which indicate that female board members have a significantly positive association with companies reporting discipline and internal governance.

Besides studies that investigate the impact of the characteristics of internal corporate governance mechanisms, there is another stream of research analyzing whether the regulatory environment of a company can influence its auditor choice. External factors like good corporate governance discipline of a country and possible litigation threats to the management are found to be positively correlated with the companies' decision towards Big 4 auditors (Francis et al. 2003; Hossain et al. 2010).

Furthermore, prior research has focused on the effect of the company's ownership structure on auditor choice decisions, showing some significant correlations for the examined variables. Studies by Ashbaugh and Warfield (2003), DeFond et al. (2000), Firth and Smith (1992), Fischkin (2012), Guedhami et al. (2009, 2014), Ho and Kang (2013), Hope et al. (2012), Lin and Liu (2009), and Wang et al. (2008) show that more influential shareholders, like the state, company insiders, or family blockholders, decrease company propensity to choose a Big N auditor. Shareholders who can monitor the management themselves do not need to rely on the assurance provided by a high quality auditor and therefore also accept non-Big 4 auditors. By contrast, foreign shareholders need the higher quality audits offered by Big 4 auditors, because of the limited monitoring possibilities. This finding is consistent with the agency cost approach.

In addition, there is a large literature that has explored further corporate governance and agency factors that could influence the companies' auditor choice. A significant association was found for e.g. a CEO that is also part of the board of directors (Chi and Weng 2013; Ho and Kang 2013; Lin and Liu 2009), the percentage of shares held by the companies' management (Ho and Kang 2013), the independence of the members of the board of directors or the audit committee measured by the percentage of outside directors (Cheng and Leung 2012; Chi and Weng 2013; Hossain et al. 2010), the academic title of the chairman (Cheng and Leung 2012), CEOs and board members related to the largest owning family (Fischkin 2012; Hope et al. 2012), internal factors like the existence of a director and officer liability insurance coverage (Chi and Weng 2013), the amount of accruals (Choi and Lee 2014; Francis et al. 1999; Houqe et al. 2012), and firms which have issued higher amounts (greater than 10% of their common capital) of

debt or equity in recent years (Cheng and Leung 2012; Choi and Lee 2014; Francis et al. 1999; Hope et al. 2008; Knechel et al. 2008; Lai 2013). Finally, the variables size (Choi and Lee 2014; Francis and Wilson 1988; Francis et al. 1999; Guedhami et al. 2014; Ho and Kang 2013; Hope et al. 2012; Lai 2013; Lennox 2005; Lin and Liu 2009; Tate 2007), internationalization of a company, measured by its numbers of foreign subsidiaries, respectively by possible cross-listings (Ashbaugh and Warfield 2003; Fischkin 2012; Ho and Kang 2013; Hope et al. 2012; Michas 2011), leverage, profitability (Chaney et al. 2004; Hope et al. 2012; Gassen and Skaife 2009; Guedhami et al. 2014), cash flow (Houqe et al. 2012), market-to-book ratio (Hope et al. 2012), and whether a company has reported a loss (Broye and Weill 2008; Chaney et al. 2004; Houqe et al. 2012; Lai 2013; Michas 2011) have a significant influence on the firm's decision to select a Big N audit firm. The results for these determinants are heterogeneous, which implies that the influence of these variables depends on country and industry-specific factors. Furthermore, the application of different econometric models could have caused such inconsistent results.

4 German setting and hypotheses

4.1 Particularities of the German setting

The literature provides evidence that financial reporting and audit quality are significantly affected by the investor protection environment (Ball et al. 2000; Ball and Shivakumar 2005; Choi and Wong 2007; Francis et al. 2003; Francis and Wang 2008; Gul et al. 2013; Leuz et al. 2003). In general, investor protection is considered weak in Germany (Gul et al. 2013; La Porta et al. 1998, 2000). Two aspects of investor protection, which are very specific in the German setting, namely the two-tier corporate governance system and the limited liability exposure of statutory auditors, are described in more detail below.

In contrast to the Anglo-American one-tier system, the German corporate governance system is characterized by an organizational division of powers between management and the control entity (Hopt 1998; Hopt and Leyens 2004). Management in the form of the executive board is solely responsible for administering the company, whereas the supervisory board fulfils appointing, advising, and monitoring tasks and is responsible for the soundness of the financial statements. The German stock corporation law stipulates this separation of powers and thereby tries to ensure a certain level of investor protection.

The company's auditor is proposed by the supervisory board to the general assembly for election (paragraph 119, 1.4 AktG = Aktiengesetz -stock corporation law) and, once elected, is appointed by the supervisory board, which is the official addressee of the German long-form audit report (paragraph 111, 2.3 AktG). Its members must not simultaneously be a member of the executive board (paragraph 105, 1 AktG). In order to perform optimally, the supervisory board is encouraged by the GCGC to set up an audit committee from its own members, which shall be responsible for the company's audit. Another particularity of the German two-tier

system is that the supervisory board consists of two principal groups, namely representatives of shareholders and of the employees. Given a certain company size, the board's seats are evenly distributed between these groups, with individual seats being granted to bank representatives as major shareholders (paragraph 7 MitbestG = Mitbestimmungsgesetz -law on co-determination).

The new law on the equal participation of women and men in managerial position implemented a 30% gender quota for supervisory boards of listed companies and large stock corporations, i.e. with more than 2000 employees. Starting on January 1, 2016, this quota has to be applied for newly elected supervisory board members. This regulation was caused by a very low percentage of female directors, which neither increased by the politically-initiated voluntary commitment of the firms, nor by the recommendation in the GCGC, and which violates against the fundamental principle of equality laid down in the German constitution.

In contrast to the one-tier system, it appears that through the personal division of the boards, independence should be sufficiently secured. However, there is considerable criticism of the efficiency of supervisory boards, for instance on the grounds that some members serve on too many supervisory boards (the total number of supervisory board seats which can be held simultaneously is ten; paragraph 100, 2 no. 1 AktG), that there is a lack of full-time mandates, and that the frequency of meetings is too low (Roe 1998). Moreover, it is common practice for former management board members to become members of the supervisory board, which certainly undermines their impartiality. Finally, supervisory boards are used as platforms to cultivate business relations between suppliers, clients, and creditors. Therefore, the division between the two boards blurs and the supervisory board's independence is negatively affected by a large number of interests (Hopt and Leyens 2004; Jungmann 2006).

The German capital market is characterized by an insider system of corporate control (Franks and Mayer 2001). Corporate ownership is based on a high concentration, primarily in the hands of families, banks and other companies. Moreover, banks provide the majority of debt capital (Hackethal et al. 2005). Therefore, the major providers of capital have access to insider information and are represented on supervisory boards. This implies that agency costs are relatively low. As a consequence, information from audited financial statements is less relevant to them.

Litigation exposure is viewed as perhaps the most effective disciplinary mechanism with respect to auditors (Hope and Langli 2010). The German Commercial Code caps auditors' liability towards audit clients for negligent misconduct at four million € for listed clients. The scope for third parties to pursue actions against auditors is very limited, because the German Civil Code requires that an intentional violation be established. The intent requirement severely restricts investors from taking actions in tort against auditors. Given the nature of an audit, it is extremely difficult to prove that the statutory auditor acted intentionally. In addition to the Civil Code, case law may hold auditors liable to third parties for negligent misconduct (case law refers to the construct "contract with a protective effect for third parties"). Judicial decisions to compensate for auditor negligence based on previous legal cases are, however, very rare (relating to a very restrictive

set of circumstances and only to other cases with similar issues or facts) and normally, a similar liability cap applies, as previously mentioned (Gietzmann and Quick 1998). Thus, the low risk of litigation in Germany does not create strong incentives for auditors to resist client-induced bias in financial reporting. Hence, the insurance hypothesis barely applies to the German setting. As a consequence of the low liability exposure of German auditors, reputation threats are a more important driver of audit quality. This may impact auditor choice, since Big 4 auditors have more reputation to lose and thus higher incentives to provide adequate audit quality. Other compensating mechanisms such as effective public oversight in terms of a stronger limitation of non-audit services may, however, contribute to disciplining auditor behavior and bolster investor trust in auditor independence and the fairness of audited financial statements.

In addition to the low civil liability exposure of German auditors, there are a few further noteworthy characteristics of auditing in Germany. The provision of certain non-audit services to an audit client, like financial accounting, internal audit, management, financial, valuation, and actuarial services is prohibited for all statutory audits and the new EU regulation (European Parliament & Council of the European Union 2014), which was finalized in 2016 and has to be applied by all Member States, includes an extensive black-list of prohibited non-audit services applicable in case of statutory audits of public-interest entities. Instead of an internal rotation of the audit partner the EU regulation now requires an audit firm rotation for public-interest audit clients after ten years. The registration as a public accountant in Germany requests a university degree, three years of practical experience and a positive result in the public accountant exams. The German auditing standards are issued by the Institute of Auditors and are normally close to the International Standards of Auditing. Nevertheless, there are some specific standards with no international equivalent, e.g. on joint audits, audit of the management report, audit of early risk warning systems, or audits under the renewable energies law. Recently, the public oversight of the profession was improved and it is now more independent. However, some weaknesses still exist (e.g. sanctions are only published anonymously; sanctions are imposed by the chamber of auditors, i.e. by a professional organization).

A study by the Handelsblatt, in corporation with the business consultancy Oliver Wyman, reported that 83% of the 160 largest listed entities in Germany were audited by one of the Big 4 audit firms (Fockenbrock 2011). Prior European research evidence on whether or not Big 4 audit firms provide higher audit quality, in particular more accurate going concern reports, is mixed and highly country-specific. Some studies suggest that large audit firms provide superior audit quality, while others do not confirm such differentiation. Again, such conflicting findings might have been caused by self-selection bias. With regard to auditor choice decisions, perceived audit quality is more relevant than actual audit quality. However, likewise, the evidence on whether or not large audit firms charge fee premia is mixed across Europe (Eilifsen and Willekens 2007). German evidence is not exhaustive. Research has failed to demonstrate a Big 4 impact on audit quality in fact, proxied by earnings management (Lopatta et al. 2015; Quick and Sattler 2011; Quick and Wiemann 2011, 2012) and the probability of issuing a going concern

opinion (Ratzinger-Sakel 2013). However, there is some evidence that Big 4 audit firms charge higher audit fees (Bigus and Zimmermann 2009; Köhler et al. 2010; Krauß et al. 2015). To the best of our knowledge, apart from such fee studies, neither in Europe nor in Germany archival studies exist that investigate the relationship between Big 4 audit firm and perceived audit quality. But the fee premium studies as well as the theoretical reasoning indicate that clients perceive a higher Big 4 audit quality or at least expect a quality signal to the users of financial statements. Since auditing is a credence good (Causholli and Knechel 2012), i.e. audit quality is not directly observable, clients might select a Big 4 audit firm due to reputational effects (Barton 2005).

4.2 Development of hypotheses

Concluding the presented literature, the influence of corporate governance on auditor choice decision is a faintly analyzed field. Even though it is logical to assume connections between the effectiveness of the company's corporate governance and its auditor choice, little empirical evidence can be found. The aim of this present study is therefore to provide such evidence and thus to contribute to our understanding of the demand for high quality audits. The fundamental research question addressed by this study is whether the quality of corporate governance impacts the demand for audit quality. Based on prior research findings, we expect a complementary relationship, i.e. that the demand for high audit quality rises with an increasing quality of corporate governance. For the concept of 'audit quality', Big 4 audit firms are used as a proxy. It is unclear whether large audit firms really provide a higher audit quality, however, they are at least perceived as such. Our applied proxies for the concept of 'quality of corporate governance' are the audit committee meeting frequency, the supervisory board meeting frequency, the supervisory board size, the supervisory board female quota and the number of deviations from the GCGC.

Corporate Governance

The main function of the audit is to provide reasonable assurance that the financial statements are free from material misstatements. However, being just one element of a comprehensive control system, the external audit is not the only instrument used to control directors' financial reporting quality. The company's internal control system, as well as its corporate governance structure impact on how the board of directors manages the company (Ashbaugh and Warfield 2003).

Two possible effects of enhanced corporate governance quality on the company's auditor choice decision are imaginable. On the one hand, a higher corporate governance quality may decrease the need for a high quality auditor, due to sufficiently effective internal control mechanisms. A mature corporate governance system enhances the quality of the information provided by the financial statements, reduces information asymmetries, as well as opportunistic behavior, and thus might reduce both the internal and the external demand for high quality audits. If the capability of the internal control mechanisms is communicated to external investors,

the perceived information quality is improved and the need for a high quality audit as a credibility-improving measure decreases (Anderson et al. 2004). Besides, an enhanced corporate governance structure enables the supervisory board to autonomously pursue its monitoring duty, due to reliable collaboration with management and the absence of internal dependences, making Big 4 audits redundant as an external control mechanism. This effect might influence the auditor choice decision in favor of smaller auditors, as the (perceived) quality premium of a Big 4 audit is not needed and the fee premium could be saved. In sum, sound corporate governance may act as a substitute for Big 4 audits.

On the other hand, the implementation of an audit committee, an active and large supervisory board, as well as compliance with the guidelines of the GCGC as a measurement of good corporate governance, reflect the company's intrinsic aim to provide financial reports free from material misstatements, of which a high quality audit might be the logical consequence. An existing audit committee may increase the internal demand for high quality audits in order to comprehensively communicate sound internal corporate governance quality and to secure a positive external perception of the financial statements. In addition, the existence of a high quality corporate governance system reduces the risk of opportunistic behavior by the company's management and therefore, eliminates possible incentives for choosing a low quality auditor to conceal fraudulent actions. Consequently, an enhanced corporate governance level may increase internal demand for high quality audits and result in a higher propensity to choose Big 4 auditors.

The supervisory board represents shareholder interests and has to ensure a high financial reporting quality. Assuming that a larger and more active supervisory board is in a better position to control management, due to a more detailed examination of its work and the information provided, as well as a higher level of expertise, more dedicated supervisory boards can thus be regarded as enhancing the company's corporate governance. In order to fulfil its duty, and as recommended by the GCGC in Section 5.3.2, the supervisory board can form an audit committee, which deals solely with the design and effectiveness of the internal control systems and the choice, along with the independence, of the company's auditor. In accordance with the previously described argumentation, it can be assumed that more active committees are more capable of doing a good job and therefore, increase the company's corporate governance quality.

Abbott and Parker (2000) present evidence of a positive correlation between an active and independent audit committee and the company's decision to choose an industry specialist auditor. Since Big 4 auditors are most frequently industry specialists, the results of Abbott and Parker (2000) are related to a choice of a Big 4 auditor. Several studies (Cheng and Leung 2012; Hossain et al. 2010; Lin and Liu 2009; Ming and Jun Lin 2009) confirm these findings and, furthermore, Ho and Kang (2013) report that the size of the audit committee and the financial expertise of its members raise the internal demand for high quality audits.

In Germany, the supervisory board, or the audit committee, is responsible for engaging the statutory auditor. The more competent they are (DeFond and Zhang 2014), the more likely the selection of a high quality auditor. However, it is difficult to define variables which sufficiently represent the company's corporate governance

quality. Whereas the internal audit can be regarded as an important part of a company's corporate governance, its influence on auditor choice cannot be analyzed in this study, due to the lack of such sensitive data on internal audit quality. According to the theoretical reasoning and presented research results, it is expected that size and the activity level of the internal control bodies will positively impact the likelihood to choose a Big 4 auditor. Based on three available proxies for corporate governance quality, the following hypotheses are formulated:

Hypothesis 1a: The more audit committee meetings per year, the more likely a company is to choose a Big 4 auditor.

Hypothesis 1b: The more supervisory board meetings per year, the more likely a company is to choose a Big 4 auditor.

Hypothesis 2: The more supervisory board members, the more likely a company is to choose a Big 4 auditor.

Alternatively, activity level and size of internal control bodies might also reduce their effectiveness. More meetings could result in oversized agendas or endless and fruitless discussions, and thereby hinder decisions. The larger a board, the more likely conflicts and coordination problems are and the more difficult it is to ensure an adequate expertise of board members. However, previous research frequently shows that the meeting frequency of the audit committee has a positive impact on financial reporting quality and thus, on the committee effectiveness (e.g. Abbott et al. 2004; Beasley et al. 2000; Farber 2005). Only few studies fail to disclose a significant effect (e.g. Baxter and Cotter 2009), whereas there is, to the best of our knowledge, no proof for a negative relationship. The results from studies on the implications of audit committee size on its effectiveness are more heterogeneous, but show either a positive (e.g. Karamanou and Vafeas 2005) or no (e.g. Davidson et al. 2005) significant impact. Therefore, there is no obvious need to predict a negative sign with regard to the first three hypotheses.

Moreover, it is assumed that the number of female supervisory board members may also affect the company's auditor choice decision. As recommended by the GCGC, the supervisory board should appoint a fair number of women, while no exact quota is provided. Several studies indicate a positive influence of women in the process of decision making, as well as in the context of financial reporting. Gul et al. (2008) note that female board members demand a higher level of audit quality to protect the board members and their reputation. Furthermore, they are more likely to take care of shareholder interests compared to male board members. Bernardi and Arnold (1997) state that women are more concerned about ethical issues throughout discussions. Consequently, women tend to be more averse to fraudulent actions, which might create further incentives to publish a financial report free from material misstatements. Additionally, Cheng and Leung (2012) report that female board members have a higher level of vigilance during the financial reporting process and that women highly significantly prefer industry-expertise, and therefore higher quality auditors. Germany is a quite masculine society, in which social gender roles are very distinct (Hofstede 1991). Consequently, we expect a gender effect and use

the supervisory board female quota as further proxy for corporate governance quality. Accordingly, the following hypothesis is proposed:

Hypothesis 3: The higher the quota of female supervisory board members, the more likely a company is to choose a Big 4 auditor.

In addition, the GCGC provides non-binding recommendations for sound corporate governance. The aim of these guidelines is to reduce agency costs, enhance the quality of information provided by the financial statements, ensure the rights of shareholders, as well as improve the work of both the supervisory board and the board of directors. Companies complying with these regulations adapt their internal corporate governance structure to current best practice, which is regularly amended by the Government Commission GCGC. Consequently, companies deviating from these recommendations might be attributed a lower corporate governance quality. Accordingly, it is assumed that the extent of compliance with the GCGC and the demand for a Big 4 auditor are positively correlated.

Hypothesis 4: The lower the deviations from the German Corporate Governance Code, the more likely a company is to choose a Big 4 auditor.

Agency costs

The agency theory, along with the level of agency costs faced by the company, is another common explanation of the demand for higher audit quality. The information asymmetries between the stakeholders and the company's management create a moral hazard problem. Agency costs increase with the amount of expenditure on monitoring and bonding activities, as well as with the extent of losses suffered due to opportunistic management behavior (Jensen and Meckling 1976). External auditing is used by the company to reduce information asymmetries between managers and stakeholders by verifying its financial reporting and thus reducing agency costs (Becker et al. 1998; Chow 1982).

Research shows that, with a higher ownership concentration, the tendency towards Big 4 auditors decreases (Fan and Wong 2005; Hope et al. 2012; Ming and Jun Lin 2009). In accordance with these findings, Fischkin (2012) reports a negative correlation between ownership concentration, or the amount of shares held by the biggest blockholder, and the likelihood of choosing a Big 4 auditor. If one or just a few shareholders concentrate the majority of stocks and thus the voting rights, they can directly control the management. This opportunity significantly decreases the need for high quality audits as a tool for supervising the management. In this vein, Hope et al. (2012) claim that in firms with a widely spread ownership structure, "it is economically less feasible for any individual shareholder to incur significant monitoring costs, thus, less sophisticated internal controls are performed and consequently agency costs increase with a decreasing ownership concentration". As Fama (1980) states, the diversification of shareholding activities by investors and thereby the "efficient allocation of risk bearing seems to imply a large degree of separation of security ownership from control of a firm"—thus raising the demand for high quality external auditing. As evidenced by several studies, this line of argumentation can applied to

family companies or to companies with a family blockholder (Fischkin 2012; Ho and Kang 2013). Since, in family firms, one of the family members, and therefore one of the shareholders, is regularly a member of management, the level of agency costs and incentives for fraudulent actions strongly decreases.

In the following analysis, the proportion of common stocks held by non-blockholders (free-float[2]) is used to measure the company's ownership concentration, and thus as a proxy for agency costs. Additionally, the extent of agency conflicts is proxied by the ratio of performance-based compensation of management to the total amount of compensation. Performance-based compensation links the interests of management with those of the company, or the stakeholders, as the amount of the manager's current, as well as of his future remuneration, depends on the quality and the sustainability of his present work. This results in lower agency costs, which might reduce the need for a high quality auditor. Synthesizing the empirical evidence, the following hypotheses are formulated:

Hypothesis 5a: The higher the quota of common stocks being free float, the more likely a company is to choose a Big 4 auditor.

Hypothesis 5b: The higher the quota of the performance-based compensation of the management, the less likely a company is to choose a Big 4 auditor.

Furthermore, based on prior research results, a significantly positive influence of the company size (Choi and Lee 2014; Guedhami et al. 2014; Ho and Kang 2013; Hope et al. 2012) and its internationalization (Fischkin 2012; Guedhami et al. 2014; Ho and Kang 2013; Michas 2011) can be expected. Companies suffering from financial distress have both motives for and against Big 4 auditors, so that a significant influence is anticipated, whereas a direction is not clearly determinable (Chaney et al. 2004; Hope et al. 2008, 2012; Houqe et al. 2012; Lai 2013; Michas 2011). Finally, the amount of the company's operative cash flow and the ratio of its market capitalization to its book value are also expected to have a significant impact on auditor choice (Hope et al. 2012; Houqe et al. 2012). Related variables are included as control variables in our regression model.

5 Sample, tests, and results

5.1 Sample selection

The sample covers a five-year period from 2010 to 2014. Since the choice of the statutory auditor normally takes place before the end of the financial year, the regression variables for auditor choice for the year t refer to the year before (t−1). The initial sample consists of all observations of German firms that are listed in the

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[2] In contrast to the definition of the Deutsche Börse, in which "free float" is defined as the amount of stocks held by non-blockholders, minus the amount of stocks held by the company itself, in the context of this study, "free float" includes the amount of stocks held by the company itself. Since the stocks held by the company cannot be used to exert any influence on the management, it would not have been suitable to consider them as a part of the stocks held by blockholders.

HDAX[3] (550 firm-year observations). The required consolidated financial statements are obtained from the Hoppenstedt company database. The information concerning the corporate governance system, shareholder structure, as well as organizational indicators, is only accessible via the annual financial reports and thus hand-collected. Company market capitalization data were obtained from the webpage of Deutsche Börse AG. Following previous research, banks and insurance companies are excluded (21 observations), since these firms are subject to different financial reporting regulations and standards, which reduces comparability of the sample firms. Observations of firms headquartered in foreign countries and therefore not applying the German dual board and firms providing its financial statements solely in US-Dollar are omitted (36 observations). Furthermore, observations with missing data are deleted (58 observations). Finally, to ensure that the results are not driven by a small number of influential outliers, i.e. to increase generalizability of the results, observations that are characterized by a high standardized Pearson residual, in combination with a high leverage statistic, are removed from the regression (3 observations).[4] This procedure leaves a final sample of 432 firm-year observations. The sample selection process is shown in Table 1.

Whereas in 390 cases a Big 4 auditor was chosen by the client company, a non-Big 4 auditor was chosen in only 42 cases. To ensure plausible outcomes of the subsequent logistic analysis, a logistic regression model requires at least a 10% share of each event (Big 4 vs. non-Big 4 auditor choice) of the dependent binominal variable (Urban and Mayerl 2011). The share of non-Big 4 auditors in the final sample sums to about 10 percent, thus meeting the necessary level. The data at hand especially presents a strong predomination of Big 4 auditors within the DAX30, with zero audit engagements given to non-Big 4 auditors within the 5-year period. The share (measured by the number of audit clients) of non-Big 4 auditors is the largest within the TecDAX amounting 22.3%, while summing to 8.3% within the MDAX.

5.2 Tests and results

Model

To test the hypotheses, we used the logistic regression method, which is based on the iterative maximum likelihood estimator. Since the dependent variable used for this type of regression is binary and coded '1' to represent the choice of a Big 4

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[3] The HDAX consists of the 30 largest companies listed on the German stock exchange (DAX30), the 50 largest Prime Standard companies, excluding the technology sector, then following the DAX30 (MDAX), as well as the 30 largest companies of the technology sector (TecDAX). The HDAX covers the large listed companies and the audits of these companies are in the focus of the European regulator. Moreover, the HDAX is a homogenous sample with strict reporting requirements.

[4] If both of these parameters exceed the critical values (standardized residual greater than 3.3; leverage statistic over 0.5), the observation can be regarded as an outlier. However, testing for outliers is regarded as problematic when using a logistic regression model. Given that the dependent variable can only have the values zero or one, a high residual value primarily indicates that the characteristics of the considered independent variables do not apply to this case. Therefore, the interpretation of high residual values caused by incorrect observations might be misleading (Urban and Mayerl 2011).

Table 1 Summary of sample size

	N (2010–2014)
Observations of HDAX listed firms between 2009 and 2013	550
Less	
Banking and insurance firm year observations	−21
Observations headquartered in foreign countries and with financial statements solely in US-Dollar	−36
Missing data	−58
Outliers	−3
Final sample size	**432**

auditor and '0' to represent the choice of a non-Big 4 auditor, the OLS method cannot be used. Logistic regression does not rely on many of the key assumptions of general linear models that are based on ordinary least squares algorithms (particularly regarding linearity, normality, homoscedasticity, and measurement level). In the context of logistic regressions, linearity and independence of errors are the key assumptions (Field 2014). The assumption of linearity means that there is a linear relationship between any continuous predictor and the logit of the outcome variable. However, it does not require the dependent and independent variables to be related linearly. Moreover, the logistic regression requires the independence of error terms.

Based on the findings of previous studies, as well as on the developed hypotheses, a pool of variables is set up, which can be regarded as highly significantly influential. Additionally, to control for omitted variables, the regression model is extended by year and industry[5] dummies. From these variables the following logistic regression model is specified under consideration of identified collinearity problems:

$$BIG4_t = \beta_0 + \beta_1 ACF_{t-1} + \beta_2 SBF_{t-1} + \beta_3 SBS_{t-1} + \beta_4 SBW_{t-1} + \beta_5 GCGC_{t-1}$$
$$+ \beta_6 FF_{t-1} + \beta_7 PBC_{t-1} + \beta_8 LNAT_{t-1} + \beta_9 CL_{t-1} + \beta_{10} LOSS_{t-1}$$
$$+ \beta_{11} CF_{t-1} + \beta_{12} MBV_{t-1} + YEAR + INDUSTRY + \varepsilon$$

Table 2 defines the variables involved in testing the hypotheses.

According to Long (1997), at least 10 observations per parameter should be provided for this type of statistical analysis, which is given for our regression model. The preconditions of linearity and independence of errors are fulfilled for our logistic regression model. Furthermore, the tests for collinearity indicate no multicollinearity problems. The values for tolerance and the variance inflation factor (VIF) are all above/below the critical values of 0.2 for the tolerance, or 5 for the VIF (Field 2014, p. 325). To check for a potential endogeneity problem, we applied the

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[5] All companies listed in the Prime Standard of the Frankfurt Stock Exchange, including the HDAX, are allocated to one of 18 sector indices on the basis of the categorization into 62 industry groups. The sector allocation of a company is determined by its focus of activities.

Table 2 Definition of variables

Variable	Definition	Expected sign
ACF	Annual meeting frequency of the company's audit committee minus teleconferences	+
SBF	Annual meeting frequency of the company's supervisory board minus teleconferences	+
SBS	Size of the company's supervisory board	+
SBW	Share of female members of the company's supervisory board (as percentage)	+
GCGC	Number of deviations from the German corporate governance code	−
FF	Share of common stocks being defined as free float (amount of shares being held by stockholders holding less than 5% of the total common stocks of a company, plus the amount of shares being held by the company itself) (as percentage)	+
PBC	The quota of the management's performance-based compensation to its total compensation	−
LNAT	Firm size, defined as the natural logarithm of the company's total sales	+
CL	Dummy variable, coded as 1 if the company's common stocks are traded on a foreign stock exchange, and 0 otherwise	+
LOSS	Dummy variable, coded as 1 if earnings are negative for company j for fiscal year t, and 0 otherwise	○
CF	The company's operating cash flow	○
MBV	Market value of equity divided by book value of equity of company j at the end of fiscal year t (as percentage)	○
YEAR	Set of year dummies, coded as 1 for the respective year, and 0 otherwise	
INDUSTRY	Set of industry dummies, coded as 1 for the respective DAX sector of the Frankfurt Stock Exchange, and 0 otherwise	

Durbin-Wu-Hausman test, which is formed by including the residuals of each endogenous right-hand side variable, as a function of all exogenous variables, in a regression of the original model. The result shows that the residual is not significant ($B = 95.783$; $p = 0.998$), indicating the absence of an endogeneity problem.

Descriptive statistics

Table 3 presents the descriptive statistics. The audit committee meeting frequency (ACF) is on average 4.116 meetings per year (there was an audit committee in 91.2% of the observations). Under the condition that the companies have chosen a Big 4, or a non-Big 4 auditor, the meeting frequency is on average 4.3 per year, or 2.4 per year respectively. The supervisory board meeting frequency (SBF) is on average 5.861 per year, whereas the average supervisory board size (SBS) is 12.149. Furthermore, the supervisory board women's quota (SBW) reached a maximum of 83.33%, while having a merely moderate mean value of 11.33%, indicating the unequal distribution and underrepresentation of women in German supervisory

Table 3 Descriptive statistics for the sample

	Obs.	Mean	SD	Min	Max
ACF	432	4.116	2.116	0	12
SBF	432	5.861	2.001	2	18
SBS	432	12.149	5.592	3	25
SBW	432	11.331	10.853	0	83.33
GCGC	432	2.928	2.527	0	15
FF	432	68.033	23.983	11.1	100
PBC	432	54.259	17.654	−5.561	87.583
LNAT	432	7.908	2.073	0.235	12.191
CL	432	0.968	0.177	0	1
LOSS	432	0.14	0.349	0	1
CF	432	1119.572	2490.573	−1768	17,109
MBV	432	168.866	219.419	16.718	3785.289

Obs. is the number of observations, Mean is the average value, Min is the lowest value, Max is the highest value

boards. Moreover, the share of female supervisory board members varies strongly across the companies, which is indicated by the high standard deviation of 10.853. The number of deviations from the GCGC is on average 2.928 in the full sample, 2.8 for Big 4 audit firms and 4.2 for non-Big 4 audit firms respectively, and thus rather modest in relation to the total amount of 66 recommendations in the GCGC.

For the variables of common stocks being free float (FF) and performance-based compensation of management (PBC), the results are almost identical, irrespective of whether the companies chose a Big 4 or a non-Big 4 auditor. The mean percentage for FF is 68.033 and 54.259% for the variable PBC. The surprisingly negative minimum of −5.56% for the share of performance-based compensation does not represent an error in the underlying sample, but is caused by the fact that management had to pay back a certain amount of its compensation for the observed year. The average amount of company logarithmized annual turnover (LNAT) is 7.908 (in million €). The company's common stocks are also regularly traded on a foreign stock exchange (CL, 0.968). The average amount of company operative cash flow (CF) is 1119.572 (in million €) and 14% of the companies reported a loss (LOSS). The average market-to-book quota (MBV) is 168.866%.

Table 4 presents correlations between selected variables. The choice of a Big 4 auditor (Big4) is significantly positively correlated with the frequency of audit committee meetings, and the size of the company's supervisory board, while there is a significant negative correlation with the frequency of supervisory board meetings and the number of deviations from the GCGC. Significant correlations are observed between the frequency of audit committee meetings and all other variables, but only the correlation with the number of deviations from the GCGC is negative. The frequency of supervisory board meetings correlates significantly negatively with the supervisory board size and number of deviations from the GCGC. Furthermore, supervisory board size is significantly negatively correlated with the number of deviations from the GCGC and significantly positively correlated with the supervisory board's women quota and performance-based management compensation. The supervisory board's women quota correlates significantly negatively with

Table 4 Correlation matrix

	ACF	SBF	SBS	SBW	GCGC	FF	PBC
Big4	0.262*** (0.000)	−0.183*** (0.000)	0.323*** (0.000)	0.018 (0.703)	−0.167*** (0.000)	−0.054 (0.263)	0.022 (0.647)
ACF		0.096** (0.045)	0.419 (0.000)	0.195*** (0.000)	−0.296*** (0.000)	0.131*** (0.006)	0.115** (0.017)
SBF			−0.131*** (0.007)	−0.003 (0.945)	−0.080* (0.095)	0.059 (0.220)	−0.035 (0.466)
SBS				0.142*** (0.003)	−0.341*** (0.000)	−0.005 (0.911)	0.238*** (0.000)
SBW					−0.085* (0.078)	−0.010 (0.840)	0.168*** (0.000)
GCGC						−0.231*** (0.000)	−0.220*** (0.000)
FF							0.053 (0.268)

The coefficients are Pearson's correlation coefficients, and the values in parentheses are the respective p values. The correlation coefficients are based on the sample of 432 company-year observations. The variables are defined in Table 2

*, **, *** Significance at the 10, 5, and 1% levels, respectively

the number of deviations from the GCGC and significantly positively with performance-based management compensation. Finally, there are significantly negative correlations between the number of deviations from the GCGC, the share of common stocks being free float, and the performance-based compensation of the management.

Multivariate analysis and findings

Table 5 presents the results of the regression model, thus suggesting significant influences of the variables of interest, as well as of the control variables.[6]

First of all, the results show that the audit committee meeting frequency has a significant positive effect on the company's tendency to choose Big 4 auditors. Consequently, Hypothesis 1a, that a more sophisticated audit committee has a complementary effect on the company's auditor choice, is confirmed. This finding is in line with Ho and Kang (2013). A high activity level of the audit committee might indicate that its members are more motivated to cooperate with management as well as with internal and external auditors. In contrast, the regression model presents a significant negative influence of supervisory board meeting frequency on the company's tendency to choose Big 4 auditors, while a complementary effect was expected. Therefore, the results falsify the previous presumptions and lead to a rejection of Hypothesis 1b. A potential cause for this outcome is that a high supervisory meeting frequency might cause coordination problems which in turn reduce the board decision effectiveness. Additionally, a high meeting frequency of the supervisory board could merely reflect problems in the company and not improved activities. The size of the supervisory board exerts a significant positive effect. Thus, Hypothesis 2 that a company with a higher number of supervisory board members is more likely to choose a Big 4 auditor, is confirmed. The lager the supervisory board, the higher its overall expertise, also with regard to accounting and auditing issues, which increases the demand for high quality audits. In contrast to previous research findings (e.g. Cheng and Leung 2012), the coefficient for the women's quota is negative but not significant, indicating that the percentage of female board members does not influence auditor choice. Hence, Hypothesis 3 cannot be confirmed. One possible explanation for this counterintuitive result might be that in a masculine society like Germany, women are only able to fill top positions if they have distinctly male characteristics.

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[6] The underlying data leads to an overall percentage of correctly predicted cases of 93.5%. The choice of a Big 4 auditor is correctly estimated in 97.7% of the cases, whereas the choice of non-Big 4 auditors can only be predicted successfully in 54.8% of the cases. However, the goodness-of-fit indicated by the Nagelkerke R^2 reaches a value of 61.4%, showing a good fit of the underlying model (Urban 1993). In comparison to other auditor choice studies, which show a Nagelkerke R^2 in the range of 6.7–39.2% (on average 21.3%), the value is quite high (e.g. Ashbaugh and Warfield 2003; Choi and Lee 2014; Gassen and Skaife 2009; Ho and Kang 2013; Houqe et al. 2012; Tate 2007). The presented Hosmer and Lemeshow test implies an adequate model design, having a Chi-square value of 0.838, and a significance of 0.999. The Hosmer and Lemeshow test compares values of the dependent variables estimated by the regression model with values observed throughout the sample. Therefore, the subjects are divided into deciles based on the predicted probabilities. The null hypothesis that there is no statistical difference between the estimated and the observed values is rejected, if the computed Hosmer and Lemeshow statistic is lower than 0.05 (Hosmer et al. 2013). Consequently, the null hypothesis cannot be rejected.

Table 5 Results of the logistic regression model with dependent variable at time t and independent variables at time t−1

Variable	Expected sign	B	SE	Wald	df	Sig. (p value)	Exp. (B)
Constant (β_0)		20.716	9353.988	0.000	1	0.998	993,071,411.7
ACF (β_1)	+	0.388	0.136	8.158	1	0.002***	1.474
SBF (β_2)	+	−0.190	0.104	3.326	1	0.034**	0.827
SBS (β_3)	+	0.281	0.086	10.611	1	0.001***	1.325
SBW (β_4)	+	−0.022	0.027	0.612	1	0.217	0.979
GCGC (β_5)	−	−0.215	0.109	3.866	1	0.025**	0.807
FF (β_7)	+	−0.030	0.013	5.214	1	0.011**	0.971
PBC (β_8)	−	−0.059	0.019	9.570	1	0.001***	0.942
LNAT (β_9)	+	−0.020	0.167	0.015	1	0.452	0.980
CL (β_{10})	+	1.108	0.961	1.331	1	0.125	3.030
LOSS (β_{11})	○	1.631	0.913	3.190	1	0.074*	5.111
CF (β_{12})	○	0.002	0.001	3.461	1	0.063*	1.002
MBV (β_{13})	○	0.012	0.004	9.728	1	0.002***	1.012
$\sum$YEAR		Included					
$\sum$Industry		Included					

Dependent variable: Big4 is coded '1' to represent the choice of a Big 4 auditor and '0' to represent the choice of a non-Big 4 auditor; Nagelkerke R^2: 0.614; Chi-square statistics (Hosmer–Lemeshow-test): 0.838 (p value: 0.999); sample size: 432 companies; classification rate: 93.5%. The variables are defined in Table 2

*; **; *** Significance at the 10, 5, and 1% levels, respectively

In line with the expectations of Hypothesis 4, a significant negative impact of the number of deviations from the GCGC on the propensity to choose a Big 4 auditor is found. Consequently, and against the backdrop of further findings of this study, it can be assumed that good corporate governance affects the company's auditor choice, and this can sufficiently be expressed by the compliance to the GCGC. Hence, on the basis of these results, Hypothesis 4 is confirmed.

Hypothesis 5a is rejected, as the variable FF shows a significant negative influence. Thus, and in contrast to prior research, the findings do not show that the assumed higher need for protection of small shareholders leads to an increased demand for high audit quality. The result is counterintuitive, because the demand for good audit quality increases with augmenting shareholdings of blockholders, i.e. with decreasing agency problems. A possible explanation for this surprising finding might be that blockholders usually have a higher expertise than small shareholders. Their better understanding of financial accounting and auditing could be associated with a greater conviction of the relevance of a high audit quality and thus causes a stronger preference for Big 4 audit firms. Contrary to these findings, the results for the variable performance-based compensation confirms Hypothesis 5b. The significant negative sign of this variable can be interpreted as reducing the internal

demand for high quality audits, as the alignment of shareholder's interests with those of the management reduces the extent of agency conflicts.

Regarding the control variables, the size of the company indicated by the amount of its logarithmized annual turnover does not show a significant influence on the dependent variable, contradicting the results of previous studies. The assumption that a greater extent of company internationalization leads to the choice of a Big 4 auditor is not confirmed, since the dummy variable of whether a company is cross-listed on a foreign stock exchange has no significant effect on the company's tendency to choose Big 4 auditors. However, as just 3% of the examined companies have not been listed a foreign stock exchange, the results might be distorted and should be treated with caution. Furthermore, the variable LOSS is significantly positively related to the choice of a Big 4 auditor. Likewise, we find a significant positive effect of the variable operating cash flow. Finally, the variable market-to-book ratio shows a significant positive effect on the company's preferences for Big 4 auditors. Therefore, it can be assumed that financial risk, as well as prevailing financial distress, lead to a greater tendency toward Big 4 auditors. The constant of the regression model is not significant, which can be interpreted as indicating the absence of omitted variables, which would otherwise be represented in a significant and highly influential constant.

5.3 Additional analyses

In order to examine the robustness of the presented results against changes in the underlying data, sensitivity analyses are performed. Since the choice of the statutory auditor normally takes place before the end of the financial year, the regression variables for auditor choice for the year t refer to the year before (t−1) in the main analysis. For the first sensitivity test, we used a different specification of variables and regress the dependent variable Big4 at time t+1 on the independent variables at time t−1, i.e. a lag of two periods. Table 6 reports the results.

In contrast to the main analysis, the findings indicate that the variables SBF and GCGC do not affect the company's auditor choice decision, whereas the other test variables remain stable. The second sensitivity test changes the specification of the regression by including both the dependent and independent variables at time t. As shown in Table 7, the results with regard to the variables that are of primary interest are almost the same. However, the variable SBW is now significantly negatively associated with the selection of a Big 4 auditor, which contradicts the prediction of Hypothesis 3. Overall, the alternatively specified regressions confirm the findings of the main analysis.

As an additional test, a logistic regression of the companies listed on the MDAX and the TecDAX, while excluding the ones listed on the DAX30, produces mostly similar results. Omitting the companies listed on the DAX30 significantly changes the variable distribution among the underlying sample. As the DAX30-listed companies are audited only by Big 4 auditors, with a high proportion of companies audited by KPMG and PwC, excluding them increases the share of Non-Big 4 auditors in the new sample by over 5%.

Table 6 Results of the logistic regression with different specification of variables: dependent variable at time t+1 and independent variables at time t−1

Variable	Expected sign	B	SE	Wald	df	Sig. (p value)	Exp. (B)
Constant (β_0)		20.561	9002.942	0.000	1	0.998	849,830,151.3
ACF (β_1)	+	0.323	0.131	6.050	1	0.007***	1.382
SBF (β_2)	+	−0.104	0.101	1.068	1	0.151	0.901
SBS (β_3)	+	0.345	0.095	13.084	1	0.000***	1.412
SBW (β_4)	+	−0.026	0.027	0.928	1	0.168	0.975
GCGC (β_5)	−	−0.046	0.102	0.209	1	0.324	0.955
FF (β_7)	+	−0.036	0.014	7.035	1	0.004***	0.964
PBC (β_8)	−	−0.028	0.018	2.371	1	0.062*	0.972
LNAT(β_9)	+	−0.222	0.175	1.618	1	0.102	0.801
CL (β_{10})	+	0.299	0.945	0.100	1	0.376	1.348
LOSS (β_{11})	○	1.067	0.889	1.440	1	0.230	2.905
CF (β_{12})	○	0.002	0.001	2.448	1	0.118	1.002
MBV (β_{13})	○	0.012	0.004	9.114	1	0.003***	1.012
$\sum$YEAR		Included					
$\sum$Industry		Included					

Dependent variable: Big4 is coded '1' to represent the choice of a Big 4 auditor and '0' to represent the choice of a non-Big 4 auditor; Nagelkerke R^2: 0.602; Chi-square statistics (Hosmer–Lemeshow-test): 2.276 (p value: 0.971); sample size: 432 companies; classification rate: 94%. The variables are defined in Table 2

*; *** Significance at the 10 and 1% levels, respectively

As presented in Table 8, the influence of the variables of interest, along with the control variables, are analogous to the results for the entire sample. While the variables LOSS and CF are no longer significant, the other variables show the same impact on company auditor choice. As a consequence, the results of the initial regression model can be confirmed and regarded as robust to changes in the underlying sample. Studying the results for an examination on the basis of either the MDAX or the TecDAX is not considered feasible, due to the low number of observations.

Furthermore, a final set of sensitivity tests applies interactions between corporate governance and other variables. Untabulated results suggest a significant negative interaction between the variables LNAT and ACF, SBF, and SBW, respectively, whereas a significant positive interaction is found for the variables PBC and ACF, SBF, as well as SBW. Moreover, significant negative interactions are revealed between MBV and ACF, MBV and SBF, and MBV and SBS.

In addition, many prior studies observed a Big 4 effect and conclude that they provide a higher audit quality. However, this observation could have been caused by self-selection, e.g. the Big 4 firms' ability to attract higher quality inputs (Chaney et al. 2004; DeFond and Zhang 2014; Lawrence et al. 2011). Our data can also be used to gain further insights into this issue. Research on the effectiveness of audit committees often shows a positive impact of their size (Ghosh et al. 2010; Karamanou and Vafeas 2005; Yang and Krishnan 2005) and their meeting

Table 7 Results of the logistic regression with different specification of variables: dependent and independent variables at time t

Variable	Expected sign	B	SE	Wald	df	Sig. (p value)	Exp. (B)
Constant (β_0)		18.797	9189.452	0.000	1	0.998	145,657,513.0
ACF (β_1)	+	0.429	0.142	9.171	1	0.001***	1.536
SBF (β_2)	+	−0.178	0.102	3.046	1	0.041**	0.837
SBS (β_3)	+	0.329	0.094	12.092	1	0.001***	1.389
SBW (β_4)	+	−0.047	0.027	2.976	1	0.042**	0.954
GCGC (β_5)	−	−0.234	0.112	4.334	1	0.019**	0.791
FF (β_7)	+	−0.028	0.013	4.617	1	0.016**	0.973
PBC (β_8)	−	−0.061	0.019	10.045	1	0.001***	0.940
LNAT(β_9)	+	0.188	0.169	1.235	1	0.133	1.206
CL (β_{10})	+	−0.063	1.082	0.003	1	0.477	0.939
LOSS (β_{11})	○	1.888	0.911	4.292	1	0.038**	6.605
CF (β_{12})	○	0.001	0.001	2.026	1	0.155	1.001
MBV (β_{13})	○	0.012	0.004	11.026	1	0.001***	1.012
$\sum$YEAR		Included					
$\sum$Industry		Included					

Dependent variable: Big4 is coded '1' to represent the choice of a Big 4 auditor and '0' to represent the choice of a non-Big 4 auditor; Nagelkerke R^2: 0.630; Chi-square statistics (Hosmer–Lemeshow-test): 1.724 (p value: 0.988); sample size: 432 companies; classification rate: 93.5%. The variables are defined in Table 2

; * Significance at the 5 and 1% levels, respectively

frequency (Abbott et al. 2004; Beasley et al. 2000; Choi et al. 2004; El-Gazzar et al. 2008; Farber 2005; Karamanou and Vafeas 2005; Md Yusof 2010; Vafeas 2005; Xie et al. 2003) on financial reporting quality. Thus, these studies indicate that financial reporting quality increases with corporate governance quality. Our results support the existence of a complementary relationship between corporate governance quality and the choice of a Big 4 audit firm. Therefore, we indirectly demonstrate that the probability of the selection of a Big 4 audit firm increases with accounting quality, and thus the existence of a self-selection bias. To obtain direct evidence, we extended our regression model by including the cost of debt capital, calculated as aggregate interest expenses for the year divided by the average short- and long-term debt during the year, respectively the cost of equity capital, estimated using the PEG approach suggested by Easton (2004),[7] as an additional independent variable. Both variables have, as expected, a negative sign which is, however, insignificant (cost of debt capital: B = −0.137, p = 0.466; cost of equity capital: B = −0.546, p = 0.958). Thus, this additional test does not confirm the existence of a self-selection bias.

Finally, to test the effect of auditor selection, the impact of a Big 4 audit firm on cost of debt and equity capital is examined. The untabulated results do not indicate a

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[7] The proxy cost of equity capital is an ex ante metric, i.e. that is a measure of expected rather than realized returns, and thus not observable. The PEG approach measures the cost of equity capital as the square root of the inverse of the price-earnings-growth ratio.

Table 8 Results of the logistic regression model MDAX/TecDAX with dependent variable at time t and independent variables at time t−1

Variable	Expected sign	B	SE	Wald	df	Sig. (p value)	Exp. (B)
Constant (β_0)		21.202	8848.721	0.000	1	0.998	1,614,611,175
ACF (β_1)	+	0.448	0.151	8.813	1	0.002***	1.565
SBF (β_2)	+	−0.167	0.104	2.569	1	0.055*	0.846
SBS (β_3)	+	0.279	0.090	9.593	1	0.001***	1.321
SBW (β_4)	+	−0.028	0.028	1.035	1	0.155	0.972
GCGC (β_5)	−	−0.208	0.111	3.509	1	0.031**	0.813
FF (β_7)	+	−0.034	0.014	6.157	1	0.007***	0.967
PBC (β_8)	−	−0.061	0.019	9.943	1	0.001***	0.941
LNAT(β_9)	+	−0.153	0.191	0.645	1	0.211	0.858
CL (β_{10})	+	0.887	0.968	0.840	1	0.180	2.429
LOSS (β_{11})	○	1.264	0.911	1.924	1	0.165	3.538
CF (β_{12})	○	0.000	0.001	0.096	1	0.757	1.000
MBV (β_{13})	○	0.011	0.004	9.658	1	0.002***	1.012
$\sum$YEAR		Included					
$\sum$Industry		Included					

Dependent variable: Big4 is coded '1' to represent the choice of a Big 4 auditor and '0' to represent the choice of a non-Big 4 auditor; Nagelkerke R^2: 0.597; Chi-square statistics (Hosmer–Lemeshow-test): 2.917 (p value: 0.939); sample size: 318 companies; classification rate: 90.9%. The variables are defined in Table 2

*; **; *** Significance at the 10, 5, and 1% levels, respectively

significant relationship. For the cost of debt model, the coefficient on Big4 is negative but insignificant (B = −0.005, p = 0.533), whereas in the cost of equity model, the coefficient of the Big4 variable is positive but also not significant (B = 0.003, p = 0.681).

6 Conclusion

6.1 Summary and implications

The study provides new empirical evidence on the influence of corporate governance quality on auditor choice in Germany. Based on a sample of 432 firm-year observations from firms listed on the regulated market of Frankfurt stock exchange (HDAX), the results suggest that all of these variables used to proxy the quality of corporate governance, except the supervisory board female quota, do indeed have a significant influence on auditor choice. Whereas a complementary effect of the supervisory board's meeting frequency was expected, the results indicate that it reduces the internal demand for Big 4 auditors and can therefore be regarded as having a substitutional effect on auditor choice. The overall impact of

corporate governance on the company's auditor choice can be considered as substantial.

Overall, the majority of our corporate governance variables suggest a significantly positive effect on the selection of a Big 4 auditor. This implies a self-reinforcing effect of good corporate governance. Thus, the selection of a Big 4 auditor might be influenced by higher competencies of client corporate governance. In contrast, our findings suggest a significant impact of agency costs, but fail to reveal a clear direction of the relationship. This might indicate that a high audit quality signal is not perceived as necessary, either because of uninformed users who do not understand such a signal, or because of a high general trust in corporate governance, or both.

The EU perceived audit markets as being too concentrated in certain segments and assumed that such concentration might entail a systemic risk (European Commission 2010). This thought resulted in a reform of the EU rules on statutory audit of public-interest entities (European Parliament and Council of the European Union 2014). The findings of this study indicate that the selection of a Big 4 audit firm is driven by the effectiveness of corporate governance and by the existence of agency problems. In light of these results, it is therefore questionable whether the EU attempts to reduce the concentration of audit markets will be successful. Moreover, our additional analyses failed to disclose a significant relationship between auditor size and perceived audit quality. This suggests that the selection of a Big 4 audit firm might be mainly driven by reputational considerations, which hampers regulators attempts to combat high market concentration. A further implication of this study is that audit committees matter. Their existence[8] and meeting frequency significantly positively impact the selection of a Big 4 audit firm. German listed companies have to report whether they comply with the GCGC and in case of deviations from the Code they have to disclose explanations for them (paragraph 161, 1 AktG). Our study shows that compliance with the GCGC significantly influences auditor choice decisions. Thus, they indicate a potential decision usefulness of a related report. Recently, the German legislator implemented a mandatory gender quota for supervisory boards. Against the backdrop of this study's findings, such a quota does not seem to affect auditor choice.

6.2 Limitations and constraints

The study is subject to a number of limitations, most of which suggest a need for future research. First, the limitation to German data, in combination with the typically German corporate governance structures, constrain the direct scope of these results to the German audit market. However, despite the specifics of the German setting, the findings of this study are also of interest for other countries. The two-tier board system exists in many other European countries, such as in Belgium, Denmark, Finland, France, Greece, Netherlands, and Sweden, either on a mandatory or at least on a voluntary basis (Weil et al. 2002). In addition, the dual board

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[8] A complementary analysis replaced the variable ACF by the dummy variable on the existence of the audit committee. It revealed a significant positive impact (B = 1.231; $p = 0.050$).

structure is used in China, Japan, and South Korea (Ran et al. 2015). Auditor liability is currently capped in some other EU member states (Austria, Belgium, Greece, and Slovenia) (London Economics and Ewert 2006). Furthermore, Spain presently has a regime of proportionate liability and since April 2008, auditors in the UK are allowed to limit their liability by contract with their clients. The Wingate-Index measures the litigiousness of the audit environment and is 6.22 for Germany, but also for France, Ireland, Italy, the Netherlands, Norway, and Switzerland (Wingate 1997). Non-Anglo-Saxon countries are characterized by lower investor protection (Francis et al. 2003; La Porta et al. 1997, 1998). However, within the range of investor protection strength, Germany has been identified as being in the middle (La Porta et al. 1998). In the light of this discussion, the study's findings are generalizable to many other Continental European countries. Second, the study is only based on companies listed on the DAX30, the MDAX, and the TecDAX and therefore includes just a small number of non-Big 4 auditees, while excluding other major prime standard companies. This might lead to non-generalizable results, especially for the variables regarding company ownership structure or its complexity. Third, the results do not apply to non-listed, banking, insurance, and financial services firms and are only valid for the sample period. Due to the limited timeframe of this study, the results should still be confirmed by a long-term study, including the effects of the newly introduced EU restrictions. It is therefore possible to examine long-term developments, as well as the effectiveness of legislative efforts. Finally, although we tested for endogeneity and included firm and industry dummies to control for omitted variables, the results of this study could be influenced by unknown underlying factors. Based on the amended eighth EU directive on statutory audits, the German legislator strengthened the requirements for audit committees in 2016. Now, the audit committee members as a whole must have competence relevant to the sector in which the audited entity is operating, at least one member of the audit committee must have competence in accounting and/ or auditing, and a majority of the members of the audit committee, including its chairman, must be independent of the audited entity (paragraph 324, 2 HGB = Handelsgesetzbuch -commercial code). It would be a promising avenue for future research to analyze whether these stricter requirements impact auditor choice.

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