Master Thesis [FEM61009]

Audit market concentration and audit quality; competition trends in the EU audit market

Accounting & Auditing

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Abstract

This thesis examines if the concentration in the EU audit market negatively affects audit quality. Using a sample of 28,323 company observations from 21 EU member states, this paper conducts cross-country analysis and trend analysis for 2004-2013 on different concentration indicators and discretionary accruals to validate market competition and audit quality concerns of the European Commission. I provide evidence for a positive relation between the Big Four's market share and audit quality, whereas I find a negative relation for the market concentration between the Big Four audit firms and audit quality. Trend analysis shows that the trend in Big Four market concentration poses a greater risk for audit quality in EU member states compared to the trend in Big Four market shares. These findings have implications for regulators and the European Commission who should put more emphasis on competition between the Big Four audit firms and less on Big Four dominance per se to ensure a competitive and qualitative EU audit market.

Key words; Audit market concentration, audit quality, discretionary accruals, Big Four audit firms, European Union

Contents

1. Introduction

The Big Four audit firms dominate the audit market and are consistently growing their market share on a global level. In many European Union member states, the market share of the Big Four audit firms exceeds 90% of the audit market (European Commission, 2021). Hence, concerns exist among regulators about the growing dominance of the Big Four audit firms in the external auditing market. This dominance can have consequences for firms' audit quality, auditor independence, audit fees, and competition between audit firms (European Commission, 2021). The House of Lords (2010) argues that the reduced ability of the client to switch auditors is the biggest obstacle that is inherent to highly concentrated markets.

To provide regulation around the Big Four dominance in the audit market, the European Commission issued the "European Union Audit Legislation" in 2014 (European Commission, 2014). The reason is that recent mergers of large audit firms, the increasing complexity of audits, the high reputation of Big Four audit firms, and the need for technical audit expertise, all keep the market concentration levels high (Mališ and Brozović, 2015). This legislation should lower the barriers for small and medium-sized audit firms to enter the audit market. Therefore, by issuing legislation, the European Commission intends to ensure a competitive statutory audit market and the option for public-interest entities to choose services from a variety of audit firms (European Commission, 2017).

However, Big Four audit firms still form an oligopoly in several EU member states. The growth in the number of oligopolies remains a concern for the competitive intensity of the audit market in the EU (European Commission, 2021). Hence, the European Commission calls for additional trend analysis and research on audit market concentration to assess the degree of competition in the EU audit market (European Commission, 2017). To check the validity of these concerns, I give voice to this call by examining the relation between different concentration indicators and audit quality in the EU. Hence, the paper comes up with the following research question;

"Does the concentration in the EU audit market negatively affect audit quality?

I perform a cross-country analysis for 21 EU member states, following the approach of Francis et al. (2013) by utilizing their concentration indicators. First, I examine the dominance of the combined market share of the Big Four audit firms relative to the market share of non-Big Four audit firms. Second, I analyze the concentration within the Big Four audit market by looking at individual Big Four market share distribution. In current reports, the European Commission lacks analysis on whether market shares of the individual Big Four audit firms are equally distributed or not. However, this indicator could pose additional concerns for regulators about EU market concentration.

I use the modified Jones Model (1991) to estimate scaled discretionary accruals as the manageable part of earnings and as a proxy for audit quality. To run the regression of the concentration indicators on audit quality, I make use of a sample that comprises 28,323 client observations from 21 EU member states. Next, I perform a trend analysis for both

concentration indicators from 2004 to 2013 to present competition trends in the EU audit market. These trends illustrate the effect on audit quality over time, validate the concerns of regulators about growing Big four dominance, and help determine the focus point for regulation around market concentration in the EU.

I find evidence that a negative association exists between the market share of the Big Four audit firms and discretionary accruals in the total audit market. Hence, EU member states with higher Big Four market shares observe better audit quality. Second, I find evidence for a positive association between the concentration within the Big Four audit market and discretionary accruals. Therefore, countries with a less equal distribution of the individual Big Four market shares observe worse audit quality in their market. The trend in concentration within the Big Four audit market shows a stable growth, which indicates decreasing audit quality over time. The trend in market shares of the Big Four audit firms is less stable. First, a large decline in the Big Four market shares decreases the quality of audits. However, this is followed by a positive trend from 2007 onwards implying a shift to increasing audit quality.

These findings have implications for regulators and the European Commission to identify the extent to which the indicators of audit market concentration in the EU affect the quality of audits. Thus, to help argue for more specific and effective regulations or caps on Big Four's dominance in the EU audit market. The findings suggest that the European Commission should be more concerned about competition within the Big Four audit market, a dimension of audit market concentration not yet analyzed in their reports. The European Commission should be less concerned about the dominance of the Big Four audit firms in the total audit market. This suggests that the overall consensus that Big Four dominance on the audit market is disadvantageous for audit quality, is not valid per se. This indicates that the European Commission should focus on effective regulation around competition between the Big Four audit firms to maintain a competitive and qualitative audit market.

This paper contributes to the existing literature in the following ways. First, mixed evidence exists on high audit market concentration and its effect on the perceived quality of audits. The conflicting findings in the literature demand more research on this topic. Second, this paper contributes to the existing literature by primarily focusing on an EU setting to evaluate the market concentration and dominance of the Big Four audit firms. Prior literature investigated the US audit market or concentration within a multitude of individual countries (Boone et al., 2012; Francis et al., 2013; Huang et al., 2016; Gunn et al., 2019; Van Raak et al., 2020). Audit market concentration analysis is relevant for the EU because market concentration levels are higher in the EU compared to other parts of the world (Mališ and Brozović, 2015). Finally, I provide a more complete analysis by looking at trends of audit market concentration and by using a concentration indicator that the European Commission has not yet incorporated in their reports.

The rest of this paper is organized as followed. Section 2 explains the theoretical background and the hypothesis development. Section 3 presents the sample, methodology, and main statistics of the variables used. Section 4 presents the results and Section 5 provides a conclusion, limitation, and advice for future research.

2. Theoretical background & Hypothesis development

2.1 Theoretical background
This section discusses the literature of prior studies that is relevant to the main research question. I discuss the primary concerns for growing market concentration, followed by literature around the two main concentration indicators in this paper; "Big Four market share" and "Big Four market concentration". Besides, I discuss descriptions of audit quality.

2.1.1. Competition Concerns
The European Commission raises concerns about the growth in Big Four's dominance and the lack of evidence on the effectiveness of competition in the EU audit market (European Commission, 2017). When the market concentration is high, the market is oligopolistic and less competitive. The reason being that only a couple of audit firms dominate the audit market. Since oligopolies of the Big Four audit firms exist in 13 EU member states in 2018 up from 11 in 2015, this suggests that the EU audit market is highly concentrated (European Commission, 2021). Further, the combined market share of the Big Four audit firms ranges from 70% to 90% (European Commission, 2021). According to a study by Caban-Garcia and Cammack (2009), such high audit market concentration raises the following concerns; "monopolistic pricing, decreasing audit service quality, decreasing stability of capital markets and investor confidence, and the impact of another large public accounting firm failure."

The House of Lords (2010) shares these concerns and questions the effect of Big Four dominance on competition and audit market concentration. Their analysis showcases the fundamental problem that is inherent to highly concentrated markets; the reduced ability of the client to switch auditors. These yearly switch rates range from 2% to 4% on average. Therefore, the House of Lords pledges for a more diverse audit market to ensure a degree of competition between various audit firms (House of Lords, 2010).

Hence, audit market concentration often serves as a proxy for competitiveness in the audit market. It also indicates the audit firms' independence (Boone et al., 2012). Low auditor independence poses a big threat to audit quality due to lacking professional competence and skepticism during the audit. According to Boone et al. (2012), an increase in audit market concentration can have negative effects on auditor independence. The lack of choice for clients can imply increasing auditor entrenchment and complacency. This contributes to auditors performing audits with a much more lenient and much less skeptical attitude.

On the contrary, Dedman and Lennox (2009) argue that the perceived competition in markets with high audit market concentrations can still be intense because of the risk of rival auditors entering the market. However, the increasing complexity of audits, greater economies of scale and reputation of the Big Four audit firms, and the need for technical audit expertise, all raise the barriers for small and medium-sized audit firms to enter the market (Mališ and Brozović, 2015). The House of Lords (2010) adds the establishment of an extensive and integrated network to these barriers for small and medium-sized firms. Because of all these barriers, audit market concentration remains high in the EU and raises concerns for regulators about the degree of competitiveness and quality in the EU audit market.

In response, regulators and committees propose different reforms to reduce audit market concentration. Examples are regulation through mandatory audit firm rotation, caps on the provision of audit services, and mandatory joint audits (Mališ and Brozović, 2015). French law already incorporated mandatory joint audits and demands assessment of the financial statements by two audit firms. Around 60% of the audits are joint audits in France (European Commission, 2021). With mandatory joint audits, medium-sized audit firms get the opportunity to carry out more audits, making the market concentration within France the lowest in Europe (Mališ and Brozović, 2015). However, coordination costs, larger audit fees, and the risk of inconsistencies in methodologies are all drawbacks for implementing such regulation (Heß and Stefani, 2012).

Besides, it may seem easy to solve competition issues through mandatory auditor rotation as it provides small and medium-sized audit firms with opportunities to perform more audits. However, such restrictions are not always effective for competition, audit quality, and auditor independence issues in markets with a high audit market concentration such as the EU (Heß and Stefani, 2012; Bandyopadhyay et al., 2014). The reason is that in highly concentrated markets, clients are likely to switch to another large audit firm (Mališ and Brozović, 2015).

2.1.2. European Union Audit Legislation

Because concerns for audit quality, auditor independence, and competition levels kept growing, the European Commission issued the "European Union Audit Legislation" in 2014, which became effective on the 17th of June 2016 (European Commission, 2017). This legislation primarily focuses on requirements for governing all statutory audits in the EU, requirements for PIE, provisions on mandatory audit firm rotation, prohibited non-audit services, and a cap on fees for permitted non-audit services. Besides, restrictive contractual clauses are prohibited, as they promote "Big Four Only" markets (European Commission, 2014). These requirements and regulations would increase the competitiveness in the EU audit market (Mališ and Brozović, 2015). Article 27 from this regulation focuses on monitoring compliance with the aim of the European Commission to enhance audit quality and competition in the audit market. It monitors market concentration levels, risks for audit quality, and the performance of audit committees (European Commission, 2017).

Each year, Article 27 requires the European Commission to draw up a joint report on developments regarding concentration levels, audit quality, and the effectiveness of audit committees in the EU (European Commission, 2017). In these reports, the European Commission analyzes market concentration through the market share of the Big Four audit firms as the number of clients and as the turnover of clients. Furthermore, they perform market analyses for the biggest four audit firms (CF4) and the 10 key audit firms per country (10KAP). Since the joint report contains many reports from different preparers, the European Commission still asks for additional research on EU audit market concentration levels and the effect on audit quality. However, finding a fixed relation remains a difficult task because the findings from studies on the effect of market concentration on the quality of audits are mixed.

This paper investigates two market concentration indicators, measured through the client's assets and revenues, to evaluate competition in the EU audit market; the *"Big Four market share"* and the *"Big Four market concentration".* These indicators are not yet all incorporated in the analyses of the European Commission and could therefore provide new and valuable insight on the competition levels of the EU and their effect on audit quality.

2.1.3. Big Four market share

As mentioned, the relation between the market share of the Big Four audit firms and audit quality is mixed. Different interpretations exist on how the Big Four market share affects audit quality. Boone et al. (2012) illustrate this by explaining two different scenarios. The first scenario shows that with the Big Four audit firms owning a greater share of the market, the Big Four auditor has a stronger watchdog role. This is caused by the reduction in the client's ability to switch auditors. Thus, the auditor is in a better negotiation position which reduces client-driven earnings and increases the quality of the audit (Mališ and Brozović, 2015). However, a second scenario from Boone et al. (2012) shows that a lower chance of getting replaced as an auditor result in audits with a less skeptical and more lenient approach. The reason is that the client's ability to switch auditors is limited, which diminishes audit quality.

Francis et al. (2013) perform regressions of the Big Four market share on different proxies for audit quality. Results show that in countries with higher Big Four market shares, the quality of audits is higher too. These countries have less discretion to engage in earnings management and are less likely to report profits. This is because accruals decrease for increasing Big Four intense markets. Therefore, Francis et al. (2013) argue that regulators should be less concerned about the market share of the Big Four audit firms and should be cautious about other concentration indicators.

The characteristics of the Big Four audit firms can explain these findings. DeAngelo et al. (1981) demonstrate that larger audit firms provide higher quality audits compared to smaller audit firms. According to their study, larger audit firms have a greater incentive to detect and report management misreporting. Furthermore, Van Raak et al. (2012) find evidence that audit quality improves for large clients when Big Four dominance increases to achieve economies of scale. The reason is that Big Four audits are more complex and need expertise.

Next, Lawrence et al. (2011) argue that larger clients have less discretionary accruals compared to smaller clients. Since larger clients are more likely to choose a large audit firm such as a Big Four firm (Heß and Stefani, 2012), earnings management occurs less for Big Four audit firms. Furthermore, the scale of the Big Four audit firms leads to an enhancement of audit quality through the Big Four's reputation. This is because trust reinforcement in the capital market could influence firm value positively (Rama and Read, 2006). Furthermore, audit fees are lower for Big Four audit firms as they use economies of scale to spread fixed costs through their large client base (Mališ and Brozović, 2015). Thus, (1) the demand from investors for high-quality audits, (2) an increase in the complexity of audits, (3) the ability to spread fixed costs through economies of scale, (4) better Big Four firm reputation, and (5)

sufficient technical audit expertise, cause growing Big Four market share (Mališ and Brozović, 2015).

2.1.4. Big Four market concentration

Big Four market concentration serves as a proxy for concentration and competition within the Big Four audit market. It is commonly measured through the Herfindahl Hirschman Index. Different studies exist on the potential lack of competition due to high audit market concentrations. However, findings remain mixed regarding its effect on audit quality. Boone et al. (2012) argue that high Big Four market concentration could cause complacency of the auditor. According to their study, this would lead to self-satisfaction, a more lenient audit, less rigorous audit procedures, and reduced professional skepticism (Boone et al., 2012). Such audit engagements can result in higher discretionary accruals and more engagement in earnings management (Caramanis and Lennox, 2008). Multiple studies provide evidence for this negative relation between Big Four market concentration and audit quality.

First, Boone et al. (2012) examine the relation of audit market concentration on tolerance for earnings management and its effect on audit quality. The results show that an increase in Big Four market concentration increases the likelihood of the client having positive discretionary accruals to meet or beat the analysts' consensus earnings forecast. They argue that this decreases the overall audit service quality through a less skeptical and more lenient audit approach. Boone et al. (2012) argue that such scenarios can occur when audit markets tend to be oligopolistic. This provides evidence for the concerns from the European Union about the growing number of oligopolies in the EU.

A follow-up study from Francis et al. (2013) examines audit market concentration by performing cross-country analysis for 42 countries. They provide evidence for a negative relation between audit quality and concentration within the Big Four audit market on a country-year level. They use different proxies for audit quality, such as discretionary accruals, the likelihood of reporting losses, and timely loss recognition. They provide evidence for a negative relation between increasing Big Four market concentration and all proxies for audit quality because of larger accruals, fewer incentives to report losses, and less timely loss recognition. This negative relation is strongest for discretionary accruals. This implies less discretion towards earnings management and a greater chance of clients reporting profits.

Evidence from a similar cross-country analysis from Gunn et al. (2019) supported the findings from Francis et al. (2013). Gunn et al. (2019) find a negative relation between Big Four market concentration and audit quality. They state that a wealth transfer occurs from shareholders to audit firms when clients are complex and barriers to enter the market are high. The reason being that in high Big Four concentrated markets, audit firms charge higher fees, while the client receives audits that are of lesser quality. All these findings are consistent with concerns from the European Commission that higher Big Four market concentration leads to a less competitive market and endangers the quality of audits.

However, there are also various studies providing evidence for a positive relation between Big Four market concentration measures and audit quality. For example, by examining non-

listed Chinese firms, Huang et al. (2016) find a positive relation between audit market concentration and audit quality through increasing audit fees. However, additional analyses pointed out that high market concentration lowers the chance to be sanctioned for audit failures. This would suggest that earnings management could still occur now executives and auditors are less likely to be punished for intentional or unintentional mistakes in the audit.

Van Raak et al. (2020) also questioned the relation between audit market concentration and audit quality. They argue that audit complexity could be a moderating factor. Their research on audit market concentration, market complexity, and audit quality for Belgium companies shows that an increase in audit market concentration only decreases audit quality for the SME-client segment. However, no such negative relation is found for the large-client segment. The large-client segment enables auditors to achieve economies of scale through audit resources and technology. Therefore, they argue that as audits become more complex, this diminishes the negative relation of concentration on audit quality.

Whereas the sign of the relation of audit market concentration and audit quality is relatively mixed, trends in audit market concentration are more consistent. Velte et al. (2012) reviewed previous empirical results of audit market concentration analysis for 1983 till 2007. For a multitude of EU member states and non-EU member states, the trend in audit market concentration is significantly positive. They argue that mergers of large audit firms, auditor changes, and audit firm bankruptcies cause the growth of concentration on the audit market.

2.1.5. Audit quality

This paper investigates the effect of audit market concentration on audit quality. DeAngelo (1981) defines audit quality as 'the market-assessed joint probability that a given auditor will both discover a breach in the client's accounting system and report the breach.' Another commonly used description of audit quality is provided by DeFond and Zhang (2014). They define higher audit quality as 'greater assurance of high financial reporting quality' since it focuses on credibility, resource allocation, and contracting efficiency. According to this definition, the accuracy and reliability of the financial statements determine the quality of audits. Therefore, different proxies exist to evaluate the quality of audits performed by audit firms as audit quality is considered to be subjective.

More direct proxies are audit fees, restatements, or going concern opinions (DeFond and Zhang, 2014). They state that financial reporting quality proxies are less direct because of the limited influence of the auditor on the reporting quality. Examples of such proxies are discretionary accruals calculated through the Jones Model (1991). This model sees discretionary accruals as an indication of the quality of earnings for companies since they reflect auditors' constraints over management's reporting decisions. Other proxies are the timely loss recognition from Basu (1997) and the meet and beat approach of earnings targets from Dechow and Dichev (2002). According to DeFond and Zhang (2014), studies use these financial reporting quality proxies because they arrive from financial statements which is a joint product of management and the audit firm. Therefore, the financial reporting quality proxies are strong in detecting earnings management and misstatements.

2.2 Hypothesis development

In this section, I derive the hypotheses from prior literature to provide an answer to the research question. The more extensive theoretical embedment of these assumptions can be found in the theoretical background. However, I discuss it here in short as well. I develop two hypotheses to analyze the relation between audit market concentration and audit quality.

2.2.1 Audit market concentration measures & audit quality

To generalize findings to the EU audit market is rather difficult. Mixed evidence exists on the sign of the relation between audit market concentration and audit quality. I develop two hypotheses because this paper investigates the relation of two different concentration indicators. While concerns exist on competition as smaller audit firms exit the audit market, prior literature showed that this does not always hurt audit quality. Big Four audit firm audits seem to have fewer restatements, less earnings management, and lower cost of capital (Lawrence et al., 2011; Boone et al., 2012; Francis et al., 2013). Thus, it makes these audits more reliable and accurate, which in turn increases the quality of the audit. The underlying increase in the demand of investors for high-quality audits also drives auditors to perform more qualitative audits (Francis et al., 2013; Mališ and Brozović, 2015).

Furthermore, the Big Four audit firms can perform increasingly complex audits, can spread fixed costs through economies of scale, have a better reputation, and have sufficient technical audit expertise, which all increase the quality of audits performed (Mališ and Brozović, 2015). All the above implies that Big Four audit firm presence in the audit market is not causing worse audit quality. Hence, I expect that a higher market share of the Big Four audit firms leads to smaller discretionary accruals and ultimately to an increase in the quality of the audit. Therefore, I test the following hypothesis;

Hypothesis 1a: *The market share of the Big Four audit firms is positively related to the quality of audits in the EU.*

Due to concerns from the European Commission about diminishing competitiveness in EU audit markets, I expect a negative relation between audit market concentration within the Big Four market and audit quality in EU member states. This negative relation follows the assumption that in markets where concentration is low and competition is high, audit firms charge lower audit fees and have lower discretionary accruals. When concentration is high, audit fees increase since the barriers for small audit firms to enter the market are high too (Gunn et al., 2019). Next, the Big Four audit firms compete with each other through audit quality instead of audit fees, as lowballing is discouraged (Van Raak et al., 2012). Thus, a decline in concentration between the Big Four audit firms implies less competition and an increase in audit quality to stay competitive and to sustain relations with their clients.

With the growing dominance of a single Big Four audit firm, the client's choice for auditors is limited and leads to audits being performed with reduced skepticism and in a much more lenient way (Boone et al., 2012). Huang et al. (2016) even pointed out that auditors and executives are less likely to be sanctioned for their accounting mistakes when audit market concentration is high. This could increase the possibility of engaging in earnings management.

Finally, in the Theoretical Background section, I discussed multiple studies that provide evidence for these assumptions that imply a negative relation between the Big Four market concentration and audit quality (Boone et al., 2012; Francis et al., 2013; Gunn et al., 2019). Hence, I expect that higher concentration within the Big Four market increases discretionary accruals and decreases audit quality. I test the following hypothesis;

Hypothesis 1b: *Concentration within the Big Four audit market is negatively related to the quality of audits in the EU.*

2.2.2 Audit market concentration trends

I conduct time trend analysis from 2004 until 2013 for market concentration indicators to analyze their impact on audit quality over time. Such analysis not only helps to visualize the trend in Big Four dominance but also identifies the concentration indicator that causes the most concerns for maintaining a degree of audit quality. The first two hypotheses show that I expect different relations between the audit market concentration indicators and audit quality (H1a & H1b). Therefore, trends complement this study by pointing out which indicator the regulators and European Commission should primarily focus on.

First, I expect that the market share growth of the Big Four audit firms is positive. The European Commission speaks of market share growth and continued oligopoly growth in many reports (European Commission, 2017; European Commission, 2021). Other regulators and studies also argue that the overall Big Four dominance is growing over time (House of Lords, 2010; Velte et al., 2012; Mališ and Brozović, 2015). Because of the negative effect on discretionary accruals, this concentration indicator should not be causing the primary concerns of regulators about poor audit quality (Francis et al., 2013). Therefore, I expect the Big Four market share to have an upward trend. I test the following hypothesis to identify the trend in Big Four market share;

Hypothesis 2a: *Market share of the Big Four (BIG4SHARE) has a positive trend in the EU for the period 2004-2013.*

Prior study shows that concentration within the Big Four market potentially causes concerns about poor audit quality (Francis et al., 2013). According to the House of Lords (2010), some sectors already reduce the Big Four audit firms to two or three audit firms as they have enough expertise to undertake complex audits. This is consistent with an analysis from Velte et al. (2012) who found growing trends of Big Four market concentration for a multitude of EU member states. Thus, as I expect a negative effect of Big Four market concentration on audit quality, I expect this concentration indicator to increase over time. This would indicate increasing discretionary accruals and decreasing audit quality. Therefore, I test the following hypothesis to check if this indicator is most problematic for audit quality and if it should be the primary concern about audit quality that regulators should have;

Hypothesis 2b: *Concentration within the Big Four Market (CONCENTR) has a positive trend in the EU for the period 2004-2013.*

3. Research design

I perform a cross-country analysis to examine the effect of audit market concentration indicators on audit quality. Trend analysis of audit market concentration on audit quality will test for competition trends and their effect on audit quality in the EU audit market over time. This section defines the variables and formulas. Appendix A describes all variables used. Appendix B shows the construct of the concepts in a Libby Box.

3.1 Audit quality

I measure audit quality with the use of the Jones model. Jones (1991) argues that discretionary accruals can be used as a proxy for audit quality since audits of high-quality constraints the possibility to engage in earnings management. This results in a decline in the magnitude of accruals. This paper uses the modified Jones Model from Dechow et al. (1995) to measure audit quality for individual company-year observations. The difference compared to the original Jones model is that the modified Jones model adjusts for the change in revenues by controlling for the change in receivables. To estimate discretionary accruals, I use the following regression, where discretionary accruals are defined as the residual term (ε_{it});

$$ST\_Accruals_{it} = \beta_{0it} + \beta_{1it}\frac{1}{ASSETS_{it-1}} + \beta_{2it}\left(\Delta Revenues_{it} - \Delta Receivables_{it}\right) + \beta_{3it}GrossPPE_{it} + \varepsilon_{it} \ (1)$$

ST_Accruals$_{it}$ are the total accruals for a specific company (i) and fiscal year (t), calculated as net income before extraordinary items minus cash flow from operating activities. These total accruals are scaled by lagged total assets conform to the modified Jones Model. The model consists of lagged assets, *ΔRevenue$_{it}$* is the one-year change in revenues, *ΔReceivables$_{it}$* is the one-year change in receivables, *GrossPPE$_{it}$* is the amount of gross property, plant, and equipment (PPE), and ε_{it} denotes the estimated discretionary accruals. I scale all variables by lagged total assets.

The next step is to calculate scaled normal accruals (*SN_Accruals*) through the estimated intercept and coefficients from the first regression (1). Now both scaled total accruals and scaled normal accruals are calculated, I compute scaled discretionary accruals by subtracting both variables (*SD_Accruals = ST_Accruals – SN_Accruals*).

3.2 Audit market concentration

Audit market concentration provides an indication of the level of competition in the EU audit market. I make an important differentiation between the Big Four audit firms (Deloitte, Ernst & Young, KPMG, and PricewaterhouseCoopers) and other, smaller audit firms. I define markets on a country-level basis considering each EU member state. Francis et al. (2013) argue that due to country-level controls of regulation and licensing of auditors, audit markets are country-specific in nature and concentration analysis should be performed on country-levels accordingly. Next, I calculate audit market concentration through two indicators. First, the variable *"BIG4SHARE"* indicates the share of the Big Four audit firms in

the total audit market on a country-year level. The *"BIG4SHARE"* variable can be calculated through different measurements. These are the number of clients, audit fees, or surrogates for audit fees, such as client total assets and revenues (Beattie et al., 2003). In this paper, I measure market share as the client's total assets and revenues since Compustat Global lacks information on audit fees. Combining two different datasets would reduce the number of observations significantly. Furthermore, measures such as total assets still show relative client size to account for the magnitude of the audit services performed. Therefore, I measure *"BIG4SHARE"* as the proportion of the client's total assets and revenues audited by Big Four audit firms on the client's assets or revenues in the overall audit market.

Next, the second indicator variable called *"CONCENTR"* measures the concentration between the Big Four audit firms to show competition within the Big Four audit market. Both concentration indicators are useful as the European Commission has concerns not only about the market share of the Big Four audit firms but also about the consequences of high market concentration for audit quality. I measure *"CONCENTR"* through the Herfindahl Hirschman Index (HHI) which serves as a proxy for market concentration and competition;

$$CONCENTR = HHI = \sum_{i=1}^{n} Market\ Share_{it}{}^2 \qquad (2)$$

The above equation sums up the squared market share of each Big Four audit firm as a proportion of the total Big Four audit market. Again, I perform these computations on a country-year level. To understand the interpretation of this concentration indicator I provide the following example; if each Big Four audit firm owns 25% of the market in an EU member state, the HHI will be 0.25 or 25%. However, when one Big Four audit firm audits all the clients in the market, the HHI equals 1 or 100%. Therefore, a higher HHI implies higher concentration and a less competitive and more duopolistic or monopolistic market.

3.3 Regression model

Next, I perform the regression of audit market concentration on audit quality. I use scaled discretionary accruals *(SD_Accruals)* as the proxy for audit quality. The Big Four market share *(BIG4SHARE),* and the Big Four market concentration *(CONCENTR)* serve as an indication of audit market concentration. I use various control variables to control for client-specific and country-specific determinants of discretionary accruals. Van Raak et al. (2020) and Francis et al. (2013) argue for various performance indicator variables that affect discretionary accruals. Hence, I account for; Client Size as the logarithm of assets *(SIZE),* Leverage as the debt-to-total assets ratio *(LEV),* Return on Assets *(ROA),* Revenue Growth *(REV_GROWTH),* PPE Growth *(PPE_GROWTH)*, Cash flows from operations *(CFO),* Earnings Before Interest and Taxes *(EBIT)*, Net Income *(NetIncome)* and the Rule of Law *(Rule_of_Law).* I also add industry fixed effects using the one-digit SIC-code and year fixed effects to the regression;

SD_Accruals = β_{0it} + β_1(BIG4SHARE$_t$) + β_2(CONCENTR$_{it}$) + β_3(SIZE$_{it}$) + β_4(LEV$_{it}$) + β_5(ROA$_{it}$) + β_6(REV_GROWTH$_{it}$) + β_7(PPE_GROWTH$_{it}$) + β_8(CFO$_{it}$) + β_9(EBIT$_{it}$) + β_{10}(NetIncome$_{it}$) + β_{11}(Rule_of_Law$_t$) + β_{12}(Industry/Year$_t$) + ε (3)

I add these performance indicators and company-specific characteristics as control variables, to control for differences in the quality of the accruals related to financial distress, reporting incentives, and the fact that the accruals increase in magnitude through the growth of a client (Van Raak et al., 2012). Interesting is the addition of *"Rule_of_Law"* as a control variable which is a governance indicator. The World Bank defines this indicator as 'the Rule of Law that captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.' I add this to the regression since higher values indicate stricter governance enforcement regimes. This implies a greater incentive to provide qualitative earnings, as punishments are stricter in these countries. This variable serves as a country-year-level control variable for my cross-country analysis with a value that ranges from -2.5 to 2.5.

3.4 Trend Analysis

To test for changes in competitiveness in the audit market, I present trends in figures illustrating the growth in the average Big Four market share and Big Four market concentration over time in the EU. I do this by conducting linear trend analysis for 2004 to 2013, which is an extensive period before the publication of Article 27 in the "European Union Audit Legislation". This way I analyze which indicator of audit market concentration provides the greatest risk for audit quality over the years. Thus, to validate the concerns of the European Commission to issue such legislation and to provide implications for future regulation around market concentration in the EU audit market.

3.5 Data sample

The dataset of Compustat Global contains financial data of listed companies (non-US). This paper selects company observations that have a Country of Incorporation Code (ISO) corresponding to an EU member state for fiscal years 2004-2013. From this dataset, I retrieve financial data to compute discretionary accruals and market shares. I also use this dataset to collect information on the respective auditors of the clients. Hence, I compose a portfolio of EU member state companies and their respective audit firms for each fiscal year. I use The World Bank DataBank to obtain information on governance indicators per country *(Rule_of_Law).* I need this variable for the regression of audit market concentration on audit quality to control for country-specific determinants of discretionary accruals.

Table 1 shows the sample selection process. I remove observations with missing financial data from the EU dataset, as I cannot use these observations for the calculations of discretionary accruals. Next, I remove financial institutions with SIC-codes between 6000-6999 from the dataset. Bigus and Zimmerman (2008) argue that due to specific asset structures and the need for more specialized audits, such companies should be excluded from audit market concentration analyses. Furthermore, I remove observations from Bulgaria, Croatia, and Romania from the dataset. These countries were not part of the European Union in 2004 and joined at a later period. I remove observations from Portugal because of

insufficient financial data. Next, I control for missing values for both current and lagged variables. I need those variables to compute discretionary accruals as a proxy for audit quality and growth rates. I control for lacking data on client's auditors for trends by removing Poland and Slovakia. These countries have little data in 2004-2005. Furthermore, French law requires clients to have two auditors, which makes it complicated to assess the primary client auditor in the dataset. Therefore, I exclude observations from France from the final sample.

I use the sample from Table 1 to compute audit quality, audit market concentration, and its respective relation over the years in the EU on a country-year level. To control for outliers in the data, I apply winsorization at the 1 and 99 percent levels for all continuous variables needed to calculate discretionary accruals, market shares, and concentration levels. The final sample contains 28,323 firm-year observations with 4,613 unique firm observations from 21 EU member states.

Table 1

Sample selection	*N*
Firm-year observations in Compustat Global with financial data 2004-2013	346,158
Less:
Firms with missing financial data	(117,267)
Firms with SIC-codes between 6000-6999	(407)
Firms with ISO-codes "Non-EU/BGR/HRV/PRT/ROU"	(185,516)
Firms with missing data for growth/lagged calculations	(8,371)
Firms with lacking auditor data - ISO-codes "POL/SVK/FRA"	<u>(6,247)</u>
Sample for analysis discretionary accruals and market concentration (Firm-year)	28,323
Additional Sample Information
Unique firm observations	4613
Number of countries	21

3.6 Descriptive Statistics

Table 2 presents descriptive statistics of the firm- and country-specific variables. All variables are in millions of dollars, except for the different performance ratios (see notes). I use these variables not only to compute discretionary accruals, market shares, and concentration levels but also to conduct the regression of audit market concentration on audit quality. Key variables from this table are the various accrual variables from the different EU member states. The means of both *"ST_Accruals"* and "*SN_Accruals*" are negative with a value of -0.06. "*SD_Accruals*" has a mean value of 0.0002. As mentioned, accruals are the difference between net earnings before extraordinary items and cash flows from operating activities. Negative accruals imply that, on average, the companies from the sample have larger cash flows compared to their earnings. This could be due to many paid-up front services or large depreciation expenses.

Table 2
Descriptive statistics of variables for firm-year observations

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Median	Pctl(75)	Max
T_Assets	28,323	2,501.98	9,182.55	0.34	30.23	133.81	758.01	68,421.26
T_Liabilities	28,323	1,448.76	5,177.47	0.07	12.06	64.96	424.33	37,131.21
T_Revenue	28,323	2,048.90	7,229.31	0.00	20.74	116.87	720.96	52,768.97
GrossPPE	28,323	1,456.85	5,663.31	0.00	5.39	44.16	346.11	42,673.99
ΔReceivables	28,323	-12.50	85.51	-573.62	-5.87	-0.37	1.25	249.31
NetIncome	28,323	111.33	498.68	-287.51	-1.66	2.02	24.51	3,750.37
EBIT	28,323	192.35	773.25	-106.80	-0.42	4.85	46.35	5,797.20
CFO	28,323	228.22	912.52	-78.99	-0.12	5.90	53.87	6,857.65
SIZE	28,323	5.06	2.39	-1.09	3.41	4.90	6.63	11.13
Rule_of_Law	28,323	1.56	0.43	0.39	1.57	1.72	1.79	2.01
T_Accruals	28,323	-113.45	441.77	-3,107.28	-30.73	-3.70	-0.01	137.61
ST_Accruals	28,323	-0.06	0.14	-0.70	-0.10	-0.05	-0.0003	0.43
SN_Accruals	28,323	-0.06	0.02	-0.15	-0.07	-0.05	-0.05	-0.004
SD_Accruals	28,323	0.0002	0.13	-0.55	-0.04	0.01	0.05	0.45
LEV	28,323	0.55	0.28	0.02	0.37	0.54	0.69	1.79
REV_Growth	28,323	0.22	0.90	-0.98	-0.05	0.06	0.22	6.77
PPE_Growth	28,323	0.17	0.66	-0.91	-0.003	0.05	0.16	4.95
ROA	28,323	-0.04	0.26	-1.67	-0.04	0.03	0.07	0.31
BIG4SHARE_A	28,323	0.89	0.14	0.26	0.91	0.94	0.96	1.00
BIG4SHARE_R	28,323	0.89	0.15	0.22	0.91	0.94	0.96	1.00
CONCENTR_A	28,323	0.36	0.09	0.25	0.31	0.32	0.37	0.93
CONCENTR_R	28,323	0.36	0.09	0.25	0.31	0.33	0.36	0.90

Note. '*N*' is the number of firm-year observations. '*T_Assets*' are the total assets. '*T_Liabilities*' are the total liabilities. '*T_Revenues*' are the total revenues. '*GrossPPE*' is the gross property, plant, and equipment. '*ΔReceivables*' is the change in receivables from year t-1 to year t. '*NetIncome*' is the net income before extraordinary items. '*EBIT*' is the Earnings Before Interest and Tax. '*CFO*' is the cash flow from operating activities. '*SIZE*' is the logarithm of total assets. '*Rule_of_Law*' is the perception of confidence and abidance of rules of society and the quality of contract enforcement and property rights per country. '*T_Accruals*' are the total accruals computed as net income before extraordinary items less cash flow from operating activities. '*ST_Accruals*' are the total accruals, scaled by lagged total assets. '*SN_Accruals*' are the normal accruals, scaled by lagged total assets. '*SD_Accruals*' are the discretionary accruals, scaled by lagged total assets. '*LEV*' is the company's leverage as the ratio of total liabilities scaled by total assets. '*REV_Growth*' is the growth ratio in revenue from year t-1 to year t. '*PPE_Growth*' is the growth ratio in property, plant, and equipment from year t-1 to year t. '*ROA*' is the ratio of net income divided by total assets. '*BIG4SHARE_A*' is the market share of the Big Four firms calculated as the audited client's assets in the market on a country-year level. '*BIG4SHARE_R*' is the market share of the Big Four firms calculated as the audited client's revenues in the market on a country-year level. '*CONCENTR_A*' is the Herfindahl Hirschman Index of the Big Four market summing the squared market share as the client's total assets for each Big Four firm in the Big Four audit market on a country-year level. '*CONCENTR_R*' is the Herfindahl Hirschman Index of the Big Four market summing the squared market share as the client's revenues for each Big Four firm in the Big Four audit market on a country-year level.

The means for "*ST_Accruals*" and "*SN_Accruals*" are the same since the modified Jones Model (1995) filters out the discretionary accruals as the error term. The expected value of the error term when performing a regression should be zero. "*SN_Accruals*" is the component of accruals that management has no influence on. "*SD_Accruals*" is the component of accruals that managers can adjust through accounting regulations and cash flows. The mean being close to zero indicates that on average discretionary accruals are non-existing and there is no earnings management. Thus, accruals close to zero indicate higher earnings quality for the

client. The negative scaled total and normal accruals together with scaled discretionary accruals close to zero for European countries are in line with discretionary accrual-based studies using cross-country analysis (Francis et al., 2013). Scaled discretionary accruals in US settings tend to be a bit more negative (Kothari et al., 2005; Boone et al., 2012).

Table 2 also provides descriptive statistics for the different Big Four market shares and concentration levels within the Big Four audit market. I show a more extensive overview of these different indicators per country in Table 4. The numbers for concentration measures in Table 2 are again in line with a study from Francis et al. (2013) who state a mean of 38% whereas I found a mean of 36%. The market share of the Big Four audit firms in EU member states is in line with reports from the European Commission. These reports state that that the Big Four market share lays between 80% and 90% (European Commission, 2021). Besides, these percentages correspond to market shares from different settings in various other studies (Boone et al., 2012; Huang et al., 2016; Gunn et al., 2019).

3.7 Pearson Correlation

I conduct a Pearson correlation to show the correlation between all the main regression variables (Formula 3). The Pearson correlation table can be found in Table 3. The correlation between the two concentration indicators "*BIG4SHARE*" and "*CONCENTR*" is negative and significant at the 1% level. The significant Pearson correlation coefficient value ranges from -0.272 and -0.349 for the different indicators and measurements of market concentration through assets and revenues. The strength of the correlation between the market share of the Big Four audit firms (*BIG4SHARE*) and concentration within the Big Four audit market (*CONCENTR*) is considered weak (Evans, 1996). This is because the absolute value of the correlation coefficient lays in between 0.20 and 0.39. A weak relation between the concentration indicators shows that the two indicators capture different aspects of the EU audit market structure (Francis et al., 2013). This implies the importance of analyzing the distinct effects of these indicators in the EU, which is not yet incorporated in the reports from the European Commission. However, to control for possible biased concentration coefficients in the regression, I perform different model regression (see Results section). This way I check if regression coefficients of the two concentration indicators would change if I either use "*BIG4SHARE*" or "*CONCENTR*" as the main independent test variable separately.

"*BIG4SHARE*" is significantly correlated with all the regression model variables. "*CONCENTR*" is significantly correlated with all the regression model variables, except with leverage (*LEV*). This indicates that adding these variables to the regression is useful for interpreting the results. Furthermore, the correlation coefficients of the regression model variables are relatively low. Only "*BIG4SHARE_A*" and "*BIG4SHARE_R*" together with "*CONCENTR_A*" and "*CONCENTR_R*" are highly correlated. However, I always use these concentration measurements separately in the regression model. This means that no highly linear relation exists between all regression variables, which implies that the presence of multicollinearity is low as well.

Table 3

Pearson correlation firm-level and country-level variables formula 3.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
(1) SD_Accruals		-0.035***	-0.041***	0.044***	0.035***	0.029***	-0.172***	0.383***	-0.039***	-0.041***	-0.013**	0.011*	0.033***	-0.042***
(2) BIG4SHARE_A	-0.035***		0.966***	-0.334***	-0.272***	-0.063***	-0.087***	-0.040***	0.052***	0.015**	0.030***	0.029***	0.034***	0.727***
(3) BIG4SHARE_R	-0.041***	0.966***		-0.349***	-0.273***	-0.053***	-0.083***	-0.046***	0.050***	0.016***	0.033***	0.032***	0.037***	0.749***
(4) HHI_Assets	0.044***	-0.334***	-0.349***		0.929***	0.049***	0.008	0.071***	-0.053***	-0.033***	-0.014**	-0.014**	-0.014**	-0.410***
(5) HHI_Revenue	0.035***	-0.272***	-0.273***	0.929***		0.027***	0.000	0.061***	-0.044***	-0.029***	-0.022***	-0.022***	-0.021***	-0.341***
(6) SIZE	0.029***	-0.063***	-0.053***	0.049***	0.027***		0.096***	0.365***	-0.087***	-0.046***	0.511***	0.506***	0.465***	-0.037***
(7) LEV	-0.172***	-0.087***	-0.083***	0.008	0.000	0.096***		-0.182***	-0.077***	-0.078***	0.016***	0.018***	-0.008	-0.079***
(8) ROA	0.383***	-0.040***	-0.046***	0.071***	0.061***	0.365***	-0.182***		-0.045***	0.008	0.098***	0.109***	0.125***	-0.065***
(9) REV_Growth	-0.039***	0.052***	0.050***	-0.053***	-0.044***	-0.087***	-0.077***	-0.045***		0.388***	-0.037***	-0.033***	-0.030***	0.067***
(10) PPE_Growth	-0.041***	0.015**	0.016***	-0.033***	-0.029***	-0.046***	-0.078***	0.008	0.388***		-0.037***	-0.034***	-0.031***	0.036***
(11) CFO	-0.013**	0.030***	0.033***	-0.014**	-0.022***	0.511***	0.016***	0.098***	-0.037***	-0.037***		0.950***	0.890***	0.009
(12) EBIT	0.011*	0.029***	0.032***	-0.014**	-0.022***	0.506***	0.018***	0.109***	-0.033***	-0.034***	0.950***		0.936***	0.021***
(13) NetIncome	0.033***	0.034***	0.037***	-0.014**	-0.021***	0.465***	-0.008	0.125***	-0.030***	-0.031***	0.890***	0.936***		0.021***
(14) Rule_of_Law	-0.042***	0.727***	0.749***	-0.410***	-0.341***	-0.037***	-0.079***	-0.065***	0.067***	0.036***	0.009	0.021***	0.021***	

Note. $*p<0.1$; $**p<0.05$; $***p<0.01$. $SD\_Accruals$ are the discretionary accruals, scaled by country-level. $BIG4SHARE\_A$ is the market share of the Big Four firms calculated as the audited client's assets in the market on a country-year level. $BIG4SHARE\_R$ is the market share of the Big Four firms calculated as the audited client's revenues in the market on a country-year level. $CONCENTR\_A$ is the Herfindahl Hirschman Index of the Big Four market summing the squared market share as the client's total assets for each Big Four firm in the Big Four audit market on a country-year level. $CONCENTR\_R$ is the Herfindahl Hirschman Index of the Big Four market summing the squared market share as client's revenues for each Big Four firm in the Big Four audit market on a country-year level. $SIZE$ is the logarithm of total assets. LEV is the company's leverage as the ratio of total liabilities scaled by total assets. ROA is the ratio of net income divided by total assets. REV_Growth is the growth ratio in revenue from year t-1 to year t. PPE_Growth is the growth ratio in property, plant, and equipment from year t-1 to year t. CFO is the cash flow from operating activities. $EBIT$ is the Earnings Before Interest and Tax. $NetIncome$ is the net income before extraordinary items. $Rule\_of\_Law$ is the perception of confidence and abidance of rules of society and the quality of contract enforcement and property rights per country.

3.8 Market concentration statistics

Table 4 provides an overview of the number of observations per country for 2004-2013. The table shows the average Big Four market share on a country-year level, measured through the client's total assets and the client's total revenues. Also, I provide statistics on Big Four market concentration, measured as the HHI of the individual squared Big Four market shares within the Big Four audit market. Important to note is that observations from Germany (DEU), the United Kingdom (GBR), Greece (GRC), Italy (ITA), and Sweden (SWE) overrepresent the sample.

Table 4

Average Market Share and Concentration level per country, 2004-2013

Country	N	CONCENTR_A	CONCENTR_R	BIG4SHARE_A	BIG4SHARE_R
Austria	507	0.416	0.419	0.895	0.881
Belgium	612	0.354	0.334	0.902	0.927
Cyprus	435	0.663	0.677	0.905	0.863
Czech Republic	112	0.428	0.400	0.913	0.920
Denmark	984	0.343	0.337	0.966	0.970
Estonia	113	0.591	0.494	0.980	0.960
Finland	816	0.499	0.504	0.977	0.977
Germany	3,202	0.391	0.383	0.916	0.912
Greece	1,531	0.398	0.353	0.651	0.615
Hungary	126	0.338	0.328	0.959	0.959
Ireland	472	0.292	0.288	0.954	0.957
Italy	1,610	0.463	0.471	0.522	0.501
Lithuania	306	0.447	0.506	0.857	0.836
Luxembourg	285	0.411	0.458	0.888	0.913
Latvia	193	0.599	0.543	0.816	0.738
Malta	92	0.560	0.605	0.632	0.867
Netherlands	1,014	0.273	0.269	0.909	0.900
Slovenia	188	0.453	0.518	0.899	0.860
Spain	655	0.339	0.322	0.850	0.867
Sweden	3,529	0.315	0.310	0.914	0.920
United Kingdom	11,540	0.316	0.326	0.949	0.945

Note. All numbers (columns 3-6) are the average of the yearly market shares and concentration levels for the period 2004-2013. *'N'* is the observations per country for the period 2004-2013. *'CONCENTR_A'* is the Herfindahl Hirschman Index of the Big Four market, summing the squared market share as the client's total assets for each Big Four firm in the Big Four audit market on a country-year level. *'CONCENTR_R'* is the Herfindahl Hirschman Index of the Big Four market, summing the squared market share as client's revenues for each Big Four firm in the Big Four audit market on a country-year level. *'BIG4SHARE_A'* is the market share ratio of the Big Four firms calculated as the audited client's assets in the audit market on a country-year level. *'BIG4SHARE_R'* is the market share ratio of the Big Four firms calculated as the audited client's revenues in the audit market on a country-year level.

The average concentration level of the Big Four audit market for most countries in the EU is close to 30% or 40% *(CONCENTR_A)*. However, Cyprus, Estonia, Latvia, and Malta have a higher concentration within their Big Four audit market. Countries with higher concentration levels have less equally distributed individual market shares of the Big Four audit firms. These countries should be more cautious of a duopoly or monopoly of a Big Four audit firm on the

audit market. The same results hold when I calculate market shares through audited revenues per Big Four audit firm *(CONCENTR_R)*. The Netherlands has the lowest concentration level, considering both measurements for the concentration within the Big Four audit market. This implies that competition in the Big Four audit market is highest in the Netherlands, where the market shares are more equally distributed between the Big Four audit firms.

When looking at the average Big Four market shares per country calculated through audited assets *(BIG4SHARE_A),* most countries show a measure close to 80% and 90%. This is in line with reports from the European Commission (European Commission, 2017; European Commission, 2021)*.* This shows that the Big four audit firms hold on average 80% to 90% of the market share of the EU audit market. Therefore, 10% to 20% of the market share is held, on average, by smaller audit firms in the EU. These numbers could imply a potential risk for the quality of audits, as competition levels in the EU are relatively low and the oligopolies of the Big Four audit firms occur in many EU member states. The existing dominance on the audit market of the Big Four audit firms shuts out new contestants and drives smaller audit firms out of the market due to their low shares (Mališ and Brozović, 2015). However, Big Four audit firms could perform more qualitative audits because of their expertise, reputation, discretion towards earnings management, and size, diminishing the potential negative influence of competition on audit quality (Mališ and Brozović, 2015).

As shown in Table 4 Greece, Italy, and Malta deviate from the average of 89% with exponential smaller market share percentages. This suggests that these countries have an audit market that is more controlled by smaller audit firms. The same results hold when I take the average Big Four market share calculated through audited revenues (*BIG4SHARE_R)*. However, Latvia instead of Malta observes a market share level relatively low compared to the average of 89%.

4. Results

4.1 Regression model (Hypothesis 1)

First, I test how different audit market concentration indicators affect audit quality (H1a, H1b). Hence, this section provides results of the regression of audit market concentration on audit quality. The concentration indicators "*BIG4SHARE*" and "*CONCENTR*" are the independent test variables. Scaled discretionary accruals are the dependent variable and serve as a proxy for audit quality. I use the model from the research design for the regression of audit market concentration on audit quality to test the first hypotheses. I make six alterations to these models which I explain in the next paragraphs. All variables are described in the "Research Design" section (formula 3) and Appendix A "Variables definition". I clustered all standard errors at the individual firm level for all six regression models. I added industry-fixed effects using one-digit SIC codes and year-fixed effects to the regression models as well.

$SD\_Accruals = \beta_{0it} + \beta_1(BIG4SHARE_t) + \beta_2(CONCENTR_{it}) + \beta_3(SIZE_{it}) + \beta_4(LEV_{it}) + \beta_5(ROA_{it}) + \beta_6(REV\_GROWTH_{it}) + \beta_7(PPE\_GROWTH_{it}) + \beta_8(CFO_{it}) + \beta_9(EBIT_{it}) + \beta_{10}(NetIncome_{it}) + \beta_{11}(Rule\_of\_Law_t) + \beta_{12}(Industry/Year_t) + \varepsilon$ (3)

4.1.1. Results assets-based concentration indicators

Table 5 provides the results of assets-based concentration indicators on scaled discretionary accruals. I present three models, a model with both "*BIG4SHARE_A*" and "*CONCENTR_A*" as the concentration indicators (1), a model with only "*BIG4SHARE_A*" as the concentration indicator (2), and a model with only "*CONCENTR_A*" as the concentration indicator (3). I do this to distinctly capture the effect of the different market concentration indicators on audit quality.

The results show that scaled discretionary accruals are significantly lower in country-year groupings where the market share of the Big Four audit firms is relatively larger. In model (1) the coefficient for "*BIG4SHARE_A*" is negative with a magnitude of -0.023 and significant at p < 0.01. Results change little when I only use "*BIG4SHARE_A*" as the test variable in the regression. The regression coefficient goes down to -0.024 and stays significant at p < 0.01, as displayed in model (2). This implies higher quality audits for more Big Four intense markets. This also implies that countries in the EU observe an increase in audit quality when their audit market is more dominated by the Big Four audit firms. However, this relation does not hold for market concentration within the Big Four audit market.

"*CONCENTR_A*" has a positive coefficient of 0.015 significant at p < 0.1 in model (1). The coefficients change little when I solely use this concentration indicator for the main independent test variable in model (3), (0.016). This shows that scaled discretionary accruals are higher when concentration levels between the Big Four audit firms are high. Therefore, growing duopolies or monopolies of a single Big Four audit firm can be risky for the quality of audits for countries in the EU. The different effects on audit quality of the two concentration indicators are important evidence for competition and regulation analysis in the EU.

Finally, the constant for all three models (1,2,3) is positive and significant at p < 0.01. Besides, the adjusted R2 shows that all models (1,2,3) explain 18.80% of the variation in the dependent variable, scaled discretionary accruals. This is in line with the discretionary accrual models from Francis et al. (2013), Gunn et al. (2019), and Van Raak et al. (2020). Almost all control variables are significant at p < 0.01 which implies that they help in controlling for the actual effect of the market concentration indicators on audit quality.

Table 5

Regression of concentration measures on audit quality (assets)

	Dependent variable:		
	SD_Accruals		
	(1)	(2)	(3)
BIG4SHARE_A	-0.023***	-0.024***	
	(0.008)	(0.008)	
CONCENTR_A	0.015*		0.016*
	(0.008)		(0.008)
SIZE	-0.008***	-0.008***	-0.008***
	(0.001)	(0.001)	(0.001)
LEV	-0.041***	-0.041***	-0.040***
	(0.005)	(0.005)	(0.005)
ROA	0.214***	0.215***	0.214***
	(0.008)	(0.008)	(0.008)
REV_Growth	-0.003***	-0.003***	-0.003***
	(0.002)	(0.002)	(0.002)
PPE_Growth	-0.010***	-0.010***	-0.010***
	(0.002)	(0.002)	(0.002)
CFO	-0.00002***	-0.00002***	-0.00002***
	(0.000)	(0.000)	(0.000)
EBIT	0.00002***	0.00002***	0.00002***
	(0.000)	(0.000)	(0.000)
NetIncome	0.00002***	0.00002***	0.00002***
	(0.000)	(0.000)	(0.000)
Rule_of_Law	0.001	-0.0003	-0.005**
	(0.003)	(0.003)	(0.002)
Constant	0.086***	0.093***	0.072***
	(0.009)	(0.008)	(0.008)
Year/Industry fixed effects	yes	yes	yes
Observations	28,323	28,323	28,323
R2	18.90%	18.90%	18.90%
Adjusted R2	18.80%	18.80%	18.80%
Residual Std. Error	0.121	0.121	0.121
F Statistic	243.991***	253.252***	252.966***

Note. *p<0.1; **p<0.05; ***p<0.01. All standard errors are clustered at the individual firm-level.

4.1.2. Results revenue-based concentration indicators

Table 6 provides results of revenue-based concentration measures on scaled discretionary accruals. Again, I construct three models; a model using both "*BIG4SHARE_R*" and "*CONCENTR_R*" as the concentration indicators (4), only "*BIG4SHARE_R*" as the concentration indicator (5), and only "*CONCENTR_R*" as the concentration indicator (6).

Table 6
Regression of concentration measures on audit quality (revenue)

	Dependent variable:		
	SD_Accruals		
	(4)	(5)	(6)
BIG4SHARE_R	-0.025***	-0.025***	
	(0.007)	(0.007)	
CONCENTR_R	0.003		0.004
	(0.008)		(0.008)
SIZE	-0.008***	-0.008***	-0.008***
	(0.001)	(0.001)	(0.001)
LEV	-0.041***	-0.041***	-0.040***
	(0.005)	(0.005)	(0.005)
ROA	0.214***	0.215***	0.214***
	(0.008)	(0.008)	(0.008)
REV_Growth	-0.003***	-0.003***	-0.003***
	(0.002)	(0.002)	(0.002)
PPE_Growth	-0.010***	-0.010***	-0.010***
	(0.002)	(0.002)	(0.002)
CFO	-0.00002***	-0.00002***	-0.00002***
	(0.000)	(0.000)	(0.000)
EBIT	0.00002***	0.00002***	0.00002***
	(0.000)	(0.000)	(0.000)
NetIncome	0.00002***	0.00002***	0.00002***
	(0.000)	(0.000)	(0.000)
Rule_of_Law	0.001	0.0005	-0.006***
	(0.003)	(0.003)	(0.002)
Constant	0.092***	0.093***	0.078***
	(0.008)	(0.007)	(0.007)
Year/Industry fixed effects	yes	yes	yes
Observations	28,323	28,323	28,323
R2	18.90%	18.90%	18.90%
Adjusted R2	18.80%	18.80%	18.80%
Residual Std. Error	0.121	0.121	0.121
F Statistic	243.923***	253.306***	252.819***

Note. *p<0.1; **p<0.05; ***p<0.01. All standard errors are clustered at the individual firm-level.

Results show that scaled discretionary accruals are significantly lower in country-year groupings where the market share of the Big Four audit firms is relatively larger. In model (4) the coefficient for "BIG4SHARE_R" is negative with a magnitude of -0.025 and significant at $p < 0.01$. This implies higher quality audits for more Big Four intense markets. This coefficient remains the same when it is solely used as the independent test variable in model (5). Again, this does not hold for Big Four market concentration. This is because "*CONCENTR_R*" has a positive coefficient of magnitude 0.003 in model (4), however not significant. The coefficient changes only slightly to 0.004 in model (6), however still not significant. While this again indicates that discretionary accruals increase when Big Four market concentration increases, I find no significant evidence for this relation.

Finally, the constant for all three models (4,5,6) is positive and significant at $p < 0.01$. Besides, the adjusted R2 again shows that all models (4,5,6) explain 18.80% of the variation in the dependent variable, scaled discretionary accruals. This is in line with the discretionary accrual models from Francis et al. (2013), Gunn et al. (2019), and Van Raak et al. (2020). Almost all control variables are significant at $p < 0.01$ which implies that they serve their purpose in evaluating the actual effect of market concentration indicators on audit quality.

Therefore, the difference between the measurement techniques, using either assets or revenues for market share calculations, only alters the magnitude and significance of the coefficient for "*CONCENTR*". The sign of the relation stays the same for both test variables. However, it indicates that different measurements of market shares are useful for extensive market concentration analysis.

4.1.3. Summary results hypothesis 1

All models show that higher Big Four market shares on the total audit market result in smaller scaled discretionary accruals which increases the quality of audits per country-year-grouping. I show this through the negative and significant coefficients of "*BIG4SHARE*". This implies that EU member states with an audit market that is more Big Four intense observe a reduction in discretionary accruals. For these countries, the market share of the Big Four audit firms is relatively high in the total market. As discretionary accruals indicate the existence of earnings management and show earnings quality, smaller discretionary accruals increase the quality of the audit. As accruals decrease for more Big Four intense markets, these countries have less discretion to engage in earnings management (Francis et al., 2013). This implies that countries with Big Four dominated markets are beneficial for the quality of audits in the EU.

Furthermore, the negative coefficient of "*BIG4SHARE*" can be explained through the fact that companies in such markets engage in earnings management to a lesser extent due to size (Lawrence et al., 2011). Besides, Big Four audit firms increase audit quality through their reputation (Rama and Read, 2006), economies of scale, and technical audit expertise (Mališ and Brozović, 2015).

When looking at "*CONCENTR*" as a measurement for concentration levels in the EU, results show that increasing concentration between the Big Four firms per country-year-grouping increases scaled discretionary accruals. This suggests that countries with a less equal

distribution of the individual Big Four market shares in the audit market, observe an increase in discretionary accruals. Larger discretionary accruals increase the engagement in earnings management and hence lower the quality of audits. On the contrary, countries with a more equal and fair distribution of the individual Big Four market shares in the Big Four audit market (*CONCENTR*) observe a decrease in discretionary accruals. That increases the quality of audits through lower engagement in earnings management. These findings are predominantly evident and significant for asset-based measurements of market shares.

Thus, I do not reject hypotheses 1a and 1b. The reason is that I find a negative relation between "*BIG4SHARE*" and discretionary accruals implying a positive relation with audit quality. Furthermore, I find a positive relation for "*CONCENTR*" and discretionary accruals implying a negative relation with audit quality. These relations suggest that the trend towards a duopoly or monopoly of a Big Four audit firm on the EU audit market (*CONCENTR*) can be relatively riskier for the quality of audits performed compared to the growth of Big Four market share per se (*BIG4SHARE*). Rising "*CONCENTR*" levels affect the competitive intensity of the Big Four audit market as shares are less equally distributed. This is a main concern for the European Commission. In my trend analysis, I control for these possible trends to validate and highlight the primary concerns for regulators in the EU.

For now, the European Commission should put more focus and potential regulation on the growth of duopolies and monopolies in the EU audit market. Also, mergers of Big Four audit firms could hence be risky for the quality of audits due to the relative growth of individual Big Four market shares in the Big Four audit market. Regulators need to be less concerned about Big Four's dominance in the EU audit market per se. However, this paper is holding back on pleading for a "Big Four Only" market as I do not investigate the effect on audit quality through an absence of small- to medium-sized audit firms. These findings are consistent with findings from Francis et al. (2013) using cross-country analysis for multiple countries worldwide.

4.2 Trend analysis (Hypothesis 2)

I perform linear trend analysis to understand the trends of both concentration measures "BIG4SHARE" and "*CONCENTR*" before the legislation of the European Commission. This section provides graphs and growth rates of both concentration indicators. A graphical illustration of these trends complements research on the relation between audit market concentration and audit quality and validates regulator's concerns. It helps regulators to focus on the right concentration indicator to ensure a degree of audit quality and competition in the EU audit market. I illustrate these trends in Figure 1 and Figure 2.

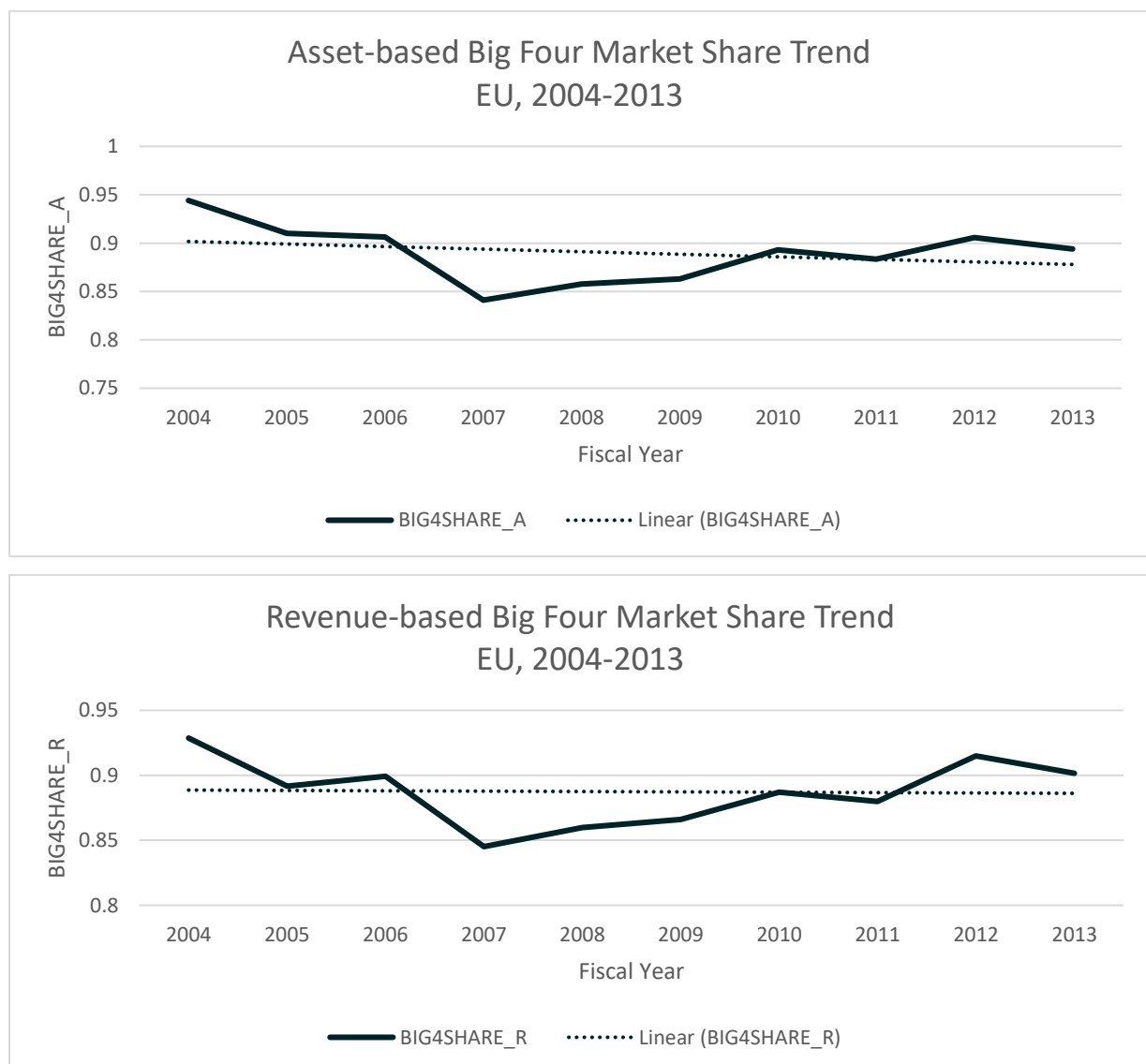#### *4.2.1. Results trends Big Four market share*

Figure 1 shows both trends of "*BIG4SHARE*" for 2004-2013 in the EU audit market. The trend for the Big Four market shares is declining in the period 2004 to 2007, followed by an increase in the period 2007 to 2013. The average trend of "*BIG4SHARE_A*" per year for 2004-2013 is negative with a value of -0.556%. This implies that on average the market share of the

Big Four audit firms is slightly declining. However, the large decrease in market share for the period 2004-2007 biases the interpretation of the linear trend of the Big Four market shares. A steady increase in market shares can be observed from 2007-2013 with an average positive trend of 1.036%. As "*BIG4SHARE_A*" and discretionary accruals are negatively related to one another, the increase in market share of the Big Four audit firms from 2007 and onwards increases the quality of audits performed in the EU.

I find the same trend for the Big Four market share calculated through audited revenues. Figure 1 shows that "*BIG4SHARE_R*" has a negative average trend of -0.283% per year in the EU. Again, from 2007 the slope of the growth in market share of the Big Four audit firms is positive with an average value of 1.100% as the trend for 2007-2013. Therefore, although I observe an average negative trend, the recent growth in Big Four dominance through market shares diminishes the risk and concern about poor audit quality. Therefore, this concentration indicator is becoming less risky for audit quality in the EU audit market.

Figure 1

*Trends in "BIG4SHARE" in the EU, 2004-2013*

4.2.2. Results trends Big Four market concentration

Figure 2 shows trends for "*CONCENTR*" in the EU for the period 2004-2013. I perform trend analysis for Big Four market concentration for both asset-based and revenue-based measurements of market shares. Both trends of Big Four market concentration have an upward slope. The average trend of "*CONCENTR_A*" is 0.512% per year. Hence, it indicates that the individual Big Four market share became less equally divided in the EU audit market. This would imply larger discretionary accruals over time and lower quality of audits performed in EU member states. The average trend of "*CONCENTR_R*" per year is slightly higher with a value of 0.747%. Again, this demonstrates an increase in the Big Four market concentration in the EU audit market. With "*BIG4SHARE*" being positively related to discretionary accruals, the trend in Big Four market concentration measured through revenues would decrease the quality of audits performed in the EU over time.

Figure 2

Trends in "CONCENTR" in the EU, 2004-2013
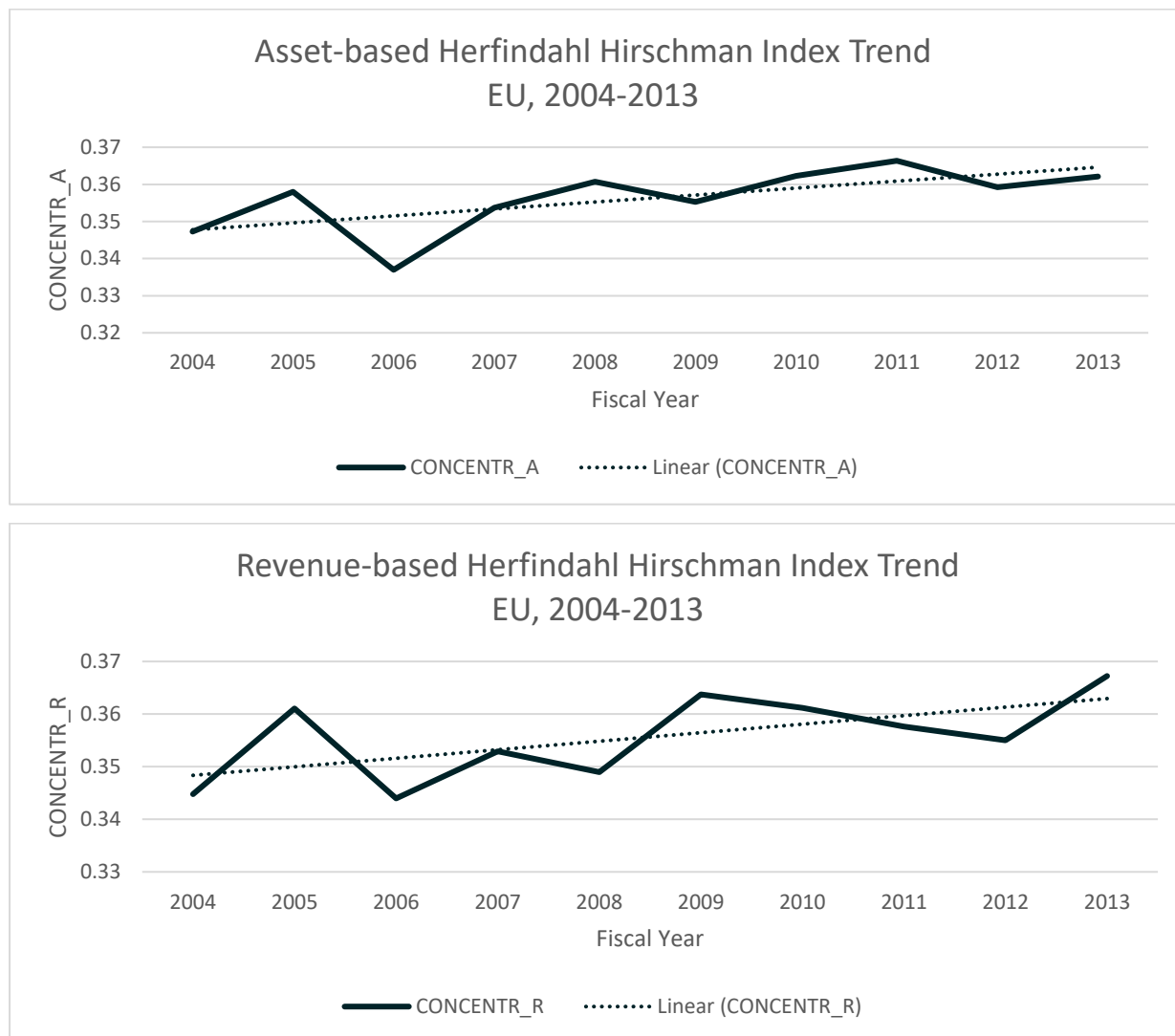
4.2.3. Summary results hypothesis 2

First, I observe a V-shape trend of *"BIG4SHARE"* as the Big Four dominance decreases until 2007 and increases onwards. Therefore, I reject hypothesis 2a because the trend in the Big Four market share (*BIG4SHARE*) is not predominantly positive. However, the results suggest that the average market shares of the Big Four audit firms were lowest in 2007 and started to rise ever since. The recent upward trend in market share of the Big Four audit firms in the total market indicates that this concentration indicator is becoming less risky towards audit quality in the EU. This conclusion becomes more evident as the reports from the European Commission show growing market shares of the Big Four audit firms, after issuing the "European Union Audit Legislation" (European Commission, 2017; European Commission; 2021). Hence, the trend in *"BIG4SHARE",* although on average negative, is growing over time since 2007 and increases the quality of audits.

Since I find a positive relation between Big Four market concentration (*CONCENTR*) and discretionary accruals, the growth in "*CONCENTR*" negatively influences the quality of audits in the EU before the "European Union Audit Legislation, Article 27". Thus, concentration within the Big Four audit market is a contributor to the risk of diminishing audit quality in the EU audit market. Because of its consistent growth, this indicator is more problematic compared to the Big Four market share. The European Commission should consider regulating the Big Four market concentration to control for its effect on audit quality. This is an important finding because the European Commission does not yet incorporate Big Four market concentration, measured through HHI, in their reports and predominantly focuses on the Big Four market share (European Commission, 2017; European Commission, 2021).

Thus, I do not reject hypothesis 2b because the trend in concentration within the Big Four audit market is positive on average. This finding is consistent with research from Velte et al. (2012) who found growing trends of the Big Four market concentration for a multitude of EU member states. Furthermore, the positive trend in Big Four market concentration confirms the concerns of the House of Lords (2010), who argue that some sectors already reduce the Big Four audit firms to two or three audit firms as they have enough expertise to undertake complex audits. This would reduce the competition in the EU audit market and the quality of audits accordingly.

5. Conclusion

This study investigates whether audit quality is negatively affected by audit market concentration in the EU. Trend analysis for two concentration indicators shows their growth and effects on audit quality over time. With a sample of 29,323 observations from 21 EU member states, this study provides implications for the concerns of regulators to ensure audit quality and to sustain a certain level of competition in the EU audit market. Since the European Commission shares these concerns, they ask for extensive research on audit market concentration trends in the EU.

With the use of a cross-country analysis to examine concentration indicators in the EU, this study identified two different associations regarding audit quality. First, the relative market share of the Big Four audit firms in the total audit market is significant and negatively associated with scaled discretionary accruals. Because smaller discretionary accruals increase the quality of earnings, the quality of audits is higher in EU member states where the Big Four audit firms dominate the overall audit market.

Second, this study finds evidence for a positive association between the market concentration within the Big Four audit market and scaled discretionary accruals. Hence, audit quality decreases in countries with a more concentrated Big Four audit market. The reason is that larger discretionary accruals diminish the quality of earnings. This suggests that regulators and the European Commission should not primarily focus on Big Four dominance through relative Big Four market share in the total audit market. Regulators should be more concerned with the risks of unequal distribution of market shares within the Big Four audit market. Thus, potential duopolies or monopolies of the Big Four audit firms on the audit market can be considered problematic and risky for audit quality.

Next, this study uses a linear trend analysis of both concentration indicators to illustrate their effects on audit quality over an extensive period before issuance of the "European Union Audit Legislation" (2004-2013). Results show a positive trend in Big Four market concentration within the Big Four audit market. Regulators should be cautious because of its growth and negative effect on audit quality. Next, while the Big Four market share observes an average negative trend, this trend becomes positive from 2007 and onwards. Hence, this indicator suggests that regulators should be less concerned with the trend in Big Four dominance on the overall audit market because ever since its decline, it started to positively affect audit quality in the EU. Hence, it is mainly the Big Four market concentration that negatively affects the quality of audits in the EU which answers the research question accordingly.

Thus, this paper implies that regulators should be more concerned with the occurrence of Big Four audit firm mergers, duopolies, and monopolies as these increase the concentration within the Big Four audit market. Regulators should question the consensus that Big Four dominance per se causes audit quality to decrease. Thus, this paper helps regulators and the European Commission to impose fitting regulations around the correct aspect of audit market concentration to ensure a competitive and qualitative EU audit market in the future. To do

so, regulators and the European Commission should put more emphasis on the level of competition within the Big Four audit market.

This study contributes to the existing literature by analyzing the EU audit market to provide a richer understanding of the effect of audit market concentration on audit quality. Even up till now, the European Commission does not incorporate a wide variety of concentration indicators and measurement techniques in their reports. To examine the validity of the regulator's market concentration concerns, this study focuses on the EU audit market, a setting not distinctly investigated yet. Furthermore, I use a new concentration indicator that is not yet considered in the reports of the European Commission as well (European Commission 2017, European Commission 2021). Therefore, in response to the European Commission, this study delivers insightful evidence concerning Big Four's dominance in the EU audit market and suggests that a potential shift of concerns from Big Four's market share dominance to competition within the Big Four audit market is needed.

My study is subject to certain limitations. First, this study only uses one proxy for audit quality, namely, discretionary accruals. More proxies such as audit fees, restatements, or going-concern opinions can demonstrate the effect of different concentration indicators on audit quality even more. For example, when audit fees are used as a proxy for audit quality, the explanatory power for the variation in the dependent variable of the model increases significantly (Huang et al., 2016; Gunn et al., 2019; Van Raak et al., 2020).

Another limitation is that more market share measurement techniques, such as audit fees, can be used to show a better variety of concentration indicators whereas this study only uses surrogates for audit fees. This is important, as I observe that the size and significance of regression coefficients alter when different market share measurements are used. Moreover, my trends are bounded to a specific setting and period in time. Hence, regulators should be cautious about generalizing findings to use them as evidence for future regulation or regulation in non-EU settings. Another limitation is that I only use publicly listed companies in this sample, where results may be different for private clients. Lastly, I could not analyze all EU member states due to the lack of financial and auditor information in the dataset.

Hence, future research could enrich the understanding of audit market concentration in the EU by analyzing different proxies, more extensive samples, and periods. This way, more analysis can supply the European Commission with sufficient knowledge on audit market concentration to impose fitting regulation. Since this paper finds evidence for diminishing quality of audits through Big Four market concentration, it could also be interesting to analyze specific EU member states where these concentration levels are highest and pose the most risk.

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7. Appendix

Appendix A. Variables definition

Variables	Description
T_Assets	Amount of total assets of the client.
T_Liabilities	This variable represents the total value of all items reported in the Liabilities section.
T_Revenue	Amount of total revenue of the client from the Income Statement.
GrossPPE	The total gross amount of Property, Plant, and Equipment representing the cost and/or valuation of tangible fixed assets used in the production of revenue.
ΔReceivables	One-year change in accounts receivable as reported in the Operating Activities section on the Statement of Cash Flows from year t-1 to year t.
NetIncome	Net Income before extraordinary items of a client.
EBIT	The Earnings Before Interest and Taxes calculated as the Net Sales minus Cost of Goods Sold minus Selling, General & Administrative Expenses minus Depreciation/Amortization.
CFO	This item represents the net change in cash from all items classified in the Operating Activities section of the Statement of Cash Flows.
SIZE	The natural logarithm of the client's total assets.
Rule_of_Law	The Rule of Law is a governance indicator that captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Its' value ranges from -2.5 to 2.5.
T_Accruals	Total Accruals calculated as Net Income before extraordinary items minus cash flow from operating activities.
ST_Accruals	Total Accruals calculated as the difference between Net Income before extraordinary items minus cash flow from operations. Following the modified Jones Model (Dechow et al., 1995). Scaled by lagged total assets.
SN_Accruals	Normal Accruals calculated through the modified Jones Model (Dechow et al., 1995). Scaled by lagged total assets.
SD_Accruals	Discretionary Accruals calculated as the residual of the modified Jones Model or the difference between Total Accruals and Normal Accruals (Dechow et al., 1995). Scaled by lagged total assets.
LEV	Leverage of a client calculated as the client's total liabilities divided by total assets.
REV_Growth	One-year growth in revenues from year t-1 to year t.
PPE_Growth	One-year growth in gross Property, Plant, and Equipment from year t-1 to year t.
ROA	Client's return on assets calculated as net income divided by total assets.

BIG4SHARE_A	Calculated as the market share of the Big 4 firms in the total audit market measured through the audited client's assets on a country-year level.
BIG4SHARE_R	Calculated as the market share of the Big 4 firms in the total audit market measured through the audited client's revenues on a country-year level.
CONCENTR_A	Variable indicating the Big Four market concentration using the Herfindahl Hirschman Index of the Big Four market summing the squared market share as the client's total assets for each Big Four firm in the Big Four audit market on a country-year level.
CONCENTR_R	Variable indicating the Big Four market concentration using the Herfindahl Hirschman Index of the Big Four market summing the squared market share as the client's total revenues for each Big Four firm in the Big Four audit market on a country-year level.

Note. Most variables are retrieved from WRDS – Compustat Global. Variable description matches with various WRDS variable descriptions.

Appendix B. Libby Boxes