

THE EFFECT OF AUDIT PARTNER AND FIRM TENURE ON AUDIT QUALITY

In 2016 new regulation on mandatory auditor rotation is introduced to reform the European audit market after the financial crisis, accounting scandals and a loss of trust in the auditing profession. This thesis studies if the alleged threat of long-lasting client-auditor relationships is true and audit tenure negatively impacts audit quality, as proponents of mandatory auditor rotation claim. According to theory, auditor tenure can affect audit quality both negatively through a lower level of independence as positive through a lack of knowledge. Where prior research is mixed in methods and results, this thesis finds evidence for a negative association between tenure at level of the partner and audit quality. It also finds a non-linear relationship between audit tenure at the firm-level and audit quality that starts of positive, while it becomes negative as tenure increases. Audit quality is measured as discretionary accruals estimated by two versions of the Jones model. The results indicate that the effect through independence takes place at both the level of the partner- as firm-level, while the knowledge effect only appears at tenure at the level of the audit firm. These results are supportive towards mandatory auditor rotation, while the terms might need to be reconsidered.

Radboud University

Master thesis Economics

Corporate Finance & Control

1st of August 2017

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Introduction

After several accounting scandals and the financial crisis, the auditing profession was highly debated in the last ten years. Auditors were criticised that they were not professional and independent enough relative to the firms they audited. Auditing became a political issue that received a lot of attention (ACCA, 2011). With the goal of improving the quality of financial reporting and to regain trust in the work of the auditing profession, new legislation has been put in place. Regulators and policymakers in the European Union have reformed the European audit market in 2016. Part of this regulation was on mandatory auditor rotation, which makes long audit engagements between auditors and clients impossible: it puts a bound on audit firm tenure. As announced in 2014, the European Union set the maximum length of an engagement between the client and the audit firm on ten successive years (Article 17 of Regulation (EU) No 537/2014). The main argument to implement such regulation is the alleged detrimental effect of longer engagements on the quality of the audit through a lower level of independence and the professional scepticism of the auditor (European Commission, 2016). It would be hard to claim that an auditor-client relationship can exist for multiple decades without the auditor becoming to feel a part of the company (ACCA, 2011). This cannot be matched with the desired standards on independence (European Commission, 2010). This thesis looks if longer auditor-client relationships indeed have a negative impact on audit quality, as proponents of mandatory auditor rotation claim.

As defined by DeAngelo (1981), audit quality is “the market-assessed joint probability that a given auditor will both (a) discover a breach in the client’s accounting system, and (b) report the breach” (p. 186). This two-folded definition describes the two factors that affect audit quality: competence and independence. First, audit quality depends on the knowledge and expertise of the auditor on the business, activities and accounting systems of the client. Secondly, it depends on the chance that the auditor will report the (material) misstatement, which guides as a measure of independence of the auditor relative to the client. This latter is referred to when advocating mandatory auditor rotation after a fixed amount of years to increase the independence of the external auditor. Studies by Carey and Simnett (2006), Chi and Huang (2005) and Davis et al. (2000) indicate that as auditor tenure increases, the quality of the audit diminishes.

However, mandating firms to change their auditor could also negatively impact audit quality by influencing the competence factor. Accountants stress that longer audit tenure is necessary to build up client-specific knowledge (PwC, 2013). Since the activities of firms can be complex and extensive, the knowledge that is formed during an engagement might be gone too early if the maximum length of a tenure is set to strict, which negatively impacts the quality of the audit (ACCA, 2011). Due to less client-specific knowledge, the risk of audit failures is higher in the first years of a new audit

engagement. As a result, mandating periodical audit rotation could lead to the opposite and undesired effect. Part of prior research indicates that audit tenure positively affects the quality of the audit Johnson et al. (2002), Geiger and Rathunandan (2002) and Carcello and Nagy (2004) find that shorter tenure is negatively associated with audit quality. These studies indicate that limiting the length of the auditor-client engagement and forcing firms to hire another external auditor periodically does not necessarily improve audit quality and even has the potential to decrease it.

Since mandatory audit rotation regulation is implemented to increase audit quality (European Commission, 2016), but prior research does not show conclusive results on the relation between audit tenure and audit quality, more research might help to find out if such regulation deals with (part of) the issues relating to audit quality. This thesis adds to prior research that it looks at both audit firm tenure as audit partner tenure and does this simultaneously. At both levels of auditor tenure (partner and firm) legislation is in place to limit the length of engagements. Next to that, it studies whether audit tenure and audit quality are related in a non-linear way. By adding quadratic terms, this thesis can capture both the possible linear relationship as a non-linear quadratic relationship and seeks to provide more evidence on the inconclusive and contradictory results obtained by research thus far on the association. The quadratic terms are used in the topic of earnings management by Davis et al. (2009), however this was the case in a probit model. For models that studied the effect with the number of discretionary accruals as dependent variable, only one study is found that used this approach. Chi and Huang (2005) did their research like this on a sample of Taiwanese firms over the period 1998-2001, where both the sample as the time makes it hard to apply it to the current situation in Europe. This research studies Dutch listed firms, since these firms should adhere to the new European regulation, while data out of the United States has been used most often and studies on European data are rare. Since the institutional and cultural environment might differ among countries, basing solely on US-data might lead to wrong conclusions. It also uses the most recent time span. Motivated by the call and implementation of legislation on mandatory auditor rotation, the research question of this thesis is as follows: *To what extent does audit tenure affect audit quality?*

In the next section background information is given on the regulation on mandatory auditor rotation in the European Union and more specific the Netherlands. After that, an overview of the theoretical background of relevant topics for this thesis and prior empirical findings takes place and arguments for and against mandatory auditor rotation are given. The fourth section describes the research that is performed in this thesis and of which the results are depicted in the section thereafter. The last section of this thesis concludes, comments on the implications and limitations and proposes some areas for future research.

Background information

In reaction to the economic and financial crisis, to counter doubts by investors on the credibility and reliability of financial reports and the alleged threat of long-lasting working relationships between the auditor and the client, the EU has introduced new rules on the statutory audit (European Commission, 2016). Part of this new regulation is the mandatory rotation of auditors, which puts a natural bound on the audit tenure of audit firms. The objective of this regulation is to tackle the risks that occur when firms hold on to the same auditor for decades. Such engagements might threaten the independence of the auditor, inaccuracies may be taken over year by year since there is no “fresh look” and it might have a negative influence on the professional scepticism of the auditor (European Commission, 2016). Overall, the goal of the periodically mandated rotation is to improve audit quality. In a Green Paper of 2010, the European Commission states that the at that time mandatory audit partner rotation, the rotation within audit firms, on its own was not effective enough to overcome issues of excess familiarity. The recommendation was to consider mandatory rotation between audit firms as well.

Such regulation on the duration of audit firm engagements went into effect on 16 June 2016 for all public-interest entities (PIEs) in the European Union. Before this date, rotation was only obligatory for the key audit partner, rotation within the audit firm. However, since the goal of an audit firm is to retain the long-lasting relationship with the client, partner rotation alone is perceived to be insufficient to get rid of the threat to independence (European Commission, 2016). Regulation 537/2014 prescribes that engagements of audit firms may not exceed ten years. Current audit firms that already have been in place for longer periods fall under the transition arrangements and can stay in place till 2020 or 2023, depending on the number of consecutive years already in place (Deloitte, 2015). Member states have the options to extend the maximum duration of the engagement if a tender takes place or the audit is done by more than one firm, while it may also adopt a lower amount of years as maximum engagement (Deloitte, 2015). The maximum for the statutory audit partner is kept on seven years, which it already was in the 2006/43/EC directive. Just as with the audit firm tenure maximum, member states may adopt shorter terms for the rotation of the key partner. In The Netherlands, the rotation periods since 2016 are ten and five years for respectively audit firms and leading partners (Koninklijke Nederlandse Beroepsorganisatie van Accountants, 2015). Before 2016, the statutory partners were not allowed to audit a firm for a longer period than seven consecutive years.

Literature review

Agency theory looks at situations and relationships in which one or more principals hire an agent to act on their behalf. It assumes that the involved parties are economic agents that might act opportunistically, that they are self-interested persons that maximize their own utility. Another assumption is that the agent does not necessarily have the same interests and/or information as the principal(s). So, the actions of the agent might be hard to control and opportunistic behaviour can take place at the cost of the principal. This is described as agency problems, in which the principals have little reason to trust the agents that they serve the interest of the principal (The Audit Quality Forum, 2005). An often-used relationship to illustrate agency problems is that between shareholders and the management, where the first is the principal and the latter the agent. According to agency theory, shareholders cannot fully trust the management due to the information asymmetry and the self-interested characteristics of the management. They will put mechanisms in place to align the interests and to reduce the information asymmetry, which reinforces the trust in the agents. One way of monitoring the management and to reduce the information asymmetry, is by performing an audit. An audit and financial reports provide tools to control the work of the management and the information given by them. This external assured information reduces the information asymmetry between the shareholders and the management and gives shareholders a trustworthy view on the financial position of the firm.

However, since the auditor is an agent itself, similar concerns arise here as at the shareholder-management relationship. The auditor is hired to serve the shareholders by assuring that the statements are a reliable representation of the firm's financial position (PwC, n.d.). Jensen and Meckling (1976) claim that the external auditor should be independent of the management of the client, to be able to monitor the firm on behalf of the shareholders. Hussey (1999) states that an auditor should see the shareholders as the client and not the company that it audits. From an agency perspective, auditors may serve their own interests and not necessarily those of the principal, which are the owners of the firm. Since the auditing process requires a close working relationship between the auditor and the directors, there might be concerns on the independence of the auditor. Also, since the management deals with the appointments of the auditor, auditors could have the motive to please the management, which may go at the expense of the shareholders. To conclude, the usage of auditors to reduce agency problems, leads to new possibilities of agency issues because of a lack of independence of the auditor relative to the management.

The level of independence is one of the determinants of audit quality. As defined by DeAngelo (1981), audit quality is "the market-assessed joint probability that a given auditor will both (a) discover a breach in the client's accounting system, and (b) report the breach" (p. 186). This definition describes

two factors that affect audit quality: competence and independence. At first, audit quality is depending on the knowledge and expertise of the auditor on the business, activities and accounting systems of the client. Next to that, it depends on the likelihood that the auditor will report the (material) misstatement, which is considered as a measure of independence of the auditor relative to the client.

A concept that influences audit quality is audit tenure: the length of the working relationship between the auditor and the firm being audited. In general, there are two views on the effect of audit tenure on audit quality. These two views are based on the effect of tenure on the two explanatory factors of audit quality described in the previous paragraph: independence and competence. First, a longer relationship between the auditor and the client can lead to a closer relationship between the two and the auditor will more likely please the client, soften its standards and act in favour of the client. This will impair the audit quality, which indicates a negative effect of audit tenure on audit quality. Second, a longer auditor-client relationship will lead to more understanding of the work by the client and more knowledge on the accounting systems of the client by the auditor. As auditor tenure increases, the auditor will build up client-specific knowledge that has a positive effect on audit quality. So, audit tenure can affect audit quality both negatively as positively, through respectively a lower degree of independence or a higher level of competence (Tepalagul and Lin, 2015).

Through independence, audit tenure negatively impacts audit quality. The independence of the auditor might be threatened by the familiarity threat described by Hussey (1999). He says that the independence of an auditor might decrease when the length of the relationship with the client becomes greater. A long-term relationship between the auditor and the directors at the company can reduce the likelihood of 'taking an unbiased viewpoint in the performance of audit tests, the evaluation of the results, and the issuance of the audit report' (Hussey, 1999, p. 191). Such relationship has the potential to impair independence and consequently audit quality, when the two parties become too familiar with each other and over time the auditor becomes unconsciously less objective when auditing the firm (Mautz and Sharaf, 1961). If tenure increases, auditors might become less sceptical and accept more easily what the company's management shows them by softening their standards and follow management (Mautz and Sharaf, 1961). Junaidi et al. (2012) claim that auditors that have a longer relationship with the client, will act more as one of the firm instead of professionally and critically overlooking the assertions of the company.

The negative effect assumed by the effect of auditor tenure on independence is empirically found by Davis et al. (2000). They look at the effect of audit tenure on the amount of discretionary accruals and the errors of analysts' forecasts, with the latter defined as the actual earnings minus the forecasted earnings by analysts. Their results indicate a positive association between auditor tenure and the amount of discretionary accruals and a negative one between tenure and forecast errors. According to Davis et al. (2000), this is in line with the client receiving more freedom and flexibility in reporting and being able to live up to earnings forecasts more likely when tenure increases. Also, Chi and Huang (2005) find supportive evidence that audit firm tenure decreases the quality of the audit measured through the level of discretionary accruals on the long term. Jonson et al. (2002) do not find evidence that longer audit firm tenure (more than eight years), relative to medium terms (four till eight years), affects audit quality. This last study uses both absolute values of unexpected accruals as the persistence of the accrual components of earnings as proxy for audit quality.

Where Chi and Huang (2005) found evidence for a negative effect of audit firm tenure on audit quality, they do not find an association between tenure at the level of the leading partner and audit quality. Contrary, such association is found by studies of Carey and Simnett (2006) and Ball et al. (2015). The study of Carey and Simnett (2006) show that a longer engagement between the audit partner and the client (more than seven years) has a negative effect on the quality of financial reports when proxied by the propensity to issue a going-concern opinion by an auditor for financial distressed firms or by the probability of just beating or missing specific financial benchmarks (e.g. avoiding to report a loss). Also Ball et al. (2015) find a negative effect between audit partner tenure and audit quality, measured as an estimation of adjustments and differences relative to the numbers under IFRS.

On the other hand, audit tenure has a positive effect on the quality of the audit because of higher client-specific knowledge. During an engagement between auditor and client, the auditor builds up knowledge relating to the firm's activities, accounting systems and internal controls. Especially at the start of a tenure, the auditor faces a period in which it builds up the knowledge: the learning curve (Jackson et al., 2008). This knowledge is client-specific and not applicable to others, so at the start of a tenure the auditor might lack expertise necessary to the client in question. In periods where auditors themselves have (too) little knowledge of the client, they must rely more on what the client presents them (PricewaterhouseCoopers, 2002). As a result, misstatements and errors are more likely to take place and the quality of the audit will suffer from this (Imhoff, 2003). When time passes, the auditor will become more competent to audit the client, which positively impacts the quality of the audit.

Such positive relationship between auditor tenure and audit quality is found by Myers et al. (2003) and Ball et al. (2015). Myers et al. (2003) study the association between audit firm-client tenure and audit

quality, with the latter measured in two ways: the level of accruals and the dispersion of income increasing and income decreasing accruals. According to Ball et al. (2015), the length of the engagement of the audit firm at the client is positively affecting the quality of the audit, with the latter measured as an estimation of adjustments and differences relative to the numbers under IFRS. These two studies are against the argument that mandatory rotation should be implemented to go against the deteriorating effect of tenure.

The effect of a lack of knowledge on the firm's operations should theoretically only occur at the starting periods of auditor-client relationships, after some years the necessary knowledge has been learned by the auditor. The results of Johnson et al. (2002) show that, relative to the medium category (four till eight years), a short audit-firm relationship (two or three years) increases the magnitude of abnormal accruals and decreases the persistency of accruals in future earnings. This indicates that shorter tenure has a negative effect on the quality of the financial report. Chi and Huang (2005) find that a shorter tenure decreases the quality of the audit, measured through the level of discretionary accruals, for both firm as partner tenure.

Audit quality is also measured in other ways than in different forms of accruals. Geiger and Raghunandan (2002) take audit reporting failures as a measure of audit quality. They look at the last financial statements of firms that went bankrupt and look at the opinion given by the auditor. The authors find a negative association between auditor tenure and the failures, which indicates that audit reporting failures are more persistent in the early years of an auditor engagement relative to longer engagements. Carcello and Nagy (2004) take a similar approach as Geiger and Raghunandan (2002) and look at the effect of auditor tenure on fraudulent financial reporting. Their results show that fraudulent reporting is more likely to take place in the first three years of the tenure, compared to later in the audit firm-client engagement. The results of both Geiger and Raghunandan (2002) as Carcello and Nagy (2004) indicate that the audit quality in the beginning of a tenure is lower due to a lack of familiarity or knowledge of the client.

As described before, audit tenure affects audit quality in two ways: positive through the competence factor and negative through the effect on independence. Previous research does not unanimously show which of the two effects dominates, or if both cancel each other out and tenure has no effect on audit quality overall. As shown, empirical studies on the effect of audit tenure on audit quality are mixed, which may have multiple reasons. This will be discussed after a description of literature on the effect of mandating firms to rotate their auditors periodically, a type of regulation that is proposed to tackle issues on a lack of independence stemming from long audit engagements.

Gietzmann and Sen (2002) build a model that describes the trade-off that illustrates the issue of mandating firms to periodically switch of auditor. They stress that such regulation would have a positive effect on the incentives to remain the level of independency of the auditor, while it could be costly and might take time to build up the client-specific knowledge each time a switch is forced to take place. In their model Gietzmann and Sen show that when management is no longer able to influence the chance of a reappointment of the current auditor, the incentives of the auditor to remain independent are bigger. On the other hand, there is the possibility of extra costs, both in terms of audit fees as lower audit quality. They conclude that mandatory auditor rotation has positive effects when the audit market consists of a relatively small amount of big clients. In such markets, auditors have more incentives to collude with management to hold their clients. When this is not the situation, the costs of mandatory rotation are higher than the positive effects. The effects of the level of independence and knowledge are described earlier in this chapter, this part will focus more on other effects of mandating rotation of auditors on the audit quality.

The main argument that speaks for the regulation on auditor rotation is that it limits the tenure to deal with concerns on the independence of the auditor relative to the client. Forcing firms to change their auditor after a fixed number of years makes sure that extensive auditor-client relationships are no longer possible. Next to this, mandatory auditor rotation will also positively influence audit quality in other ways. First, a new auditor faces the audited firm with a fresh look. Shockley (1981) describes the situation in where an auditor that audits a firm for a longer period and he or she starts doing the audit on routine. The auditor will put too much emphasis on reports of previous years and earlier made mistakes will not be discovered and carried over from year to year. A new auditor that sees the financial statements for the first time will do the audit more critically and will less likely transfer earlier made mistakes to the new year, which would increase the audit quality (Shockley, 1981). Second, the beginning of the auditing process is characterised by high costs at the beginning of tenure. These costs are higher at the start of an engagement, because the auditor needs to become familiar with the client and needs to understand the business, activities and the accounting systems of the client. The current auditor, who has incurred these costs already, can do the audit at lower costs than other auditors that have to start and have to incur the starting costs. Due to this cost advantage, the incumbent auditor earns client specific quasi-rents and terminating the relationship will come at costs for the auditor (DeAngelo, 1981). These quasi-rents lead to a situation in which the auditor accepts more from the client to maintain the proceeds in future years. Mandatory rotation makes sure that the period of economic dependency of the auditor, the period in which it profits from the earlier incurred starting costs, will have a natural bound and thus decreases, which lowers the incentive to soften the control in order to keep receiving the proceeds. Lastly, the reputation that the auditor has to keep up, might

positively affect audit quality when mandatory auditor rotation is in place. Since another auditor, a competitor, will take over and examine their work within a couple of years, the current auditor will make sure that it delivers audits with high quality in the last fiscal years of the engagement. Cameran et al. (2015) call this the embarrassment effect.

Next to the positive effects of mandatory auditor rotation, it may also affect audit quality in a negative way. The biggest argument against mandatory rotation of auditors is the loss of client-specific knowledge. Mandating a firm to switch her auditor periodical, will result in more periods of learning by the auditor and more knowledge that will be gone since the expertise will not be transferred over to the next auditor. These extra learning periods can lower the audit quality (Imhoff, 2003). Another negative effect of mandating auditor switches periodically is that with switching both the auditor as the client must make extra costs. In the first years of the engagement starting-up costs are prevalent: from procedural costs to costs for becoming familiar with the client and his business/industry. Also, the client must devote more resources in the first year relative to following years to make the audit possible. Arruñada and Paz-Ares (1997) analyse that with a shorter rotation period, the total costs of auditing increase.

This thesis studies the effect of audit tenure on audit quality, motivated by the call and implantation of rules on auditor rotation. In general, there are two main views on the effect of audit tenure on audit quality. In the first one, audit tenure increases the familiarity between the auditor and the client. This could hamper the independence of the auditor relative to the firm it audits and would negatively impact the quality of the audit. The second view states that during the engagement, client-specific knowledge will be build up. Due to a lack of this knowledge, the quality of the audit would be lower at the beginning of a tenure. During an engagement, this knowledge positively impacts the quality of the auditing process and reports. Prior research shows mixed results, which could be the case due to these opposite effects: through knowledge tenure positively effects audit quality, where the effect of independence is negative.

Another probable reason that the results of prior research are mixed, is the fact that some of them distinguish between the effect of tenure on the short term and the long run. This distinction comes from the timing of the two main effects of audit tenure on audit quality. The concerns on a lower level of independence between the auditor and the client are focussed on longer working relationships between the two, on long-term audit tenure. On the other hand, the negative effect of the loss or lack of client-specific knowledge is associated with the first years of the tenure. The effect of a lack of client-specific knowledge will diminish when tenure increases due to the learning effect, where the effect of a loss of independence will enlarge when tenure increases. Out of this, one might expect to find a non-

linear and concave relationship between audit tenure and audit quality, where the effect of tenure on the quality of the audit will go from positive to negative as tenure increases.

A third probable reason for the different found associations between tenure and quality might lie in the levels of tenure that are captured in the studies. Tenure can refer to both the audit firm-client relationship as the audit partner-client relationship. By looking at only one of the two types of tenure, the effect of both might be falsely attributed to only one of them, since both levels of tenure increase by the same amount per year when there is no switch of auditor. This can lead to wrong conclusions on the effect(s).

The study in this thesis looks at both the levels of tenure at the same time to overcome the threat that the effects of both might add up together or cancel each other out. Concerning the two possible and opposite effects of audit tenure on audit quality and the timing of both effects, a distinction is made between the two types of tenure. This thesis hypothesises that the client-specific knowledge that is build up during the first years of an engagement, can be spilled over between audit partners and audit teams of the same audit firm (EY, 2016). After a partner switch, the new audit partner will have access to the dossier, can discuss with the previous statutory partner and ask for information where needed. The information that is acquired during the learning period at the beginning of the tenure, will thus not be lost if there is rotation within an audit firm. Keeping this knowledge of the client, maintains the level of audit quality. However, this information will be lost when there is rotation between audit firms. So, this thesis hypothesises that the effect of audit tenure on audit quality through client-specific knowledge is specific to tenure at the firm-level, where this knowledge effect is absent at the partner-level. The effect through independence is hypothesised to be apparent at both levels of auditor tenure, motivated by excess familiarity and accepting more of the client.

All together the effect of tenure at the level of the firm will be positive at the beginning of the engagement and becomes negative as tenure rises, while the effect of audit partner tenure will be negative from the start of an engagement onwards. The two hypotheses that are tested in this thesis are therefore:

H1: Audit partner tenure negatively affects audit quality.

H2: The effect of audit firm tenure on audit quality follows an inverse U-shape, where the effect goes from positive to negative as audit firm tenure increases.

Research method

Sample and data

The subjects that are studied in this thesis are firms listed on the Amsterdam Exchange Index (AEX), the Amsterdam Midkap Index (AMX) and the Amsterdam Small Cap Index (AScX), all three containing 25 traded funds, which makes a total of 75 funds. These firms are relevant to study since they should adhere to the new mandatory rotation laws from 2016 onwards. The sample period is 2005-2015, since this contains the most recent data available, especially the data on audit tenure is hard to find for earlier years. Klein (2002) mentions that the accruals of financial firms are hard to estimate due to the business of these firms. Therefore, this thesis excludes the firms that have a SIC Code in the range 6000-6799 (finance, insurance and real estate). Of the 75 firms listed on the three named indices, fifteen belong to this industry segment. Data on auditor tenure was missing for eight other funds during more than seven of the eleven years sample period. Of the remaining funds, one fund reported for the first time as a standalone firm in 2016 (Philips Lightning) and another one was the only fund in its industry (Beter Bed). For the first fund, there was no (auditor) data available in the sample period, while the latter is removed to avoid issues on reliability due to too less observations per industry. At the end, the sample consists of 50 firms. All the six industries left in the sample have more than three companies and more than thirty observations belonging to them. The complete distribution of the year-observations per sector and the firms can be found in the appendix (Table A1 and Table A2). The derivation of the remaining sample is graphically depicted in Table 1 below.

Table 1 - Selection of the sample starting with all listed firms in The Netherlands

Number of listed firms on AEX, AMX and AScX	75 firms
Firms in finance, assurance or real estate	(15) firms
Firms where auditor information is missing	(8) firms
Firms that did not exist during estimation period as standalone firm	(1) firms
Firms that belong to industry with too little observations	(1) firms
Resulting sample	50 firms

All the financial data necessary for the estimation of the dependent and for the independent variables originate from the Thomson One database. Data on the length of the auditor engagement is manually collected from annual reports, news articles, firm's websites, records of annual general meetings or other official documents of the firms.

Research design

The study involves performing ordinary least squares (OLS) regressions on panel data to test the effect of audit tenure on audit quality. For audit tenure, both the length of the relationship audit firm-client as that of audit partner-client will be considered. Audit quality is measured as discretionary accruals. Since the dependent variable is a continuous variable, an OLS regression is suitable. This thesis drops the usual assumption that all observations are independent of each other. The regressions deal with panel data, where observations might be correlated due to repeated observations on the same firms over the years. The research method assumes correlation within clusters (firms), where independence is assumed across clusters (firms).

The independent variable to test the hypotheses is auditor tenure, both at partner-level as at the level of the firm. The relationship between tenure and discretionary accruals is tested in two ways, because of the two different relationships between audit tenure and audit quality that might appear and are hypothesised. First, the variables that measure tenure will be normal continuous variables that state the number of consecutive years of the current engagement, starting at one when the firm switched of audit firm or partner. Next to that, a non-linear relationship between tenure and discretionary accruals is tested. Previous research (Johnson et al., 2002; Chi and Huang, 2005; Carey and Simnett, 2006) has done this by dividing tenure into three categories (short, medium and long) and adding dummy variables for the shortest and longest categories to the regression. However, differences exist on which periods the categories should refer to. Short tenure is at the three named articles either the first two years, the first three year or only the second and third year. The longest category starts from the eighth or ninth year. Since this categorization might impact the results quite heavily, the research in this thesis tests the non-linear relationship by adding polynomial terms of tenure to the regression. In this way, it can study if the effect of tenure on audit quality (measured via discretionary accruals) is non-linear, where the effect changes as tenure rises of sign. A benefit of this approach is that it allows for a gradual change of the effect, where dummy variables assume immediate changes in sign at chosen points. Since audit quality and discretionary accruals are inverse related (more earnings management represent a lower level of audit quality), the expected relationship between audit firm tenure and discretionary accruals follows a U-shaped curve, in line with an effect on audit quality that starts off positive and later on turns into a negative effect. Such a relationship would mean a negative coefficient for the normal tenure variable and a positive one for the squared tenure variable. Just as Ball et al. (2015), tenure at both levels (partner and firm) are tested together to be able separate the two effects. This leads to four variables on auditor tenure in the regressions: audit partner tenure, audit partner tenure squared, audit firm tenure and audit firm tenure squared.

Following prior research, the dependent variable audit quality is measured as discretionary accruals. This is an indirect measure of audit quality, since more earnings management (discretionary accruals) is associated with lower audit quality. The Jones model (1991) is a standard model to estimate the discretionary accruals of a year-observation. This model, which is used as the base line model in this study, estimates the discretionary part of the total accruals based on economic numbers of a firm for that year. Next to the original Jones model, also a modified version is used to detect and estimate earnings management. To be more precise the version of Dechow et al. (1995) is used. After a comparison of different models in their article, Dechow et al. (1995) conclude that the modified Jones model is the most powerful model to detect earnings management, followed by the standard Jones model. The research in this study uses the two mentioned models to estimate discretionary accruals, which both will be used as dependent variable.

Both the Jones model (1991) as the modified version of Dechow et al. (1995) take the amount of total accruals as starting point. Total accruals is defined as reported net income before extraordinary items and discontinued items subtracted by the cash flows from operating activities. The end goal of these models is to distinguish the discretionary part of the total accruals. The first step in the original Jones model is to estimate the amount of non-discretionary accruals per year. It predicts the amount of non-discretionary accruals based on three economic circumstances of a firm: the amount of total assets at the beginning of the year, changes in revenues during the year and the amount of property, plant and equipment. The amount of non-discretionary accruals according to the standard Jones model (1991) is estimated according to equation one below. Relative to the original Jones model, the modified version does not implicitly assume that discretion cannot be exercised over revenues (Dechow et al., 1995). By correcting for changes in net receivables, earnings management on the part of recognition of revenues is taken into account. The non-discretionary accruals according to the modified Jones model (Dechow et al., 1995) are calculated as in equation two.

$$\frac{NDAC_{it}}{A_{it-1}} = \alpha_{1i} \left[\frac{1}{A_{it-1}} \right] + \alpha_{2i} \left[\frac{\Delta REV_{it}}{A_{it-1}} \right] + \alpha_{3i} \left[\frac{PPE_{it}}{A_{it-1}} \right] \quad (1)$$

$$\frac{NDAC_{it}}{A_{it-1}} = \alpha_{1i} \left[\frac{1}{A_{it-1}} \right] + \alpha_{2i} \left[\frac{\Delta REV_{it}}{A_{it-1}} - \frac{\Delta REC_{it}}{A_{it-1}} \right] + \alpha_{3i} \left[\frac{PPE_{it}}{A_{it-1}} \right] \quad (2)$$

In equation one and two, A_{it-1} represents the amount of total assets in period t-1, ΔREV_{it} the difference between the amount of revenues in period t and period t-1, PPE_{it} is the amount of gross property, plant and equipment in period t and ΔREC_{it} the difference between the amount of receivables in period t and period t-1. The parameters α_{1i} , α_{2i} and α_{3i} in both equations are the OLS-coefficients predicted during the estimation period according to the original Jones model, as displayed

in equation three. This is done per sector, all firms that belong to the same sector are put together to increase the number of observations per regression and get more reliable coefficients.

$$\frac{TAC_{it}}{A_{it-1}} = \alpha_{1i} \left[\frac{1}{A_{it-1}} \right] + \alpha_{2i} \left[\frac{\Delta REV_{it}}{A_{it-1}} \right] + \alpha_{3i} \left[\frac{PPE_{it}}{A_{it-1}} \right] + \varepsilon_{it} \quad (3)$$

TAC_{it} is the amount of total accruals in period t and all other variables are specified as in equation one. The last step to receive the discretionary accruals is to subtract the non-discretionary accruals from the total accruals, according to equation four below.

$$\frac{DAC_{it}}{A_{it-1}} = \frac{TAC_{it}}{A_{it-1}} - \frac{NDAC_{it}}{A_{it-1}} \quad (4)$$

Next to the variable of interest, which is auditor tenure, other factors might impact audit quality as well. To control for these factors several control variables will be included. They are related to the client's characteristics: age, growth, leverage, cash flows from operations, return on assets and firm size. The first control variable is age, measured as the number of years listed. According to Carey and Simnett (2006), younger firms have a larger chance of being in financial distress and engage more in earnings management. The next control variable corrects for the growth of a firm's operating activities. Young (1999) states that non-discretionary accruals are positively associated with growth rates as a result of changes in working capital due to growth or shrinkage. Without controlling for growth rates, the non-discretionary accruals are overstated and these accruals will be attributed to the discretionary part. So, the expected relation between the variable growth and discretionary accruals is negative (Young, 1999). Leverage is included as control variable since companies with more debt might use the freedom in accounting in terms of accruals to stay away of violations of debt-covenants (DeFond and Jiambalvo, 1994). Cash flows from operations are controlled for since these flows are (negatively) correlated with accruals (Sloan, 1996). The control variable for operating cash flows is scaled by total assets. Dechow et al. (1995) recommend to control for firm performance (ROA), since this association is not captured in the model. Earnings management might be influenced by firm performance which then should be controlled for. The last control variable is the size of the client, measured by the natural logarithm of total assets. The variable is transformed to normalize the distribution of the variable. Bigger firms tend to engage less in earnings management than smaller ones (Carey and Simnett, 2006).

Another control variable commonly used is the type of auditor. To be more precise if the auditor belongs to the Big-4 (Deloitte, PricewaterhouseCoopers, Ernst & Young and KPMG) or not, categories as the five or six biggest auditors are also used. According to DeAngelo (1981), bigger audit firms deliver higher quality reports. However, the subjects in this research are all audited by one of the four greatest audit firms in the research period except for seven year-observations where it is done by the fifth

largest auditor (BDO), so this variable can be ignored since no big differences in the size of the audit firm are apparent. This leads to the regression equation five, which is the main regression of this thesis and will be used to study the effect of auditor tenure on audit quality.

$$DAC_{it} = \alpha + \beta_1 APTENURE_{it} + \beta_2 APTENURE_{it}^2 + \beta_3 AFTENURE_{it} + \beta_4 AFTENURE_{it}^2 + \beta_5 AGE_{it} + \beta_6 GROWTH_{it} + \beta_7 LEV_{it} + \beta_8 OCF_{it} + \beta_9 ROA_{it} + \beta_{10} SIZE_{it} + \varepsilon_{it} \quad (5)$$

Where DAC_{it} =	the amount of discretionary accruals scaled by lagged total assets (calculated through either the original Jones model or the modified version of it),
$APTENURE_{it}$ =	the length of the current audit partner engagement at the firm (either just the number of years or the number of years squared),
$AFTENURE_{it}$ =	the length of the current audit firm engagement at the firm (either just the number of years or the number of years squared),
AGE_{it} =	the number of years the firm is listed on the Amsterdam Stock Exchange,
$GROWTH_{it}$ =	the percentage change in the firm's net sales relative to last year,
LEV_{it} =	the proportion of the firm's total assets consisting of liabilities at the end of the year,
OCF_{it} =	the net cash flows from operating activities over total assets at the end of the year,
ROA_{it} =	the return on assets over the last year, and
$SIZE_{it}$ =	the natural logarithm of the firm's total assets at the end of the year.

Summary statistics

Of the 50 firms that are studied in this research, in 2016 twenty were listed on the AEX (40%), fifteen on the AMX (30%) and fifteen on the AScX (30%). Considering the estimation period of eleven years, the fifty funds result in a maximum of 550 firm-year observations. However, financial data is missing for 41 year observations and the data on auditor tenure of another 39 years. This results in a sample of 470 firm-year observations.

The summary statistics can be found in Table 2. The average amount of discretionary accruals divided by lagged total assets are -0.00424 and -0.00341 for respectively the original Jones model and the modified version of the Jones model. The standard deviation, minimum and maximum are about equal between the two variables estimated by the two models. The means of the variables audit firm and audit partner tenure are respectively 12.575 and 2.945 years. The maximum of audit partner tenure is equal to 7, which corresponds to the maximum number of years that statutory auditors are permitted to serve a client, regulated by the mandatory audit partner rotation regulations. On average, the audit partners (firms) are auditing their clients for 2.945 (12.575) consecutive years during the estimation period 2005-2015.

The average number of years that the firms are listed is 16.397 years over the estimation period. The minimum is zero, belonging to year observations of firms before their IPO. However, the financial data and data on the auditor is available for these observations and therefore these years will be considered in the regressions. The average growth of net sales is 8.44 percent, with a relatively large standard deviation and big extremes. The average proportion of total assets consisting of liabilities equals around 57 percent. The mean of the amount of operating cash flows, scaled by total assets, is approximately 0.0844. The return on assets is on average 6.11 percent in the period of estimation, with extremes of around -36 percent and +69 percent. The firms in the sample are quite different in terms of size, with the distribution skewed to the right. To normalize the distribution and handle extremes at high values of total assets, the amount of total assets is normalized by taking the natural logarithm of it. To illustrate the differences in size, Royal Dutch Shell was in 2015 about 5,600 times as big as ICT group in terms of total assets. The average of the natural logarithm of total assets over the sample is 21.564, which would correspond to around 2.3 billion Euros.

Table 2 - Summary statistics

Variable name	Number of observations	Mean	Standard deviation	Minimum	Maximum
Dependent variables					
DAC (Original)	509	-0.00424	0.0876	-0.621	0.721
DAC (Modified)	509	-0.00341	0.0895	-0.626	0.733
Independent variables					
APTenure	470	2.945	1.749	1	7
AFTenure	508	12.575	9.761	1	51
Control variables					
Age	509	16.397	9.401	0	33
Growth	509	0.0844	0.345	-0.761	3.690
Leverage	509	0.573	0.181	0.0562	1.286
OCF	509	0.0844	0.0668	-0.296	0.327
ROA	509	0.0611	0.0881	-0.359	0.693
Size	509	21.564	1.860	17.629	26.437

Results

Analysis

The base line model in this research is the original Jones model (1991). The results of the regression based on this model are depicted in the middle column of Table 3. The regression is based on 470 observations and has an adjusted R-squared of 64.9%. All the four variables of audit tenure are significant, with the two variables on audit firm tenure variables at a higher level than those at the partner-level. Since both the normal variable for audit partner tenure as the squared version of it are significant, the association between audit partner tenure and discretionary accruals based on the Jones model is quadratic. Based on the signs of the two coefficients, the effect found is an inverse U-shaped association: the amount of discretionary accruals increases at the start of engagements, whereas the effect becomes negative when audit partner tenure increases. Since earnings management and audit quality are inversely related, the association between audit partner tenure and audit quality follows a U-shaped relationship. The effect of audit partner tenure on audit quality is negative at the start, where it becomes positive later on. The positive effect at later stages of client-audit partner relationships was not hypothesised, the effect was expected to be negative through all stages of audit partner tenure.

Also, the effect between audit firm tenure and discretionary accruals is non-linear, but the effect is reversed. This effect on discretionary accruals starts off negative but becomes positive later on when tenure increases. This is in line with the inverse U-shaped relationship between audit firm tenure and audit quality predicted in the hypothesis, where audit quality increases at early phases of client-audit firm relationships and decreases with audit firm tenure later on at the tenure. For both audit partner tenure as audit firm tenure, the coefficients seem to be low and one might question if they differ from zero. However, one should bear in mind that the dependent variable discretionary accruals is scaled by lagged total assets, has an average of -0.00424 and half of all observations have values between -0.0320 and 0.0262. Due to these relatively low values of the dependent variable, year changes in audit tenure at both levels have a meaningful impact on the amount of discretionary accruals and therefore audit quality.

The significant control variables are growth, operating cash flows and return on assets, where the first two variables are negatively associated with earnings management and return on assets positively. The directions of the found effects on audit quality are as expected: growth and operating cash flows positively affect audit quality, while return on assets negatively impacts the quality of the audit.

Next to the original Jones model, the modified Jones model is used to estimate the dependent variable. Comparing the regressions based on the two estimation methods of earnings management, not much differences appear. The results of the regression with the dependent variable estimated according to

the modified Jones model are depicted in the upper right column in Table 3. It has the same number of observations, while the explanatory power of the model drops only slightly to 64.4%. The effects of the independent variables on audit tenure stay significant and the signs of the coefficients stay the same. Also, the magnitudes of the coefficients are as good as equal to those of the first regression. This means that, just as with the standard Jones model, audit quality drops at the beginning of an audit partner tenure and becomes as audit partner tenure rises. For tenure at the firm-level, the effect is the opposite: the effect of audit firm tenure on audit quality goes from positive to negative as firm tenure rises. Again, relative to the formulated hypotheses the effect of audit firm tenure is as expected. The found non-linear effect of audit partner tenure would reject the hypothesis on this, since it predicted a negative and linear association between audit partner tenure and audit quality.

The signs of the control variables coefficients do not change, while in terms of significance the variable growth loses its significance. The significant control variables in this regression are those of operating cash flows and return on assets, where the effect on audit quality of the first is positive and that of the latter negative.

Since evidence is found for non-linear relationships between audit tenure and audit quality, it is possible to find the height of the tenures at partner- and firm-level at which the effect changes of sign. The estimation method and the turning points of the regressions of Table 3 are outlined in the appendix. For audit partner tenure, the turning points for the standard and the modified Jones models are respectively 4.54 and 4.55 years. So, after approximately four and a half years the effect of audit partner tenure on audit quality changes from negative to positive. The point at which the effect of audit tenure at the firm-level on audit quality changes from positive to negative is either 18.57 or 18.48 years for the original Jones model and the modified version. This means that audit firm tenure positively affects audit quality in approximately the first eighteen and a half years, while after that period audit quality will diminish as tenure rises.

Table 3 - Results of regressions on total sample of firms

	<i>Jones model</i>	<i>Modified Jones model</i>
Audit partner tenure	0.00996* (1.95)	0.0104** (2.08)
Audit partner tenure squared	-0.00110* (-1.76)	-0.00114* (-1.88)
Audit firm tenure	-0.00203** (-2.61)	-0.00200** (-2.58)
Audit firm tenure squared	0.0000547*** (3.22)	0.0000540*** (3.23)
Age	0.000679 (1.36)	0.000689 (1.40)
Growth	-0.0347* (-1.89)	-0.0263 (-1.27)
Leverage	-0.0253 (-1.33)	-0.0270 (-1.42)
OCF	-0.883**** (-8.25)	-0.894**** (-8.19)
ROA	0.759**** (6.61)	0.775**** (6.42)
Size	-0.000327 (-0.16)	-0.000675 (-0.32)
Constant	0.0311 (0.74)	0.0385 (0.90)
Observations	470	470
Adjusted R-squared	0.649	0.644

*T statistics in parentheses. Dependent variable: Amount of discretionary accruals based on mentioned model. * p<0.100, ** p<0.050, *** p<0.010, **** p<0.001.*

Robustness check

In this thesis, the calculation of the discretionary accruals is done by estimating the parameters per industry, based on the SIC-codes. As described at the start of the research method section and exhibited in the appendix, more than half of the yearly observations (around 53%) belong to one industry segment: manufacturing. The other remaining industries in the sample have quite less observations: between 31 and 87 observations per industry. This relatively small number of observations per industry during the estimation period might lead to unreliable estimations of the amount of discretionary accruals for these firms. To test this and check if the results found in the previous table are robust, the effects of auditor tenure at both levels is studied on the manufacturing industry alone as well. For this industry, one may assume that the number of observations to calculate the sector-specific parameters is high enough to speak of reliable estimations of discretionary accruals. In the total sample, 269 firm-year observations belong to this category. Auditor data was missing of sixteen observations, which result in 253 observations. The results of regressions on this industry can be found in Table 4 hereafter.

In Table 4, one sees that the results based on the subset of the sample are quite similar between the two regressions based on the original and the modified Jones model, just as in Table 3 the found effects are similar in terms of sign, magnitude and significance between the two different dependent variables. The explanatory power of the regression with the discretionary accruals estimated according to the original version of the Jones model is 68.3%. The other regression in this table explains 67.5% of the variation. Comparing these two with the regressions on the full sample, one sees that the regressions on the subsample have a larger explanatory power. The coefficient of audit partner tenure squared that is significant when tested at the total sample, loses its significance when studying only this industry. In these regressions, audit partner tenure and discretionary accruals are linear and positively related. This indicates that the association between audit partner tenure and audit quality is negative, regardless of the height of the tenure. This difference between the results of Tables 3 and 4 might be due to noise in the observations of other industries than the manufacturing industry. Also, when taking all industries except that of the manufacturing industry, both the normal as the squared variable on audit partner tenure are insignificant. This indicates again that these firms do not have enough observations per industry to create reliable estimations of the amount of discretionary accruals and create noise in the whole sample. So, no robust evidence is found for a non-linear effect of tenure at the partner-level on discretionary accruals. The non-linear effect of audit partner tenure found in the whole sample in Table 3, cannot be supported by the robustness check.

However, evidence is found for a normal and positive linear relationship, since the coefficient of the normal audit partner tenure variable is significant at the whole sample and the subsample consisting of the manufacturing industry solely. On the other hand, the effect of audit firm tenure on discretionary accruals is equal to the effect found in Table 3 at both models, which indicates that the association found there can be called robust since it appears in both the whole sample as the subset in which the estimations of discretionary accruals are assumed to be reliable.

The control variables that are significant in the two regressions on the subsample are again operating cash flows and return on assets. Cash flows from operating activities positively affect audit quality and a higher return on assets negatively impacts the quality of the audit.

The turning points at which the effect of audit firm tenure on audit quality becomes negative are somewhat higher than they are when doing the analysis on the whole sample. For the two regressions in Table 4 they are respectively 19.32 and 19.38 years, where the average of turning points at the regressions depicted in Table 3 was 18.53 years. All together, the average amount of years at which the effect on audit quality turns from positive to negative is approximately nineteen years. Since evidence for the non-linear relationship between audit partner tenure and audit quality is not found in the regressions on the manufacturing industry solely, calculating the turning point of audit partner tenure might lead to wrong conclusions. When there is no evidence for a non-linear relationship, there is no evidence for a turning point either.

The research question in this thesis is as follows: To what extent does audit tenure affect audit quality? Considering all the regressions performed in this thesis, evidence is found for a negative effect of audit partner tenure on audit quality. Higher audit partner tenure leads to a lower quality of the audit. Audit firm tenure and audit quality are non-linear related, the effect starts off positive but becomes negative when firm tenure increases. The turning point of the effect of audit firm tenure lies at approximately nineteen years, after which extra years of the engagement impair audit quality.

Table 4 - Results of regressions on firms belonging to the manufacturing industry

	<i>Jones model</i>	<i>Modified Jones model</i>
Audit partner tenure	0.0123* (1.74)	0.0125* (1.75)
Audit partner tenure squared	-0.00127 (-1.62)	-0.00129 (-1.60)
Audit firm tenure	-0.00274** (-2.40)	-0.00281** (-2.44)
Audit firm tenure squared	0.0000709*** (3.08)	0.0000724*** (3.13)
Age	0.000605 (0.85)	0.000579 (0.83)
Growth	-0.0400 (-1.10)	-0.0232 (-0.57)
Leverage	-0.0153 (-0.50)	-0.0147 (-0.48)
OCF	-0.947**** (-6.29)	-0.960**** (-6.25)
ROA	0.807**** (5.73)	0.822**** (5.63)
Size	-0.00284 (-1.07)	-0.00302 (-1.15)
Constant	0.0810 (1.33)	0.0850 (1.41)
Observations	253	253
Adjusted R-squared	0.683	0.675

*T statistics in parentheses. Dependent variable: Amount of discretionary accruals based on mentioned model. * p<0.100, ** p<0.050, *** p<0.010, **** p<0.001.*

Conclusion

This thesis studies the effect of auditor tenure on audit quality, with auditor tenure at both the partner- as the firm-level. Audit quality is measured through discretionary accruals based on the original Jones model and a modified version of that model. The research is motivated by the new regulation that the European Union has put in place to improve audit quality after a period in which doubts occurred on the audit world. There are generally two theoretical effects of audit tenure on audit quality: negative through a lower degree of independence and positive through knowledge on the client's business. In line with the formulated hypothesis, the research of this thesis finds a negative effect of audit partner tenure on audit quality. This provides evidence of the reasoning that longer engagements of audit partners will lead to more earnings management and impairs the quality of the audit. Clients receive more freedom in accounting when audit partner tenure rises. For audit firm tenure, robust evidence is found of a non-linear effect on audit quality. Audit quality improves at the start of a relationship between the client and the audit firm, where at some point the effect turns and audit firm tenure negatively impacts audit quality. This can be explained by the timing of the two main possible effects, at starts of auditor-client engagements the effect is positive through the learning effect, where this effect stops at some point and will be taken over by the quality diminishing effect of a lower level of independence.

This thesis contributes to the literature that it studies both levels of auditor tenure at the same time, allows the effects of tenure to be non-linear and uses the most recent European data. Both audit partner tenure and audit firm tenure are taken together to make sure that the effects will not be put into one falsely. Due to the timing of the two possible effects of auditor tenure, allowing the association between tenure and quality to be non-linear makes sense. This approach as such is not used frequently in the past, while the found effects of this thesis are defensible and can be linked with theories on this topic.

This thesis has some implications useful for practitioners at the field of regulation on the audit market. The results of the research advocate mandating firms to change their audit partner periodically. Longer audit partner tenure impairs the quality of the audit, so setting a natural bound on partner tenure should improve the quality. For audit firm tenure, long engagements are also detrimental for the quality of the audit. At some point, it would thus be quality enhancing to rotate the auditor firm. However, the effect of auditor tenure is not negative from the beginning of an engagement immediately, which indicates that a switch of audit firm does not necessarily improve the quality of the audit from the beginning onwards. Due to the non-linear and inversed U-shaped relationship between audit firm tenure and audit quality, one can estimate the moment at which the effect of audit firm tenure becomes negative. This is after approximately nineteen years. However, due to the

concave relationship this turning point does not mean that this should be the maximum of an audit term since this would result in a new period of learning and a greater decrease in audit quality than another year of the current tenure would imply.

Future research on this topic might look further into what would empirically be the correct terms that regulators should use when setting the maximum bounds of auditor tenure. Another thing that could be done over some years is to check what the effect of mandating firms to rotate their auditor periodically is on the association between audit tenure and audit quality. This research has studied the effect in a period where rotation was not mandated and all auditor switches were voluntary.

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Appendix

Estimation turning points audit tenure

Turning points are the points that indicate the minimum or the maximum points of quadratics. This is on the point (height of audit firm tenure) at which the sign of the effect changes. This point can be estimated by equalling the first derivative to audit firm tenure of the discretionary accruals formula below to zero. The derivation towards the turning points for the several regressions is outlined below.

$$DAC = \alpha + \beta_1 \text{APTENURE} + \beta_2 \text{APTENURE}^2 + \beta_3 \text{AFTENURE} + \beta_4 \text{AFTENURE}^2 + \beta_5 \text{AGE} + \beta_6 \text{GROWTH} + \beta_7 \text{LEV} + \beta_8 \text{OCF} + \beta_9 \text{ROA} + \beta_{10} \text{SIZE}$$

$$DAC' (\text{AFTENURE}) = \beta_3 + 2 \cdot \beta_4 \cdot \text{AFTENURE}$$

$$DAC' (\text{AFTENURE}) = 0 \quad \rightarrow \quad \beta_3 + 2 \cdot \beta_4 \cdot \text{AFTENURE} = 0 \quad \rightarrow \quad -\frac{\beta_3}{2 \cdot \beta_4} = \text{Turning point}$$

Audit firm tenure	All industries	Manufacturing industry only
Original Jones model	18.57 years	19.32 years
Modified Jones model	18.48 years	19.38 years
Total average	18.94 years	

For audit partner tenure, evidence is found only at the regressions based on the whole sample. For the part of the sample only consisting of firms belonging to the manufacturing industry, no evidence was found for a non-linear relationship. Therefore, the turning point is only calculated on the regressions on all industries together.

$$DAC' (\text{APTENURE}) = \beta_1 + 2 \cdot \beta_2 \cdot \text{APTENURE}$$

$$DAC' (\text{APTENURE}) = 0 \quad \rightarrow \quad \beta_1 + 2 \cdot \beta_2 \cdot \text{APTENURE} = 0 \quad \rightarrow \quad -\frac{\beta_1}{2 \cdot \beta_2} = \text{Turning point}$$

Audit partner tenure	All industries
Original Jones model	4.54 years
Modified Jones model	4.55 years
Average	4.55 years

Table A1 - Distribution of firm-year observations over industries (missings due to a lack of auditor data are not yet taken into account here)

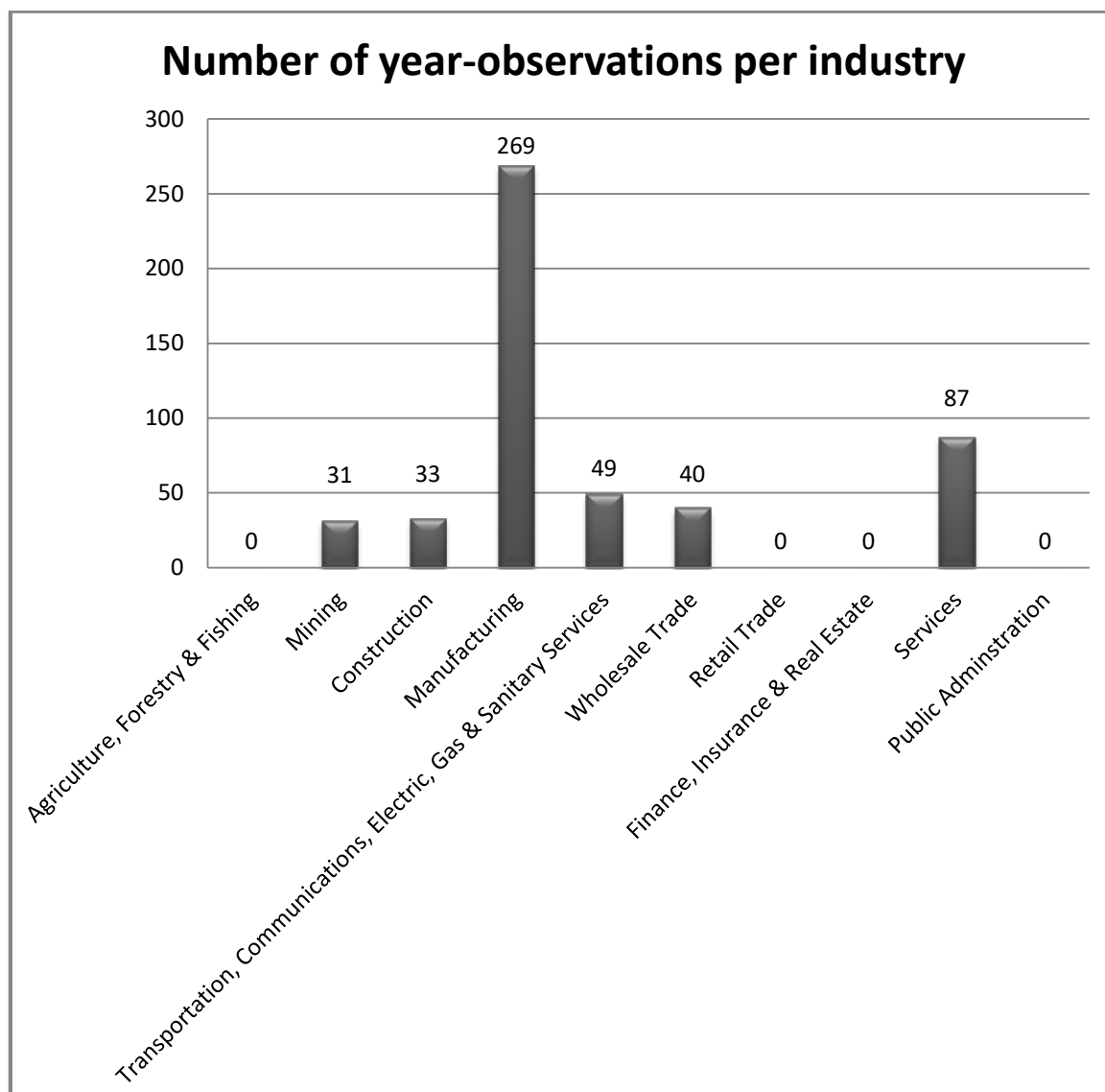


Table A2 - Year observations per firm (missings relative to starting sample period 2005-2015)

Company	Index	Observations	Industry	Missings
ASML	AEX	11	4	
Aalberts	AEX	11	4	
Ahold Delhaize	AEX	11	9	
Akzo Nobel	AEX	11	4	
Altice	AEX	5	5	6 Full
Arcelor Mittal	AEX	11	4	
Boskalis	AEX	9	3	2 APTenure
DSM	AEX	10	4	1 APTenure
Galapagos	AEX	11	4	
Gemalto	AEX	10	9	1 Full
Heineken	AEX	10	4	1 APTenure
KPN	AEX	7	5	4 APTenure
Philips	AEX	10	4	1 APTenure
RELX Group	AEX	11	4	
Randstad	AEX	11	9	
SBM	AEX	11	4	
Shell	AEX	7	2	4 APTenure
Unilever	AEX	8	4	3 APTenure
Vopak	AEX	11	5	
Wolters Kluwer	AEX	9	9	2 APTenure
ASMI	AMX	9	4	2 APTenure
Air France-KLM	AMX	8	5	3 APTenure
Aperam	AMX	5	4	6 Full
Arcadis	AMX	11	9	
BAM	AMX	11	3	

Company	Index	Observations	Industry	Missings
Besi	AMX	10	4	1 APTenure
Corbion	AMX	10	4	1 APTenure
Fugro	AMX	11	2	
IMCD	AMX	4	6	7 Full
OCI	AMX	4	4	6 Full, 1 APTenure
PostNL	AMX	11	5	
Refresco Gerber	AMX	5	6	6 Full
Sligro	AMX	9	6	2 APTenure
TKH Group	AMX	10	4	1 APTenure
TomTom	AMX	11	4	
AMG	AScX	9	2	2 Full
Accell	AScX	11	4	
Amsterdam Commodities	AScX	9	6	2 APTenure
Brunel	AScX	10	9	
Fagron	AScX	9	6	2 Full
ForFarmers	AScX	6	4	5 Full
Heijmans	AScX	11	3	
Hunter Douglas	AScX	7	4	
ICT Automatisering	AScX	11	9	
Kendrion	AScX	11	4	
Nedap	AScX	11	4	
Ordina	AScX	11	9	4 APTenure
Stern Groep	AScX	11	4	
Telegraaf Media Groep	AScX	9	4	2 APTenure
Wessanen	AScX	9	4	2 APTenure

Full = all data missing of year, APTenure = audit partner tenure data missed and APTenure = audit firm tenure data missed