Do Relatively More Efficient Firms Demand Additional Audit Effort (Hours)?

MALI, Dafydd and LIM, Hyoung-joo

Published version

MALI, Dafydd and LIM, Hyoung-joo (2020). Do Relatively More Efficient Firms Demand Additional Audit Effort (Hours)? Australian Accounting Review.

AAR
AUSTRALIAN ACCOUNTING REVIEW
CPA AUSTRALIA

Do Relatively More Efficient Firms Demand Additional Audit Effort (Hours)?

Dafydd Mali, *Sheffield Hallam University*
Hyoung-joo Lim, *Kyonggi University*

We examine whether firms with higher relative efficiency (operational performance) require additional audit effort (hours) to signal audit quality to demonstrate that their financial reporting systems are robust. Therefore, we use a Korean sample of publicly listed firms because of the Korean audit hour policy which mandates that audit hour information be made available for market participants. We find that client firms with higher relative efficiency have higher audit hours, suggesting that management has an incentive to demand additional audit hours for signalling purposes, and that shareholders, amongst other stakeholders, have an incentive to demand external monitoring to reduce potential agency problems. The results show that relative efficiency is a unique measure of firm performance that can provide insights into a client firm's business and audit risk. We also find evidence suggesting that audit firms do not subject clients to a fee (fee per hour) premium based on relative efficiency, supporting our finding that client firms require audit effort for signalling purposes. Thus, our results have important implications for policymakers about audit effort demand.

We question whether the argument that firms with higher levels of relative efficiency require higher levels of audit effort in hours to signal efficiency performance is genuine, relative to inefficient peers. The productivity literature divides efficiency into two measures, absolute efficiency and relative efficiency. Absolute efficiency is estimated using simple accounting ratios that capture performance by dividing earnings with total asset or equity values. Relative efficiency estimates performance as an aggregate measure of the most efficient utilisation of resources and costs that are directly under the control of management to generate sales. Recent studies show relative efficiency is inherently more informative compared to absolute efficiency because it captures managerial operational performance (Combs et al. 2005; Crook et al. 2008; Demerjian et al. 2012; Frijns et al. 2012). Relative efficiency performance information can be considered important to various stakeholders. Market participants may therefore seek assurances that financial reporting quality is robust to legitimise business activities by demanding external monitoring in the form of audit effort. However, whether the management of client firms accommodates market participants is a question that remains unanswered.

We have several motivations to conduct this study. First, the relationship between relative efficiency and audit effort can be interpreted from both audit demand and supply theory perspectives (Simunic 1980). Numerous audit supply studies consider that audit firms control audit effort and request a fee premium based on their incentives to reduce litigation threats and reputational damage (Weber et al. 2008; Cahan et al. 2009; Skinner and Srinivasan 2012). Thus, in the audit literature, increasing audit fees (input) can be interpreted as a signal of higher audit risk (output) based on the incentives of audit firms. However, Enron and similar infamous collapses suggest that audit firms can control audit fees without imparting audit effort. Due to the unavailability of audit hour information on annual reports in most countries, empirical results linking audit demand based on firm performance characteristics are limited. However, we conjecture that client firms with higher efficiency performance would demand audit effort in hours (input) to signal higher audit quality (output). We base our assumption on the following. First, additional audit effort (hours) is shown to be demanded by shareholders to reduce agency problems (Lobo and Zhao 2013; Lee et al. 2014). Therefore, we posit that shareholders are likely to demand incrementally higher audit effort, as managerial performance improves to reduce agency problems and legitimise annual report information. Second, Defond and Zhang (2014) suggest

Correspondence: Hyoung-joo Lim, School of Accounting and Tax, Kyonggi University, 154-42 Kyangkyosan ro, Youngtong gu, Suwon, Kyonggi, South Korea; Tel. +82-10-3490-7588; email: limhj@kgu.ac.kr

Accepted for publication 27 September 2020.

that audit hours can be considered a direct driver of audit quality and 'value adding'. Thus, to accommodate the information needs of external stakeholders, management may have incentives to require sufficient audit effort to signal that firm performance is genuine. Third, relative efficiency captures performance as sales generated from the resources and expenses under the direct control of managers. It is therefore likely that the most efficient/effective managers have an incentive to accommodate the demands of stakeholders to face less opposition to warrant remuneration payments based on robust performance. Therefore, whilst it is established that audit firms have an incentive to reduce risk by demanding a fee premium, we are motivated to discover whether audit firms accommodate the audit hour demand of their clients. Capturing incentives to increase/decrease audit demand would offer a unique insight into the behaviour of stakeholders.

Second, there has been an increasing demand to improve audit quality internationally. Currently, the policy to enhance audit quality in Europe is the mandatory audit firm rotation rule. The mandatory audit firm rotation rule was adopted in South Korea (2006) before it was adopted in Europe (2016), but was considered ineffective due to a reduction in audit quality (Choi et al. 2017; Mali and Lim 2018). An audit policy that has been implemented in South Korea since 2001 mandates audit hours and fees be recorded on annual reports. In Europe and in other major economies, audit information can be considered opaque because audit disclosures may not be directly comparable. Moreover, in the literature there is evidence that audit hours improve audit quality (Ettredge et al. 2014), but audit firms feel time pressure to conduct audits (Guénin-Paracini 2014; Lambert et al. 2017). Therefore, we are motivated to provide insights for international legislators about the Korean audit hour policy that requires firms to list audit effort information on annual reports on a comparable basis. Finally, previous accounting studies associate signalling theory with education, corporate social responsibility (CSR), dividends and earnings management. We are motivated to associate audit effort and a firm's relative performance using a signalling theory framework to capture client firm signalling through audit-level demand.

Our study demonstrates a positive relation between audit effort and relative efficiency. We interpret that audit firms and market participants are interested in relative efficiency because it captures a client firm's ability to generate sales from resources and costs that are utilised by managers. From a market participant perspective, we also interpret that audit hours capture audit quality. Therefore, we surmise that as relative efficiency increases, additional audit hours demonstrate that financial reporting quality and financial performance is robust. Next, we conduct an analysis to establish the relationship between audit fees/fees per hour and relative efficiency. Our fee analysis shows consistent results. However, our results are insignificant when we capture the relation between relative efficiency and audit fee per hour. The results suggest that client firms demand additional audit hours based on relative efficiency, but do not incur a higher audit fee. We interpret that relative efficiency is a measure of firm performance and not considered by audit firms as a measure of audit or business risk.

For robustness, we separate our samples into groups with different levels of risk; investment grade (IG) and non-investment grade (NIG) credit ratings, and larger/smaller firms that are listed on the Korea Composite Stock Price Index (KOSPI) and Korean Securities Dealers Automated Quotations (KOSDAQ) stock exchanges. Our additional analyses show that regardless of sample selection criteria, relative efficiency is positively related to audit effort. However, we find a different relationship between return on assets (ROA) (a measure of absolute efficiency) and relative efficiency, suggesting that audit firms and market participants perceive both types of efficiency to be incrementally informative but different in terms of performance.

Our results make several contributions to the literature. First, the audit hour (effort) literature is mixed. There is evidence of both a positive (Simunic 1980; Deis and Giroux 1992; O'Keefe et al. 1994) and negative (Caramanis and Lennox 2008; Jung 2016) relationship between firm risk and audit hours. Our results clearly demonstrate a positive relationship between efficiency performance and audit effort in hours. Whilst audit firms are known to increase their audit effort (fee) when auditing high-risk clients (as suggested in the literature), firms with high performance request high levels of audit hours for signalling purposes in South Korea because it is well known that audit hour information is publicly available. Second, South Korea can be considered a unique case study for the academic community and legislators. Korea is a developed country in terms of economic power, but a developing country when it comes to legal infrastructure (Wood 2013). South Korea implemented a policy to mandate that publicly listed firms record audit hour information on annual reports in 2001, following major financial collapses. Therefore, we utilise a unique dataset to provide valuable insights into both developing and developed countries to demonstrate the effect of the policy on the Korean market.

Finally, the productivity literature is divided into absolute and relative efficiency. Baik et al. (2013) show that relative efficiency can be considered a different form of efficiency performance compared to absolute efficiency, but both demonstrate a consistent relationship with firm performance. To the best of our knowledge, we are the first to capture that relative efficiency and absolute efficiency may be interpreted differently by market participants based on different directional

relationships with audit effort. The results are likely to be of interest to analysts who have an incentive to capture audit quality and efficiency performance.

Previous Literature and Hypotheses

Literature review

Historically, audit quality has been defined as the 'joint probability that a given auditor will both be able to detect a breach in a client's accounting system and report the breach' (DeAngelo 1981: 186). However, following recent financial scandals, the binary concept of audit quality may be considered insufficient. DeFond and Zhang (2014: 281) suggest a modern definition of audit quality as 'assurance that the financial statements faithfully reflect the firm's underlying economics, conditioned on its financial reporting system and innate characteristics', suggesting that specific characteristics such as income generation may influence future audit quality debates. DeAngelo's (1981) audit quality definition suggests that an audit has two outcomes based on sufficient/insufficient audit effort to detect audit failures. Defond and Zhang (2014) imply that based on innate characteristics, such as firm efficiency, incremental audit effort can increase/decrease audit quality. Thus, we are interested in how firm income-generating processes are perceived by both market participants and audit firms. It is established that more efficient firms enjoy various comparative advantages relative to peers (Demsetz 1973; McWilliams and Smart 1993). The literature also suggests that market participants are interested in client performance 'authenticity' to ascertain whether business operations are truly reflected in financial statements. Thus, based on the incentives of various groups, additional audit effort can be considered a potential signal for increased audit quality that legitimises a firm's efficiency performance.

Simunic's (1980) audit demand theory suggests that clients have the potential to request audit services for two reasons. First, agency theory suggests that because the incentives of shareholders and managers may not always be aligned, managers may take actions to act in their own self-interest (Jensen and Meckling 1976; Watts and Zimmerman 1983). However, an audit of sufficient quality can reduce the potential for managers to act in their own self-interest at the expense of shareholders (Caramanis and Lennox 2008; Lobo and Zhao 2013; Lee et al. 2014). Thus, to reduce agency conflicts, additional auditor scrutiny is likely requested by shareholders to enhance monitoring as assurance that financial reporting quality is robust and financial statements demonstrate a true and fair view of the business. Second, management can demand additional audit services to enhance their knowledge about a firm's internal operations to improve 'audit management' (Bailey et al. 2012). Defond and Zhang (2014) suggest that additional audit effort can be demanded internally to provide assurance that accounting systems are accurate for decision making, 'adding value' to the audit process. As an extension, there is the potential that additional accounting effort in hours may be considered as a form of signalling in developing countries to show that business systems are robust. Thus, as Esplin et al. (2018) suggest, audit effort can be demanded by both internal stakeholders and external stakeholders.

Based on audit supply theory (Simunic 1980), audit effort can be limited based on an auditor's strategy to reduce reputational and litigation risk. Following the audit failure of one of KPMG's large clients in Germany, KPMG lost business and its remaining clients experienced declining share prices (Weber et al. 2008). In Japan, following the audit failure of a PwC affiliate, PwC lost clients due to reputational damage (Skinner and Srinivasan 2012). As a result of the infamous Enron scandal, Andersen's clients experienced a significant market decline (Cahan et al. 2009). The above studies suggest that: i) an audit firm's brand value is subject to upside performance potential and downside risk; ii) audit fees (input) influence market participants' perceived audit quality (outputs); and iii) based on supply theory, an audit firm's fees increase with client risk. Various studies show that higher audit fees are demanded by audit firms based on audit risk proxies including industry and competition risk (Simunic and Stein 1996; Cahan et al. 2008), earnings management (Gul et al. 2003; Abbott et al. 2006), weak internal control (Hogan and Wilkins 2008) and unethical business practices (Lyon and Maher 2005). Furthermore, audit fees have been shown to be higher when an audit firm's perception about a client's audit risk increases (Bell et al. 2001; Bedard and Johnstone 2004; Lyon and Maher 2005; Schelleman and Knechel 2010; Bryan and Mason 2016). However, the assumption that audit fees are a proxy for risk *per se* is not accepted in the literature because additional audit effort can signal the incentive of clients to demand additional audit testing to enhance audit quality (Ghafran and O'Sullivan 2017). Khan et al. (2015) posit that additional audit fees demonstrate clients request additional audit services to improve audit systems. Gul and Goodwin (2010) find that clients that have undergone a credit rating reduction request additional audit effort to reduce the potential of another decrease. Thus, the literature shows that the true relationship between audit quality (risk) and audit fees is an ongoing debate with the majority of studies considering audit fees to capture an audit risk premium.

Likewise, the relationship between audit hours and firm risk is not established in the literature. Simunic (1980) shows that audit effort increases with firm risk, suggesting that audit hours are demanded by audit

firms to reduce business threats. Deis and Giroux (1992) report that additional audit hours have a negative influence on brand value. Their results suggest that additional audit effort is imposed onto clients. Using a sample of government firms, O'Keefe et al. (1994) demonstrate that audit effort (hours) increases with various client firm risk proxies which include firm-level complexity and client size. On the other hand, more recent studies show that there is a negative association between audit hours and firm risk. Caramanis and Lennox (2008) demonstrate that firms that secure higher levels of audit effort relative to peers are less likely to engage in earnings management. There is evidence that firm owners request different levels of audit effort based on specific incentives. Knechel el al. (2008) demonstrate that client firms with larger international ownership demand additional audit hours relative to firms that are owned by management. The results show that management has an incentive to reduce audit hours compared to international investors who demand additional monitoring to reduce agency problems. The relation between audit hours and audit risk is also mixed in South Korea. Kang et al. (2014) suggest that auditors spend more time and effort focusing on high-risk engagements, whilst a Korean study by Jung (2016) reports that audit hours reduce firm risk. Their study shows that firms that secure additional audit effort benefit from lower capital costs, suggesting that additional audit effort can be considered a form of signalling to market participants. However, whilst the audit (effort) hour literature is somewhat mixed, audit hours are a direct audit effort input because they equate to the number of tests completed by an audit firm. Audit fees on the other hand can be considered a less robust measure of audit effort because audit fees include a risk premium which is an indirect measure of audit effort/quality.

Thus, a question emerges. Can audit hours be influenced by firm efficiency, a proxy for firm performance? Efficiency studies are divided into two estimation methods, relative efficiency and absolute efficiency. Absolute efficiency is calculated using accounting book value ratios of output divided by inputs including ROA, earnings divided by assets and the asset turnover ratio (ATO). The productivity literature establishes a positive relation between financial performance and absolute firm efficiency (Ou and Penman 1989; Lev and Thiagarajan 1993; Abarbanell and Bushee 1997; Soliman 2008). However, recently, critics of absolute efficiency studies (estimation) suggest it is a less informative measure of performance compared to relative efficiency (Combs et al. 2005; Crook et al. 2008). Recent studies also demonstrate a positive relationship between financial performance and relative efficiency using frontier analysis (Alam and Sickles 1998; Greene and Segal 2004; Cummins et al. 2010). Baik et al. (2013) conduct a study to capture whether changes in operational efficiency using both absolute efficiency and relative efficiency can predict firm performance. The study demonstrates that a positive relationship exists between relative efficiency and firm performance after controlling for absolute efficiency, suggesting that both relative efficiency and book value efficiency may be considered different organisational phenomena. ROA is a commonly used audit risk variable in audit effort studies to demonstrate lower audit and business risk. However, because relative efficiency is shown to be an informative but different measure of firm performance compared to absolute efficiency in previous studies (Demerjian et al. 2012; Frijns et al. 2012), we are interested to capture if the directional relationship is consistent or different.

Relative efficiency is considered a more informative measure of efficiency performance in the literature for two reasons. First, relative efficiency is informative because it measures the relative performance of each firm known as a decision-making unit (DMU) within a specific industry and year using well-designed parameters. For each DMU, the optimum aggregate ratio of limited given resources and costs (inputs) that are under the direct control of management to generate sales (output) can be identified. Based on the efficiency frontier horizon, the most efficient aggregate of resource utilisation can be captured by the efficiency frontier horizon; deviations from this resource utilisation aggregate can be captured as 'relative inefficiency'. Thus, from the perspective of market participants, relative efficiency can be considered a genuine measure of efficiency performance because it captures how effectively managers have generated sales utilising selling general and admin costs (SGA), plant, property and equipment (PPE) and cost of goods sold (COGS) amongst other inputs relative to peers. Absolute efficiency does not differentiate. Absolute efficiency is a simple accounting ratio that includes all asset values listed on financial statements whether they are utilised to generate sales or not. Second, compared to relative efficiency, absolute efficiency ignores the inputs required to generate sales in different industries. For ease of computation, ROA simply divides earnings with assets. Whilst this value is simple to interpret, it is not comparable in different industries such as mining, merchandising or service industries. However, relative efficiency captures the efficiency of each firm within an industry using resources and costs specific to the industry, and then with the market as a whole. Based on evidence that credit rating agencies reward firms with higher relative efficiency (not absolute efficiency) with higher credit ratings (Mali and Lim 2019), we conjecture that market participants are aware of the difference of book value (absolute) efficiency and relative firm efficiency, and have the sophistication to capture both types of efficiency.

South Korean audit infrastructure

The South Korean sample is unique because the audit profession has experimented with numerous audit policies to improve audit and earnings quality. In 1999, following the 1997 financial crisis, one of South Korea's largest firms, Daewoo, filed for bankruptcy as a result of window dressing. During 2000–2001, successive bankruptcies of Korean conglomerates increased public demand for additional auditor scrutiny. Therefore, Korean audit legislators suggested the implementation of two policies. In 2001, the South Korean Government mandated that the number of completed audit hours/audit engagement must be transparent and recorded on financial statements. In 2003, the Mandatory Audit Firm Rotation Rule (MAFR) was implemented and became effective in 2006. MAFR was introduced based on the entrenchment hypothesis, suggesting that familiarity between audit firms and clients reduces earnings quality. MAFR required clients to rotate audit firms every six years. However, the policy was considered ineffective and ceased in 2011 when Korea adopted International Financial Reporting Standards (IFRS) (Choi et al. 2017; Mali and Lim 2018).

The 2001 audit effort policy that requires all listed firms to record audit hours (and fees) received per fiscal year on annual reports is still practiced. Korean market participants may therefore perceive audit effort differently to market participants where the audit policy does not exist. For example: i) in Anglo-American economies, audit information can be communicated relatively more cheaply using audit disclosures. However, audit disclosure information has been criticised for being limited (IFRS 2017). Second, because audit hour information is known to market participants in South Korea, audit hours (input) can be considered a direct and felicitous measure of audit/financial reporting quality (output). The alternative audit quality signalling strategy using audit disclosures could be considered secondary information and would incur additional cost in South Korea. Third, in South Korea, increasing competition amongst audit firms has driven down audit fees (Kwon et al. 2014; Park and Lee 2008). Therefore, because the audit market is highly competitive and audit information is available, it is likely that clients have the power to secure audit effort based on the incentives of various stakeholders. We discuss the incentives of various stakeholders based on relative efficiency in our hypothesis development section below.

Hypotheses

Audit supply theory suggests that audit firms have an incentive to mitigate reputational damage and litigation risk, and therefore demand a fee premium based on a client's audit risk (Simunic and Stein 1996; Bell et al. 2001; Gul et al. 2003; Bedard and Johnstone 2004; Lyon and Maher 2005; Abbott et al. 2006; Cahan et al. 2008; Hogan and Wilkins 2008; Schelleman and Knechel 2010; Bryan and Mason 2016). Audit fee studies suggest that audit firms control the supply of audit services, implying that audit effort and audit fees are equivalent. However, as Enron and similar cases show, audit fees can be collected by audit firms for consulting without the completion of audit tests (effort). Thus, audit fees can be considered a direct driver of audit risk, but an indirect driver of audit effort/quality. On the other hand, audit demand theory implies that audit effort in hours is required by clients to 'add value' (Simunic 1980; DeFond and Zhang 2014). From a demand perspective, audit hours can be considered a direct input of audit quality because audit hours represent the incremental levels of system, control and substantive tests conducted by an audit team. In the literature, there is evidence that audit hours can reduce earnings management (Caramanis and Lennox 2008) and reduce the risk perceptions of market participants (Jung 2016); however, an association between audit hours and efficiency performance has not been captured empirically.

We interpret that the association between audit hours and efficiency performance is not recorded in the literature for the following reasons. First, audit quality studies are underpinned by DeAngelo's (1981) assertion that the purpose of an audit is to detect breaches in a client's financial reporting. Moreover, 'audit equilibrium' implies that auditors have an incentive to transfer costs from low-risk clients to high-risk clients (Balachandran and Ramakrishnan 1987). Audit fee studies therefore imply that audit firms control every aspect of audit planning and that audit fees are an indicator of audit risk, not audit quality. Thus, audit fee (effort) studies associate audit effort with the incentives of audit firms when client firms have high levels of audit/business risk, but ignore the audit demands of clients with higher levels of efficiency performance. Second, whilst audit fee information is available to most market participants, audit hour information is not recorded on annual reports on a comparable, structured and consistent basis internationally. Therefore, the relationship between audit hours/quality and efficiency performance can only be recorded in a handful of countries. Third, audit effort would only be demanded in value-adding situations to demonstrate robust audit and financial reporting quality.

Based on the incentives of various stakeholders, the explanations for a positive association between audit hour and relative efficiency are outlined in Figure 1. First, relative efficiency is an empirical measurement of the effectiveness of managers to maximise output (sales) from inputs that are directly under the control of management including PPE, SGA and goodwill amongst

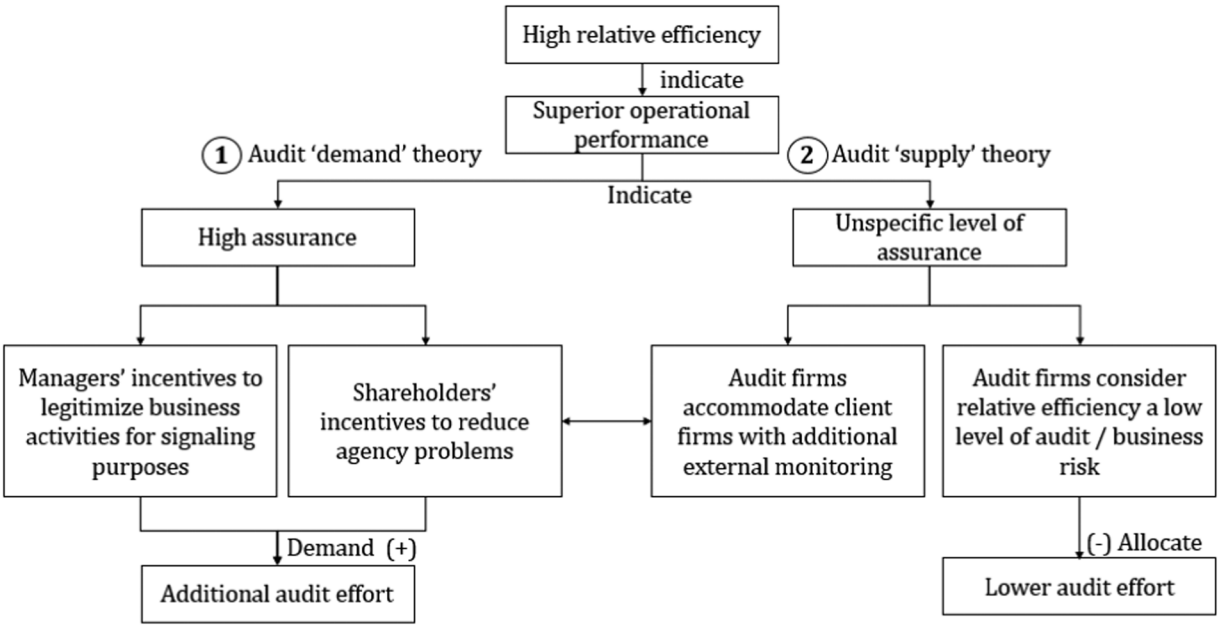

Figure 1 **Relative efficiency and audit effort**

others (given resources and costs) (Demerjian et al. 2012, 2017; Frijns et al. 2012). Audit effort in hours can be perceived by market participants as enhancing audit quality. Thus, both audit hours and relative efficiency can be considered a measure of organisational quality. Lim and Mali (2018) demonstrate that relative efficiency is a signal of managerial effectiveness that influences a market participant's propensity to invest/disinvest in a firm. The study also suggests that investors monitor relative efficiency and retain investments in more efficient firms causing higher levels of uncertainty in less efficient firms. If relative efficiency reduces uncertainty and reduces disinvestment, management is likely to have an incentive to demonstrate that robust efficiency performance was achieved in an organisation with high financial reporting and audit quality. Thus, as efficiency performance increases, audit effort (input) is likely required to enhance audit quality (output) to signal that efficiency performance is genuine. On the other hand, firms with low levels of relative efficiency have no incentive to request additional external audit scrutiny. This relationship would be captured empirically as a positive association between relative efficiency and audit hours.

Second, we hypothesise that as relative efficiency increases, shareholders will demand higher levels of audit hours. Agency theory implies that information asymmetry will cause groups to take action to protect their own self-interest (Watts and Zimmerman 1983). Dopuch et al. (1986) surmise that the perception of an agency problem, not its existence, will cause groups to take action to reduce information asymmetry. In a situation in which a firm has high levels of relative efficiency, but low audit quality, shareholders may perceive that managers can expropriate wealth from shareholders. Therefore, because audit effort is shown to improve governance and mitigate agency problems (Lobo and Zhao 2013; Lee et al. 2014), the shareholders of high-performing client firms can consider audit effort as a small financial outgoing to ensure financial resources are not misused or misappropriated. The managers of high-performing firms are likely to accept the audit effort request of shareholders to reduce objections to performance-related benefits. Third, as suggested by Esplin et al. (2018) creditors, suppliers and other equity stakeholders require assurances that financial reporting quality is accurate to set credit terms. Therefore, we conjecture that management will accommodate the audit quality demands of external stakeholders. Taken together, we hypothesise that audit firms as a service provider would accommodate the audit requirements of client firms with higher efficiency. Based on the above, we develop the following hypothesis:

H1: Firms with higher relative efficiency demand higher audit effort in hours relative to inefficient peers.

Research Design

Variable definition

Our model is developed by borrowing from both Frijns et al. (2012) and Demerjian et al. (2012). However, our model estimates relative efficiency as operational performance or sales generated by only the inputs that

are directly under the control of management. Relative efficiency using frontier analysis can be estimated using data envelopment analysis (DEA), a non-parametric approach. Our DEA efficiency ratio is listed in equation (1). Sales, the numerator, is the value of gross sales. The denominators in equation (1) are the combination of 'given resources' and 'costs' that are firm inputs subject to management's discretion. 'Given resources' are a firm's PPE, operating lease, other intangibles and goodwill. Costs are a combination of cost of goods sold and selling general and admin expenses. All these values are taken from the financial statements.

$$max_u\theta = \frac{u_1 Sales}{u_1 GivenResources + u_2 Costs} \quad (1)$$

where,

Sales (output): Gross sales
Given resources: PPE + operating lease + goodwill + other intangibles
Costs: Cost of goods sold + SGA
PPE: Net PPE
Operating lease: Net operating lease
Goodwill: Purchased goodwill

In equation (1), we illustrate output (sales) divided by inputs (costs and given resources). In equation (2) *x* represents sales and *y(s)* represent given resources and costs; however, we add a weighting structure *u* and *v* to optimise the DEA procedure. To estimate equation (2), first, a DMU is divided into its specific industry to measure the effectiveness of a firm's innate business characteristics based on its income-generating process. Dividing DMUs into industries allows us to compare like with like. Next, we maximise the values of equation (2) for each DMU by varying the weights of both *u* and *v* using the DEA Malmquist index. By varying the values of *u* and *v* for each DMU, it is possible to determine the weights of equation (2) so that the efficiency ratio of each DMU is maximised. Third, the derived optimal values of *u* and *v* are multiplied by output (numerator) and inputs (denominator) to estimate our efficiency score for each individual DMU. Using this approach, it is possible to develop a relative measure to derive an efficiency score for each firm independently within a specific year and industry. Relative efficiency is estimated for each DMU by industry and year because economic factors, government regulation amongst market factors will be different for DMUs and industries in a specific year. However, based on an individual efficiency score in each industry and year, it is possible to discover relative efficiency as it relates to the most efficient firm that is situated on the optimal efficiency frontier horizon for each firm-year.

Finally, we scale the efficiency scores so that they are comparable across various industries. This careful decomposition is required because the relatively most efficient firm in different industries can be considered. Relative efficiency estimates an optimal efficiency vector for a specific industry, and then divides the values with the most efficient score to provide a value of zero to one, with one reflecting the optimal ordinal value of relative efficiency. Therefore, relative efficiency enables a comparison of all firms regardless of industry, mitigating benchmarking problems defined in previous literature (Barr and Siems 1997; Leverty and Grace 2012). If we consider that the maximum efficiency value of 15 represents the maximum value for a mining firm, and 21 for a merchandising firm, the scaled values of both would be one (15/15 and 21/21). Furthermore, a firm in a mining industry with an efficiency score of (7/15 =) 0.467 can be compared with an electronics firm and (13/21 =) 0.619 for modelling purposes. This scaling process allows us to estimate efficiency based on an ordinal ranking to compare efficiency scores of DMUs within an industry compared to the market. We then rerun our model for each year and combine our sample, which allows us to compare each firm's efficiency in relative terms.

$$\frac{\sum_{i=1}^{s} u_i y_{ik}}{\sum_{j=1}^{m} \upsilon_j x_{jk}} \; k = 1, \ldots, n. \quad (2)$$

In its most simple implementation, DEA identifies the observation with the highest ratio of sales (output) to the resources and costs that are under the control of management (input) as an efficiency observation (here the frontier is a single point from the positive orthant in R1). Each observation is assigned a value of zero to one on the efficiency scale. For example, the resource allocation (SGA, for example) of the most efficient firm is captured. This is then compared with the most efficient utilisation of resource (PPE, for example) of the second most efficient firm. The estimation of efficiency for each resource for each DMU in the industry is measured to capture the most effective utilisation of resources as an efficiency frontier horizon. The remaining observations would be scaled relative to the efficient observation from R1 into the closed interval [0, 1]. Thus, DEA can be considered an aggregate firm measure to demonstrate how managers transform aggregate costs/resources (inputs) into revenues (outputs).

In equation (3), our dependent variable, audit hours, a proxy for audit effort is estimated as the natural logarithm of audit hours. As explained in our hypothesis, we conjecture a positive relationship between relative efficiency and audit effort. Next, we include determinants and independent variables that influence audit hours based on previous studies (O'Keefe et al. 1994; Jung 2016). The estimation of our independent variables and determinant categorisation are listed in Table 1. To estimate the first determinant 'size', we estimate firm size

Table 1 Variable definitions

Dependent variable		Definition
	Audit effort	Natural logarithm of audit hours
Variables of interest		
	Relative efficiency *(Relative_Effi)*	Technical efficiency score computed using data envelopment analysis
Control variables		
1. Size		
	Firm size(Size)	Natural logarithm of total assets
	Investment size(Invested_Capital)	Average invested capital/total assets
	Auditor size(Big4)	A dummy variable that takes the value one if an auditor is Big 4, and zero otherwise
2. Business risk		
	Indebtedness(Lev)	Debt ratio (=total liabilities/total assets)
	Financial risk(Loss)	A dummy variable that takes the value one if a firm's net income is negative, and zero otherwise
	Liquidity risk(Current_Debt)	Current debt ratio (=current liabilities/current assets)
3. Performance/Complexity		
	Efficiency performance(ROA)	Absolute efficiency, return on assets (net income/total assets)
	Firm value(Tobin_Q)	Tobin's Q calculated using Chung and Pruitt (1994)
	Firm experience(Age)	Firm age
4. Ownership structure		
	Bigown	Biggest shareholder's share holdings (%)
	Fore	Foreign investors' share holdings (%)
5. Fixed effect		
	ID	Industry fixed effect
	YD	Year fixed effect

as the natural logarithm of a firm's total assets. Auditor size is proxied by a dummy variable that takes the value one if a client firm is audited by a Big 4 firm, and zero otherwise. Investment size is estimated as average invested capital/total assets and average invested capital is estimated in equation (4). We expect a positive relation between audit effort and all our 'size' variables because larger and more complex firms are shown to require additional audit hours in previous studies (Brinn et al. 1994). Next, we proxy for 'business risk' using indebtedness, financial risk (loss) and liquidity risk (as estimated in Table 1). We expect that audit effort will increase with all business risk proxies based on audit supply theory (Simunic 1980). We expect a positive relation between Tobin Q and audit hours because firms with higher market-to-book value are likely to require more audit effort to legitimise their market position. We expect to find a positive relation between firm experience/age and audit hours because older firms are likely to be more complex. Next, we proxy firm ownership structure. We expect a positive relation between foreign ownership and audit hours consistent with foreign owners demanding higher governance in a Korean setting (Lim and Mali 2020). We would expect a negative relationship between the percentage shareholding of the largest domestic shareholder and audit hours because as the power of the largest shareholder increases, it is likely that the largest shareholder will take an active role in firm monitoring.

Finally, we control for absolute efficiency. Based on audit supply theory, firms with higher ROA are considered less risky by audit firms compared to firms with lower ROA. We conjecture a negative relation is likely to exist between audit effort in hours and absolute firm efficiency based on previous studies that use ROA to control for audit risk. A positive relationship between relative efficiency and audit hours, and a negative relationship between absolute efficiency and audit hours would provide evidence that relative efficiency and absolute efficiency must be considered as different forms of efficiency by market participants. We include industry and year dummy variables to control for year and industry effects because audit effort can vary due to the implementation of audit policies (Carson et al. 2014).

$$\begin{aligned} Audit_{Effort\,i,t} = {} & \beta_1\, Relative_{Effi_{i,t}} + \beta_2 Size_{i,t} \\ & + \beta_3 Invested_{Capital\,i,t} + \beta_4 Big4_{i,t} \\ & + \beta_5 Lev_{i,t} + \beta_6 Loss_{i,t} + \beta_7 Current_{Debt\,i,t} \\ & + \beta_8 ROA_{i,t} + \beta_9 Tobin_{Q_{i,t}} + \beta_{10} Age_{i,t} \\ & + \beta_{11} BigOwn_{i,t} + \beta_{12} Fore_{i,t} \\ & + itID + YD + \varepsilon_{i,t} \end{aligned} \quad (3)$$

Table 2 Sample selection

Panel A: Firm efficiency and audit hour sample 2002–2014

Potential sample	15 200
Excluding firms with no financial data available	(4085)
Final sample	11 115

Panel B: Audit hour (raw data) by year

Year	Obs.	Mean audit hour	Year	Obs.	Mean audit hour
2002	755	308.17	2009	875	1039.14
2003	801	703.06	2010	887	1151.25
2004	810	876.39	2011	888	1413.88
2005	831	933.91	2012	897	1437.07
2006	849	1024.33	2013	897	1553.73
2007	857	1059.59	2014	909	1601.05
2008	859	1078.96	Total	11 115	1107.55
Total				11 115	

Panel C: Relative efficiency by year

Year	Obs.	Mean efficiency	Year	Obs.	Mean efficiency
2002	754	0.46	2009	874	0.60
2003	800	0.62	2010	886	0.77
2004	809	0.56	2011	887	0.73
2005	830	0.44	2012	896	0.72
2006	848	0.54	2013	896	0.74
2007	856	0.67	2014	908	0.77
2008	858	0.69	Total	11 102	0.65

$$\textit{Average invested capital} = AVGCA + AVGNPPE + AVGOBA + AVGNIBD \quad (4)$$

where,

AVGCA: Average current asset [= (Beginning current assets + Ending current assets)/2]

AVGNPPT: Average net property, plant and equipment [= (Beginning net PPE + Ending net PPE)/2]

AVGOBA: Average other business assets [= (Beginning OBA + Ending OBA)/2]

AVGNIBD: Average non-interest-bearing debts [= (Beginning NIBD + Ending NIBD)/2]

Sample

In Table 2, Panel A, we provide details of our sample selection process. The 2002–2014 sample period is selected because the Korean economy had recovered from the 1997 Asian financial crisis in 2002 and audit effort information is available. All firm variables are downloaded from two Korean databases, KISS-Value and TS2000; these Korean databases can be considered equivalent to Osiris or Compustat. The values are then merged and the values for financial firms are deleted leaving an initial panel sample of 15,200 firm-year observations after excluding financial firms. We exclude an additional 4,085 observations because of financial data being unavailable (in our panel), leaving a final sample of 11,115. In Table 2, Panel B, we illustrate the mean levels of audit hours from 2002 to 2014. Audit hours have increased significantly from 2002 to 2006 and have continued to increase to 2014. In Panel C, the yearly average relative efficiency of all firms from 2002 to 2014 is listed. Overall, relative efficiency increases over the sample period excluding 2005–2009, a period in which the world economy was in decline (United Nations 2005). We would expect an increase in relative efficiency given recent technological advances in periods excluding economic decline.

Empirical Results

Descriptive statistics

In Table 3, we perform tests comparing the business and financial fundamentals of clients audited by Big 4/non-Big 4 firms. Column 4 provides the details of mean (median) difference tests. We find that client firms that are audited by Big 4 auditors are larger, have higher investment capital, leverage, profitability, are older and have higher foreign ownership and large shareholders compared to client firms that are not audited by Big 4 firms. Furthermore, we find that firms that are audited by Big 4 auditors have lower levels of short-term debt and are less likely to make a financial loss. However, the relative efficiency of Big 4 and non-Big 4 clients is indifferent, showing that client firms of various characteristics can achieve high relative efficiency. We find that clients audited by Big 4/non-Big 4 auditors have statistically indifferent Tobin Q values. The results suggest that market confidence is indifferent based on the preference of clients to select a Big 4 or a non-Big 4 audit firm. We surmise that auditor size has no significant effect on firm valuation.

In Table 4, we list our Pearson correlation results. Consistent with our expectation, audit hours increase with relative efficiency (0.07). We find a weak negative correlation between ROA and audit hours (–0.01, 10% significance level). The results suggest that whilst relative efficiency increases with audit effort, the relationship between audit effort and absolute efficiency is weak. Interestingly, the relationship between audit hours and the increasing share ownership of the largest domestic shareholder is statistically significantly negative (–0.03) whilst the relationship is statistically significantly positive for foreign owners (0.25). We interpret that domestic shareholders demand lower levels of audit effort as a result of local knowledge and potentially a closer relationship with management based on increasing share ownership. Larger international owners are likely to

Table 3 **Descriptive statistics and difference tests (Big 4 vs non-Big 4)**

	(1) Full				(2) Big 4				(3) Non-Big 4				Diff (2)-(3)
Var	Obs.	Mean (Med.)	Max. (Min.)	S.D.	Obs.	Mean (Med.)	Max. (Min.)	S.D.	Obs.	Mean (Med.)	Max. (Min.)	S.D.	*t* (*z*)
Audit hour	11 115	6.41 (6.51)	8.96 (1.79)	1.21	5869	6.78 (6.84)	8.096	1.17	5246	5.99 (6.25)	8.96 (1.79)	1.13	36.01*** (46.78***)
Relative_Effi	11 102	0.64 (0.80)	1 (0.06)	0.34	5857	0.64 (0.81)	1 (0.06)	0.35	5245	0.65 (0.79)	1 (0.06)	0.33	1.51 (0.03)
Size	11 115	18.79 (18.53)	25.82 (13.35)	1.45	5869	19.32 (19.11)	25.82 (14.99)	1.57	5246	18.20 (18.13)	22.24 (13.35)	1.01	44.06*** (40.39***)
Invested_Capital	11 115	0.18 (0.12)	0.89 (0.00)	0.18	5869	0.20 (0.14)	0.859 (0.00)	0.20	5246	0.17 (0.11)	0.89 (0.00)	0.17	9.51*** (8.47***)
Big4	11 115	0.53 (1)	1 (0)	0.49									
Lev	11 115	0.42 (0.42)	0.95 (0.04)	0.00	5869	0.43 (0.43)	0.95 (0.04)	0.20	5246	0.41 (0.41)	0.96 (0.04)	0.19	3.92*** (4.40***)
Loss	11 115	0.25 (0)	1 (0)	0.43	5869	0.21 (0)	1 (0)	0.41	5246	0.28 (0)	1 (0)	0.45	-8.72*** (-8.70***)
Current_Debt	11 115	0.74 (0.77)	1 (0.00)	0.191	5869	0.72 (0.76)	1 (0.00)	0.19	5246	0.75 (0.79)	1 (0.01)	0.18	-6.91*** (-7.53***)
ROA	11 115	0.05 (0.05)	0.87 (-2.75)	0.09	5869	0.05 (0.04)	0.55 (-2.75)	0.08	5246	0.04 (0.04)	0.87 (-0.93)	0.09	7.09*** (6.59***)
Tobin_Q	11 082	0.44 (0.32)	10.51 (0.00)	0.46	5855	0.44 (0.32)	7.96 (0.00)	0.43	5227	0.43 (0.31)	10.51 (0.00)	0.49	0.99 (1.09)
Age	11 115	30.77 (29.93)	72.88 (2.93)	14.98	5869	32.61 (31.94)	72.88 (2.93)	16.06	5246	28.73 (27.87)	68.98 (1.87)	13.91	13.74*** (12.98***)
BigOwn	11 115	0.41 (0.41)	0.79 (0.00)	0.17	5869	0.42 (0.42)	0.79 (0.00)	0.16	5246	0.40 (0.40)	0.75 (0.00)	0.42	6.51*** (6.00***)
Foreign	11 115	0.06 (0.01)	0.93 (0.00)	0.12	5869	0.09 (0.02)	0.93 (0.00)	0.14	5246	0.03 (0.01)	0.70 (0.00)	0.07	26.51*** (28.45***)

t indicates *t*-value for mean-difference test.
z indicates Wilcoxon *z*-value for median-difference test.
*, **, *** indicate significance at 10%, 5%, 1% respectively.
See Table 1 for variable definitions.

Table 4 Pearson correlations

	1	2	3	4	5	6	7
1. Audit hour	1						
2. Relative_Effi	0.07***	1					
3. Size	0.51***	0.01	1				
4. Invested_Capital	0.20***	-0.11***	0.22***	1			
5. Big4	0.32***	-0.01	0.38***	0.08***	1		
6. Lev	0.06***	-0.01	0.12***	-0.17***	0.04***	1	
7. Loss	−0.01	−0.10***	−0.18***	0.03***	−0.08***	0.22***	1
8. Current_Debt	−0.09***	0.11***	−0.23***	−0.20***	−0.06***	0.00	0.00
9. ROA	−0.01*	0.18***	0.17***	−0.11***	0.07***	−0.21***	−0.54***
10. Tobin_Q	0.05***	0.05***	−0.09***	0.04***	0.01	−0.28***	0.01
11. Age	0.27***	−0.00	0.46***	0.17***	0.13***	0.04***	−0.09***
12. BigOwn	−0.03***	0.05***	0.074***	0.03***	0.066***	−0.07***	−0.21***
13. Fore	0.25***	−0.02***	0.44***	0.08***	0.24***	-0.12***	−0.14***

	8	9	10	11	12	13
8. Current_Debt	1					
9. ROA	0.06***	1				
10. Tobin_Q	0.01	0.08***	1			
11. Age	−0.17***	−0.01	−0.17***	1		
12. BigOwn	−0.02**	0.16***	−0.14***	0.11***	1	
13. Fore	−0.06***	0.18***	0.17***	0.12***	−0.03***	1

*, **, *** indicate significance at 10%, 5%, 1% respectively.
See Table 1 for variable definitions.

Table 5 Relative efficiency and audit effort Model:

$$Audit\_Effort_{i,t} = \beta_1 Relative\_Effi_{i,t} + \beta_2 Size_{i,t} + \beta_3 Invested\_Capital_{i,t} + \beta_4 Big4_{i,t} + \beta_5 Lev_{i,t} + \beta_6 Loss_{i,t} + \beta_7 Current\_Debt_{i,t} + \beta_8 ROA_{i,t} + \beta_9 Tobin\_Q_{i,t} + \beta_{10} Age_{i,t} + \beta_{11} BigOwn_{i,t} + \beta_{12} Fore_{i,t} + ID + YD + \varepsilon_{i,t}$$

	Pred. sign	Parameter estimate	*t*-statistic
Intercept	+/–	−1.34***	−7.81
Relative_Effi	+	0.33***	11.37
Size	+	0.36***	39.34
Invested_Capital	+	0.55***	10.09
Big4	+	0.36***	17.34
Lev	+	0.08*	1.74
Loss	+	0.08***	2.90
Current_Debt	+	0.30***	5.81
ROA	-	−1.10***	−8.51
Tobin_Q	+	0.24***	10.59
Age	+	0.01***	6.07
BigOwn	-	−0.39***	−6.71
Fore	+	0.18**	2.01
YD		Included	
ID		Included	
F value		434.10***	
Adj. R2		0.3103	
Obs.		11 069	

*, **, *** indicate significance at 10%, 5%, 1% respectively.
See Table 1 for variable definitions.

demand higher levels of audit effort as a form of monitoring to improve governance. Loss has no significant association with audit effort, suggesting that a financial loss does not have a relationship with audit hours, without controlling for the firm risk/performance determinants that are likely to have led to a financial loss. All other variables show the predicted signs and are statistically significant at the 1% level.

Multivariate analysis

In Table 5, we provide details of our main analysis. We conduct OLS regressions to establish the relationship between our dependent variable audit hours (audit effort) and relative efficiency estimated using DEA. We find a highly statistically significantly positive relation between relative efficiency and audit hours (0.33,

t-value 11.37). The results imply that an increase in relative firm efficiency by one unit is associated with a 0.33 increase in audit hours. Because relative firm efficiency is a value of zero to one, it is possible to interpret the relative efficiency value as a percentage from zero to 100%. Moreover, because we use the natural logarithm of audit hours, our results can be interpreted as follows. The most efficient firm with a relative efficiency score of one (100% relative efficiency) requests 33% more audit effort compared to the least efficient firm with a relative efficiency score of zero (0%). If a firm is 77% efficient compared to the most efficient firm (firm with an efficiency ratio of one), this firm would require 25.41% (0.77*0.33) additional audit effort based on increasing efficiency. Therefore, whilst it may possible that the most efficient firms have higher risk (Nguyen and Swanson 2009), our results imply that confident management with robust business operations requires additional audit effort with increasing relative firm efficiency. This evidence allows us to accept our hypothesis.

Based on audit demand theory, our results can be interpreted as management having an incentive to signal relative efficiency performance to secure better terms from suppliers and capital providers; and to reduce the opposition to performance-related remuneration as a result of additional audit hours signalling higher audit quality and financial reporting quality to market participants. We also interpret that shareholders request additional audit effort to minimise agency problems. On the other hand, the stakeholders of relatively inefficient firms would not have a similar incentive to signal that financial reporting is robust using audit effort because it would be considered an unnecessary expense for a relatively poorly performing organisation.

Next, we include details about the relationship between absolute efficiency (ROA) and audit effort. We find that the relationship between absolute efficiency is negative (–1.10, *t*-value –8.51). We interpret that based on absolute efficiency being estimated as a simple book value ratio, audit firms have few incentives to use valuable resources to scrutinise firms with high levels of ROA. The results also show that client firms have few incentives to demand additional audit effort to signal high levels of absolute efficiency. Baik et al. (2013) is one of the first studies to interpret that relative efficiency and absolute efficiency may be considered as different efficiency performance measurements and real-world phenomena. Our results show that the relationship between relative efficiency and audit hours is different compared to absolute efficiency and audit hours. To the best of our knowledge, we are the very first to demonstrate that relative efficiency and absolute efficiency can be captured as explicitly different forms of efficiency performance. Firm size (0.36, *t*-value 39.34), investment capital (0.55, *t*-value 10.09) and firm age (0.01, *t*-value 6.07) increase with audit hours, suggesting audit effort increases with business complexity. We also find that firms with higher risk require higher audit effort based on leverage (0.08, *t*-value 1.74), short-term debt (0.30, *t*-value 5.81) and loss-making firms (0.08, *t*-value 2.90). We find a positive relationship between audit hours and Big 4 auditors (0.36, *t*-value 17.34). The results suggest that clients may perceive that Big 4 audit firms may be 'value adding' for signalling purposes. Our ownership structure measures BigOwn (–0.39, *t*-value –6.71) and Fore (0.18, *t*-value 2.01) also show consistent results with our descriptive statistics.

Additional Analysis

Audit fees and audit expertise

Nam (2018) shows that following the adoption of IFRS in South Korea, audit hours have increased at a higher rate compared to audit fees, suggesting that audit hours are associated with efforts to improve audit quality. If a positive association between audit hours and relative efficiency can be perceived as client firms securing additional audit effort for signalling purposes, there should be no association between relative efficiency and a fee (per hour) premium. Thus, we estimate the relationship between i) audit fees with relative efficiency and ii) audit expertise (fee per hour) with relative efficiency. Audit fees in the literature are considered to increase with audit risk. However, previous studies are unable to disentangle audit fees and hours because of data unavailability. Thus, in previous studies audit effort (fees/hours) may be misinterpreted as risk, not audit effort to enhance audit quality. Audit fee per hour will depend on the service levels demanded by client firms and the incentives of audit firms to reduce business and audit risk. Lower levels of audit fee per hour are a result of junior members of staff being allocated to an audit assignment. Higher levels of fee per hour would be a result of audit partners or other senior auditors working on an audit to mitigate risk. In Table 6, our results show that audit fees increase with relative efficiency (0.05, *t*-value 3.35). This result is expected because audit hours and fees are likely to be linked. However, we find an insignificant relationship between audit fees per hour and relative efficiency. We interpret that an insignificant relationship between audit fees per hour and relative efficiency shows that audit firms do not consider relative efficiency to be a form of business/audit risk based on a risk premium basis (after controlling for our firm risk and performance proxies that show the expected sign). Thus, the levels of audit services (experience) provided by junior members of staff, senior auditors and partners are not influenced by relative efficiency. Taken together, the results suggest that additional audit effort is more likely demanded by client firms as opposed to imparted

Table 6 Audit fee and fees per hour Model: $$Audit\_Effort_{i,t} = \beta_1 Relative\_Effi_{i,t} + \beta_2 Size_{i,t} + \beta_3 Invested\_Capital_{i,t} + \beta_4 Big4_{i,t} + \beta_5 Lev_{i,t} + \beta_6 Loss_{i,t} + \beta_7 Current\_Debt_{i,t} + \beta_8 ROA_{i,t} + \beta_9 Tobin\_Q_{i,t} + \beta_{10} Age_{i,t} + \beta_{11} BigOwn_{i,t} + \beta_{12} Fore_{i,t} + ID + YD + \varepsilon_{i,t}$$

	Pred. sign	DV: Audit fee	DV: Fee per hour
Intercept	+/–	3.39***(45.30)	6.10***(39.57)
Relative_Effi	+	0.05***(3.35)	0.03(0.88)
Size	+	0.38***(100.15)	0.03***(4.37)
Invested_Capital	+	0.08***(3.62)	−0.11**(−2.48)
Big4	+	0.11***(13.87)	−0.24***(−14.51)
Lev	+	0.25***(13.04)	0.07*(1.89)
Loss	+	0.06***(6.24)	0.02(1.07)
Current_Debt	+	0.16***(7.58)	0.09**(2.35)
ROA	–	−0.33***(−6.53)	0.17*(1.68)
Tobin_Q	+	0.14***(15.01)	0.02(1.25)
Age	+	−0.00(−0.09)	−0.00*(−1.88)
BigOwn	–	−0.32***(13.52)	−0.02(−0.40)
Fore	+	0.22***(5.93)	−0.02(−0.29)
YD		Included	Included
ID		Included	Included
F value		625.20***	125.82***
Adj. R2		0.6887	0.3682
Obs.		11 062	11 062

Results of statistical estimation amounts in parentheses are *t*-values. *, **, *** indicate significance at 10%, 5%, 1% respectively. Refer to Table 1 for variable definitions.
The dependent variable 1) Audit_Fee is the natural logarithm of audit fees, 2) Fee per hour is computed by natural logarithm of (audit fees/audit hours).
See Table 1 for variable definitions.

by audit firms to reduce reputational damage and litigation threats.

Robust tests based on credit ratings

A credit rating[1] is considered a tool by market participants to evaluate a firm's comparative default risk (Boot et al. 2006; Kraft 2015). Various studies provide evidence of a fundamental difference in how financial institutions, including credit-rating agencies, insurance firms and banks perceive the default risk of investment grade (IG) and non-investment grade (NIG) firms (Bhojraj and Sengupta 2003; Ashbaugh-Skaife et al. 2006; Kisgen 2006). Therefore, based on evidence that credit-rating agencies interpret relative efficiency as a default risk determinant (Mali and Lim 2019), NIG/IG firms are likely to have different incentives to legitimise relative efficiency performance. IG firms have an incentive to protect their rating levels by demonstrating audit quality. NIG firms are likely to enjoy various advantages by straddling the investment grade threshold, including lower borrowing and bond yield rates, better terms from suppliers, enhanced brand value, access to capital and investment opportunities that are only available to IG firms but not NIG firms (Alissa et al. 2013). However, whether or not it is possible to capture the incentives of both groups is a question that remains unanswered.

In Table 7, we perform three regressions. In columns (2) and (3), we run regressions after dividing our sample into IG and NIG samples. In both regressions we find that there is a positive relationship between relative efficiency and audit hours for IG firms (0.28, *t*-value 7.81) and NIG firms (0.39, *t*-value 8.50) regardless of sampling, consistent with our previous results. We also find a negative relation between audit hours and ROA, consistent with our previous result. Again, we demonstrate that firms with higher relative efficiency demand additional audit effort (0.44, *t*-value 9.59). Our IG dummy variable shows that IG firms require additional audit hours compared to NIG firms (0.12, *t*-value 2.75). Given that IG firms are larger than NIG firms (Mali and Lim 2019), we interpret that this dummy variable captures that larger firms require additional audit effort. Our interaction term *Effi* IG* shows the difference in the relationship between relative efficiency and audit hours for IG firms compared to NIG firms. Our results suggest an incrementally negative relationship between relative efficiency and audit effort for IG firms, compared to NIG firms (–0.18, *t*-value –3.19). We interpret that D to CCC+ firms are more likely to demand audit effort compared to B– to AAA firms because they have an incentive to signal robust performance to straddle the investment grade threshold to benefit from the numerous advantages based on IG status. This evidence again suggests that audit effort may be used as a signalling strategy to influence credit ratings. However, in this instance it is also possible to interpret that audit firms impose additional audit hours on to NIG firms with higher relative efficiency compared to IG firms.

Table 7 **Investment grade vs non-investment grade firms Model:**

$$Audit_{Effort\,i,t} = \beta_1 Relative_{Effi\,i,t} + \beta_2 IG_{i,t} + \beta_3 Effi * IG_{i,t} + \beta_4 Size_{i,t} + \beta_5 Invested_{Capital\,i,t} + \beta_6 Big4_{i,t} + \beta_7 Lev_{i,t} + \beta_8 Loss_{i,t} + \beta_9 Current_{Debt\,i,t} + \beta_{10} ROA_{i,t} + \beta_{11} Tobin_{Q\,i,t} + \beta_{12} Age_{i,t} + \beta_{13} BigOwn_{i,t} + \beta_{14} Fore_{i,t} + ID + YD + \varepsilon_{i,t}$$

$$Audit\_Effort_{i,t} = \beta_1 Relative\_Effi_{i,t} + \beta_2 Size_{i,t} + \beta_3 Invested\_Capital_{i,t} + \beta_4 Big4_{i,t} + \beta_5 Lev_{i,t} + \beta_6 Loss_{i,t} + \beta_7 Current\_Debt_{i,t} + \beta_8 ROA_{i,t} + \beta_9 Tobin\_Q_{i,t} + \beta_{10} Age_{i,t} + \beta_{11} BigOwn_{i,t} + \beta_{12} Fore_{i,t} + ID + YD + \varepsilon_{i,t}$$

	Pred. sign	IG vs NIG	IG	NIG
Intercept	+/−	−1.41***	−0.89***	−1.99***
		(−8.00)	(−3.85)	(−7.32)
Relative_Effi	+	0.44***	0.28***	0.39***
		(9.59)	(7.81)	(8.50)
IG	+/−	0.12***		
		(2.75)		
Effi IG*	+/−	−0.18***		
		(−3.19)		
Size	+	0.37***	0.35***	0.38***
		(39.32)	(27.82)	(27.29)
Invested_Capital	+	0.55***	0.543***	0.48***
		(9.90)	(7.23)	(5.56)
Big4	+	0.36***	0.37***	0.32***
		(17.25)	(13.99)	(10.11)
Lev	+	0.08	0.14	0.06
		(1.55)	(1.55)	(0.82)
Loss	+	0.08***	−0.02	0.14***
		(2.89)	(−0.46)	(4.17)
Current_Debt	+	0.30***	0.14**	0.558***
		(5.74)	(2.03)	(7.14)
ROA	−	−1.11***	−1.83***	−0.56***
		(−8.53)	(−8.95)	(−3.15)
Tobin_Q	+	0.23***	0.22***	0.34***
		(10.62)	(8.45)	(8.01)
Age	+	0.00***	0.00***	0.01***
		(5.96)	(2.89)	(5.03)
BigOwn	−	−0.39***	−0.37***	−0.48***
		(−6.76)	(−4.70)	(−5.38)
Fore	+	0.18**	0.21*	0.52***
		(2.01)	(1.87)	(2.67)
YD		Included	Included	Included
ID		Included	Included	Included
Chi2		373.10***	270.12***	171.94***
Pseudo R2		0.3209	0.3340	0.3106
Obs.		11 069	6476	4593

Results of statistical estimation amounts in parentheses are *t*-values.
*, **, *** indicate significance at 10%, 5%, 1% respectively. Figures in parenthesis indicate t value
See Table 1 for variable definitions.

Robustness test based on market size

We find that efficient NIG firms demand higher levels of audit hours compared to IG firms. To further demonstrate that our model is robust, we divide our sample into groups listed on the Korean KOSPI and KOSDAQ stock exchanges. If our model is robust, we would expect that after controlling for size and established measures of relative efficiency, a firm's listing on two different stock exchanges would not have an incremental effect on audit effort. In Table 8, we examine the relation between audit hours and relative efficiency for larger firms that are listed on KOSPI and smaller KOSDAQ listed firms. In columns (2) and (3), we again demonstrate that there is a positive relation between relative efficiency and audit hours in both KOSPI (0.22, *t*-value 5.81) and KOSDAQ (0.35, *t*-value 8.11) samples. In column (1), we use a dummy variable, *market*, to separate KOSPI and KOSDAQ firms. Market takes the value one if a firm is listed on the larger KOSPI stock exchange, and zero otherwise. We find that larger KOSPI firms require fewer audit hours compared to smaller KOSDAQ firms using a dummy variable approach. However, when we use an interaction term for relative efficiency with the market dummy variable to control for size effect, we find an insignificant association (–0.06, *t*-value –1.11)

Table 8 Relatively larger firms vs smaller firms Model:

$$Audit\_Effort_{i,t} = \beta_1 Relative\_Effi_{i,t} + \beta_2 Market_{i,t} + \beta_3 Effi{*}Market_{i,t} + \beta_4 Size_{i,t} + \beta_5 Invested\_Capital_{i,t} + \beta_6 Big4_{i,t} + \beta_7 Lev_{i,t} + \beta_8 Loss_{i,t} + \beta_9 Current\_Debt_{i,t} + \beta_{10} ROA_{i,t} + \beta_{11} Tobin\_Q_{i,t} + \beta_{12} Age_{i,t} + \beta_{13} BigOwn_{i,t} + \beta_{14} Fore_{i,t} + ID + YD + \varepsilon_{i,t}$$

$$Audit\_Effort_{i,t} = \beta_1 Relative\_Effi_{i,t} + \beta_2 Size_{i,t} + \beta_3 Invested\_Capital_{i,t} + \beta_4 Big4_{i,t} + \beta_5 Lev_{i,t} + \beta_6 Loss_{i,t} + \beta_7 Current\_Debt_{i,t} + \beta_8 ROA_{i,t} + \beta_9 Tobin\_Q_{i,t} + \beta_{10} Age_{i,t} + \beta_{11} BigOwn_{i,t} + \beta_{12} Fore_{i,t} + ID + YD + \varepsilon_{i,t}$$

	Pred. sign	KOSPI vs KOSDAQ	KOSPI	KOSDAQ
Intercept	+/−	−1.81***	−2.62***	−1.14***
		(−10.05)	(−10.56)	(−3.81)
Relative_Effi	+	0.33***	0.22***	0.35***
		(7.54)	(5.81)	(8.11)
Market	+/−	−0.18***		
		(−4.15)		
Effi Market*	+/−	−0.06		
		(−1.11)		
Size	+	0.39***	0.41***	0.37***
		(40.48)	(32.53)	(21.86)
Invested_Capital	+	0.54***	0.41***	0.65***
		(9.89)	(5.23)	(8.17)
Big4		0.37***	0.41***	0.34***
		(18.11)	(12.96)	(12.58))
Lev	+	0.08*	0.14*	0.09
		(1.78)	(1.79)	(1.50)
Loss	+	0.07***	0.11***	0.01
		(2.65)	(2.88)	(0.37)
Current_Debt	+	0.32***	0.42***	2.01***
		(6.14)	(5.39)	(2.98)
ROA	−	−1.14***	−1.15***	−1.17***
		(−8.84)	(−5.62)	(−6.96)
Tobin_Q	+	0.22***	0.48***	0.09***
		(9.98)	(11.63)	(3.72)
Age	+	0.01***	0.01***	0.01***
		(9.33)	(8.08)	(6.22)
BigOwn	−	−0.40***	−0.02	−0.75***
		(−6.87)	(−0.23)	(−9.25)
Fore	+	0.23**	0.01	0.41***
		(2.50)	(0.07)	(2.49)
YD		Included	Included	Included
ID		Included	Included	Included
Chi2		380.85***	257.93***	114.80***
Pseudo R2		0.3254	0.3600	0.1991
Obs.		11 069	5515	5554

Results of statistical estimation amounts in parentheses are *t*-values.
*, **, *** indicate significance at 10%, 5%, 1% respectively.
See Table 1 for variable definitions.

suggesting that the relation between audit effort and relative efficiency for KOSPI and KOSDAQ listed firms is indifferent. The results suggest that regardless of market listing, we find a consistent positive relationship between relative efficiency, adding robustness to our previous findings.

Controlling for time trend, endogeneity and panel data analysis

We conduct three more additional analyses to add further robustness to our main findings. First, both key variables, audit hours and relative firm efficiency (means), show a general upward trend over the sample period. In the main analysis, we control for year effects using a year dummy variable. To rule out spurious results, we repeat our main analysis but include both year dummy variables and time trend simultaneously to control for the exogenous increase in our dependent variable. Specifically, we arrange our data by year and create a trend variable that is equal to the time index for each year. Our sample period is from 2002 to 2014, and thus our time trend equals 1 for 2002, 2 for 2003… 13 for 2014. After controlling for time trend, our reported untabulated results (*Relative_effi* Coeff 0.03, *t*-value 2.16) are consistent with our main analysis. Second, we conduct panel data analyses using random GLS regression

models, so our regressions consider cross-sectional and time dependency. Our panel is made up of 911 firms, and the average observations (years) per group (firm) is 12.2 (years). Whilst we do not have a perfect panel, untabulated results show that our analysis using a time-dependent panel data model is consistent with our main analysis (*Relative_effi* Coeff 0.46, z statistics 12.41).

Third, because our results may not be free from endogeneity, we test endogeneity using the two-stage least squares models listed below. In the first stage, we use relative efficiency (endogenous variable) as a dependent variable, and include key determinants of relative efficiency at time *t*. The two key independent variables (instruments) that are highly likely to influence the dependent variable are: 1) relative efficiency in the previous year (at time *t*–1) which is inherently associated with relative efficiency in the current period (at time *t*) and 2) absolute efficiency (ATO = Sales/Assets) at time *t*. We also control for variables that are likely to influence relative efficiency including invested capital, leverage, ROA and the percentage holding of the largest shareholder and foreign owners. Our results suggest that relative efficiency is persistent, largely influenced by relative efficiency in the previous year (Coeff 0.28, *t*-value 31.77) and positively associated with absolute firm efficiency (ATO ratio) (Coeff 0.28, *t*-value 13.99). Moreover, relatively efficient firms are likely to have higher levels of invested capital (Coeff 0.08, *t*-value) and higher firm performance (ROA) (Coeff 0.55, *t*-value 20.44). Furthermore, ownership concentration (BigOwn) (Coeff 0.02, *t*-value 1.74) and foreign ownership (Fore) (Coeff –0.08, *t*-value –3.73) are positively and negatively associated with relative efficiency. Leverage is found to have no significant association with relative efficiency (Coeff 0.00, *t*-value –0.20).

$$\begin{aligned} 1st\ stage\ :\ & Relative\_Effi_{i,t} = \beta_1\ Relative\_Effi_{i,t-1} \\ & + \beta_2 Absolute\_Effi_{i,t} + \beta_3 Invested\_Capital_{i,t} \\ & + \beta_4 Lev_{i,t} + \beta_5 ROA_{i,t} + \beta_6 BigOwn_{i,t} \\ & + \beta_7 Fore_{i,t} + ID + YD + \varepsilon_{i,t} \end{aligned}$$

$$\begin{aligned} 2nd\ stage\ :\ & Audit\_Effort_{i,t} = \beta_1\ Relative\_Effi_{i,t} \\ & + \beta_2 Size_{i,t} + \beta_3 Invested\_Capital_{i,t} \\ & + \beta_4 Big4_{i,t} + \beta_5 Lev_{i,t} + \beta_6 Loss_{i,t} \\ & + \beta_7 Current\_Debt_{i,t} + \beta_8 ROA_{i,t} \\ & + \beta_9 Tobin\_Q_{i,t} + \beta_{10} Age_{i,t} + \beta_{11} BigOwn_{i,t} \\ & + \beta_{12} Fore_{i,t} + ID + YD + \varepsilon_{i,t} \end{aligned}$$

Using the first-stage regression, we compute the predicted value of relative efficiency after controlling for key determinants. We then repeat the main analysis in the second regression stage after substituting relative efficiency with the newly computed predicted value of relative efficiency, with other control variables being held constant. Our untabulated results suggest that our main results remain qualitatively the same (Predicted *Relative_effi* Coeff 0.11, *t*-value 4.21). After conducting 2SLS analysis, we conduct the Durbin and Wu-Hausman test where the null hypothesis implies that relative efficiency is exogenous. The Wooldridge's score doesn't reject the null hypothesis that relative firm efficiency is exogenous at a conventional significance level (score = 0.25, p = 0.63) suggesting that our main results (the positive relationship between the two main dimensions) are free from endogeneity.

Conclusion and Discussion

In this study, we find that client firms demand increasing audit hours based on higher levels of relative efficiency (operational performance). The results suggest that management demands additional audit hours to demonstrate robust financial reporting, and stakeholders require additional audit effort to reduce agency problems. Overall, the results show that increased audit effort in hours is a signal of increasing audit quality to market participants. We also find consistent evidence that audit fees increase with relative efficiency. In the extant literature, it is suggested that audit fees increase based on an audit firm's incentive to reduce business risk and reputational damage. Therefore, audit fees may be imparted to audit clients based on the incentive of audit firms. However, we find that audit fees per hour has no relation to relative efficiency, suggesting that audit firms do not require a risk fee premium based on relative efficiency.

These findings are important for several reasons. First, the audit effort literature is divided into two approaches designed to capture i) the influence of audit fees (input) on audit quality (output) and ii) audit hours on audit quality. The audit fee literature suggests that additional audit effort is demanded by audit firms to reduce business/audit risk (Simunic and Stein 1996; Bell et al. 2001; Gul et al. 2003; Bedard and Johnstone 2004; Lyon and Maher 2005; Abbott et al. 2006; Cahan et al. 2008; Hogan and Wilkins 2008; Schelleman and Knechel 2010; Bryan and Mason 2016), based on audit supply theory. Mixed results are demonstrated in the audit hour literature with studies suggesting that audit hours both increase (Simunic 1980; Deis and Giroux 1992; O'Keefe et al. 1994) and decrease (Caramanis and Lennox 2008; Jung 2016) with audit risk, and are also influenced by the incentives of stakeholders (Kane and Velury 2004; Niemi 2005; Mitra and Hossain 2007; Knechel el al. 2008). Relative efficiency captures the ability of

management to generate sales based on operational inputs; thus, relative efficiency is an important performance benchmark that requires assurances by stakeholders. We interpret that management and shareholders request audit hours to demonstrate that financial reporting is robust and financial statements provide a true and fair view based on additional audit effort in hours signalling audit quality. The results suggest that audit effort in hours is requested by stakeholders because audit hours are considered value adding, consistent with demand theory, as opposed to arguments that audit effort is imparted to clients by auditors (based on the audit fee literature).

Second, South Korea is a unique case study because the economy can be considered both developed in terms of economic power, but developing in terms of legal infrastructure. Audit hour information has been listed on annual reports since 2001 in Korea. Very few other countries have adopted this rule. Thus, our study can provide insights for policymakers and legislators in both developed and developing economies. Europe has adopted the mandatory audit firm rotation policy to enhance audit quality (Cameran et al. 2015). However, the rule was ceased in Korea because the enforcement of the rule was expensive and has been shown to reduce audit quality (Choi et al. 2017; Mali and Lim 2018). We suggest that legislators may mandate that audit effort in hours be recorded on financial statements as an international policy because the policy can enhance the informativeness of financial statements. Furthermore, Ettredge et al. (2014) suggest that securing audit effort could be considered a strategy to enhance earnings quality, with survey evidence reporting that auditors feel time pressure to complete audits (Lambert et al. 2017). We surmise that listing audit hour engagement information on financial statements can be considered an inexpensive policy to enhance financial statement transparency. We also surmise that it is in the best interests of the general public if a comparative audit effort benchmark is made available to compare equivalent firms including going concerns and bankrupt institutions.

Finally, we clearly identify a different relationship between relative efficiency and audit hours, and absolute efficiency and audit hours. The majority of previous studies suggest that firms with higher ROA require lower audit effort in fees (Gul and Goodwin 2010; Eshleman and Guo 2013). However, we find that the relationship between relative efficiency and audit hours is positive. Whilst there is evidence to suggest that efficiency performance is a form of risk (Nguyen and Swanson 2009), client firms have an incentive to signal higher performance based on relative efficiency because market participants can interpret that it is easier to manipulate financial statement values (absolute efficiency) compared to the operational resources under the control of management. Previous studies interpret both types of efficiency to represent different types of real-world phenomena (Baik et al. 2013). However, we are the very first to show that they are different forms of efficiency that have different influences on audit effort in hours. We would encourage future performance studies to distinguish between absolute and relative efficiency to provide further insights into the reliability of simple but superficial measures.

To conclude, we list limitations. Whilst our model is robust based on our test statistics, controls, the division of firms based on risk and numerous additional analyses, there is the potential for an unobservable effect to influence audit effort. We are unable to control for audit quality determinants including audit office size (Francis and Yu 2009; Choi et al. 2010; Francis et al. 2012) and auditor experience (Carson et al. 2012) because the data are publicly unavailable in South Korea. Because this information is unavailable, we posit that these variables may not be considered a signal of audit quality by market participants or stakeholders of client firms. The literature also suggests that audit disclosures are associated with audit quality (Schultz and Reckers 1981; Lee et al. 2003; Knechel et al. 2015). However, the IFRS (2017) criticise audit disclosures, reporting that i) there is not enough relevant information; ii) there is too much irrelevant information; and iii) information is not communicated effectively in audit disclosures. Our study is based on the assumption that whilst audit disclosures can be considered informative in some economies, because audit hour information is available on a comparative basis in Korea, it is more accessible to market participants and can be considered a more plausible proxy for audit quality.

Finally, in South Korea, the implementation of the auditor retention rule in 1997 triggered a price competition for audit contracts because client firms received the power to switch auditors. As a result, audit firms were incentivised to offer better terms to extend audit contracts (Park and Lee 2008). Furthermore, the introduction of the mandatory audit firm rotation policy in 2006 led to a situation where audit fees have decreased significantly (Kwon et al. 2014). Thus, in Korea, there is the potential that audit firms can agree to provide high levels of audit effort for a discounted fee. Because Korean firms must disclose audit fees and hours on the annual report, relatively more efficient firms can take advantage of increasing audit hours and the benefits associated with a higher level of substantive and control tests. This paper is therefore based on the premise that an audit firm is a service provider and would reflect the needs of highly efficient audit firms in the audit plan. Thus, our results should be interpreted with caution because they are based on a South Korean context. Future studies can extend the literature by using an international comparative analysis approach to develop insights about the relationship between efficiency performance and the

incentives of stakeholders/audit firms to demand/supply audit effort.

Note

1 Credit ratings are coded as below.

Conflict of Interest

The authors declare that there is no conflict of interest.

References

Abarbanell, J.S. and Bushee, B.J. 1997, 'Fundamental Analysis, Future Earnings, and Stock Prices', *Journal of Accounting Research*, 35 (1): 1–24.

Abbott, L.J., Parker, S. and Peters, G.F. 2006, 'Earnings Management, Litigation Risk, and Asymmetric Audit Fee Responses', *Auditing: A Journal of Practice & Theory*, 25 (1): 85–98.

Alam, I.M.S. and Sickles, R.C. 1998, 'The Relationship Between Stock Market Returns and Technical Efficiency Innovations: Evidence from the US Airline Industry', *Journal of Productivity Analysis*, 9 (1): 35–51.

Alissa, W., Bonsall IV, S.B., Koharki, K. and Penn Jr, M.W. 2013, 'Firms' Use of Accounting Discretion to Influence Their Credit Ratings', *Journal of Accounting and Economics*, 55 (2–3): 129–47.

Ashbaugh-Skaife, H., Collins, D.W. and LaFond, R. 2006, 'The Effects of Corporate Governance on Firms' Credit Ratings', *Journal of Accounting and Economics*, 42: 203–43.

Baik, B., Chae, J., Choi, S. and Farber, D.B. 2013, 'Changes in Operational Efficiency and Firm Performance: A Frontier Analysis Approach', *Contemporary Accounting Research*, 30 (3): 996–1026.

Bailey, A.D.., Gramling, A.A. and Ramamoorti, S. 2012, *Research Opportunities in Internal Auditing. The Institute of Internal Auditors Research Foundation Report, Third Quarter 2012*, The Institute of Internal Auditors, Florida.

Balachandran, B.V. and Ramakrishnan, R.T. 1987, 'A Theory of Audit Partnerships: Audit Firm Size and Fees', *Journal of Accounting Research*, 25 (1): 111–26.

Barr, R.S. and Siems, T.F. 1997, 'Bank Failure Prediction Using DEA to Measure Management Quality', in R. Sharda and Stefan Voß, *Interfaces in Computer Science and Operations Research*, Springer, Boston, MA: 341–65.

Bedard, J.C. and Johnstone, K.M. 2004, 'Earnings Manipulation Risk, Corporate Governance Risk, and Auditors' Planning and Pricing Decisions', *The Accounting Review*, 79 (2): 277–304.

Bell, T.B., Landsman, W.R. and Shackelford, D.A. 2001, 'Auditors' Perceived Business Risk and Audit Fees: Analysis and Evidence', *Journal of Accounting research*, 39 (1): 35–43.

Bhojraj, S. and Sengupta, P. . 2003, 'The Effect of Corporate Governance Mechanisms on Bond Ratings and Yields: The Role of Institutional Investors and outside Directors', *The Journal of Business*, 76: 455–75.

Boot, A.W., Milbourn, T.T. and Schmeits, A. 2005, 'Credit Ratings as Coordination Mechanisms', *The Review of Financial Studies*, 19 (1): 81–118.

Brinn, T., Peel, M.J. and Roberts, R. 1994, 'Audit Fee Determinants of Independent and Subsidiary Unquoted Companies in the UK: An Exploratory Study', *The British Accounting Review*, 26 (2): 101–21.

Bryan, D.B. and Mason, T.W. 2016, 'Extreme CEO Pay Cuts and Audit Fees', *Advances in Accounting*, 33: 1–10.

Cahan, S.F. and Emanuel, D. 2009, 'Compensation Committee Governance Quality, Chief Executive Officer Stock Option Grants, and Future Firm Performance', *Journal of Banking & Finance*, 33 (8): 1507–19.

Cahan, S.F., Godfrey, J.M., Hamilton, J. and Jeter, D.C. 2008, 'Auditor Specialization, Auditor Dominance, and Audit Fees: The Role of Investment Opportunities', *The Accounting Review*, 83 (6): 1393–423.

Cameran, M., Francis, J.R., Marra, A. and Pettinicchio, A. 2015, 'Are There Adverse Consequences of Mandatory Auditor Rotation? Evidence from the Italian Experience', *Auditing: A Journal of Practice & Theory*, 34 (1): 1–24.

Caramanis, C. and Lennox, C. 2008, 'Audit Effort and Earnings Management', *Journal of Accounting and Economics*, 45 (1): 116–38.

Carson, E., Fargher, N., Geiger, M., Lennox, C., Raghunandan, K. and Willekens, M. 2012, 'Auditor Reporting on Going-concern Uncertainty: A Research Synthesis', *Auditing: A Journal of Practice and Theory*, 32 (Supplement): 353–84.

Carson, E., Redmayne, N.B. and Liao, L. 2014, 'Audit Market Structure and Competition in Australia', *Australian Accounting Review*, 24 (4): 298–312.

Choi, J.H., Kim, C., Kim, J.B. and Zang, Y. 2010, 'Audit Office Size, Audit Quality, and Audit Pricing', *Auditing: A Journal of Practice & Theory*, 29 (1): 73–97.

Choi, J.S., Lim, H.J. and Mali, D. 2017, 'Mandatory Audit Firm Rotation and Big 4 Effect on Audit Quality: Evidence from South Korea', *Asian Academy of Management Journal of Accounting and Finance*, 13 (1): 1–40.

Chung, K.H. and Pruitt, S.W. 1994, 'A Simple Approximation of Tobin's q'. *Financial Management*, 70–74.

Combs, J.G., Russell Crook, T. and Shook, C.L. 2005, 'The Dimensionality of Organizational Performance and Its Implications for Strategic Management Research', in B. Boyd, T. Russell Crook, J. Le and A. Smith, *Research Methodology in Strategy and Management*, Emerald Group Publishing Limited, Bingley: 259–86.

Crook, T.R., Ketchen, D.J., Combs, J.G. and Todd, S.Y. 2008, 'Strategic Resources and Performance: A Meta-analysis', *Strategic Management Journal*, 29 (11): 1141–54.

Cummins, J.D., Weiss, M.A., Xie, X. and Zi, H. 2010, 'Economies of Scope in Financial Services: A DEA Efficiency Analysis of the US Insurance Industry', *Journal of Banking & Finance*, 34 (7): 1525–39.

DeAngelo, L.E. 1981, 'Auditor Independence, 'Low Balling', and Disclosure Regulation', *Journal of Accounting and Economics*, 3 (2): 113–27.

DeFond, M. and Zhang, J. 2014, 'A Review of Archival Auditing Research', *Journal of Accounting and Economics*, 58 (2–3): 275–326.

Deis Jr, D.R. and Giroux, G.A. 1992, 'Determinants of Audit Quality in the Public Sector', *The Accounting Review*, 67: 462–79.

Demerjian, P., Lev, B. and McVay, S. 2012, 'Quantifying Managerial Ability: A New Measure and Validity Tests', *Management Science*, 58 (7): 1229–48.

Demerjian, P.R. 2017, Calculating Efficiency with Financial Accounting data: Data Envelopment Analysis for Accounting Researchers, Working Paper.

Demsetz, H. 1973, 'Industry Structure, Market Rivalry, and Public Policy', *The Journal of Law and Economics*, 16 (1): 1–9.

Dopuch, N., Holthausen, R.W. and Leftwich, R.W. 1986, 'Abnormal Stock Returns Associated with Media Disclosures of 'subject to' Qualified Audit Opinions'. *Journal of Accounting and Economics*, 8 (2): 93–117.

Eshleman, J.D. and Guo, P. 2013, 'Abnormal Audit Fees and Audit Quality: The Importance of Considering Managerial Incentives in Tests of Earnings Management', *Auditing: A Journal of Practice & Theory*, 33 (1): 117–38.

Esplin, A., Jamal, K. and Sunder, S. 2018, 'Demand for and Assessment of Audit Quality in Private Companies', *Abacus*, 54: 319–52.

Ettredge, M., Fuerherm, E.E. and Li, C. 2014, 'Fee Pressure and Audit Quality', *Accounting, Organizations and Society*, 39 (4): 247–63.

Francis, J.R. and Yu, M.D. 2009, 'Big 4 Office Size and Audit Quality', *The Accounting Review*, 84 (5): 1521–52.

Francis, J.R., Michas P. N. and Yu, M. 2012, 'Office Size of Big 4 Auditors and Client Restatements', *Contemporary Accounting Research*, 30 (4): 1626–61.

Frijns, B., Margaritis, D. and Psillaki, M. 2012, 'Firm Efficiency and Stock Returns', *Journal of Productivity Analysis*, 37 (3): 295–306.

Ghafran, C. and O'Sullivan, N. 2017, 'The Impact of Audit Committee Expertise on Audit Quality: Evidence from UK Audit Fees', *The British Accounting Review*, 49 (6): 578–93.

Greene, W.H. and Segal, D. 2004, 'Profitability and Efficiency in the US Life Insurance Industry', *Journal of Productivity Analysis*, 21 (3): 229–47.

Guénin-Paracini, H., Malsch, B. and Paillé, A.M. 2014, 'Fear and Risk in the Audit Process', *Accounting, Organizations and Society*, 39 (4): 264–88.

Gul, F.A. and Goodwin, J. 2010, 'Short-term Debt Maturity Structures, Credit Ratings, and the Pricing of Audit Services', *The Accounting Review*, 85 (3): 877–909.

Gul, F.A., Chen, C.J. and Tsui, J.S. 2003, 'Discretionary Accounting Accruals, Managers' Incentives, and Audit Fees', *Contemporary Accounting Research*, 20 (3): 441–64.

Hogan, C.E. and Wilkins, M.S. 2008, 'Evidence on the Audit Risk Model: Do Auditors Increase Audit Fees in the Presence of Internal Control Deficiencies?', *Contemporary Accounting Research*, 25 (1): 219–42.

IFRS 2017, *Disclosure Initiative—Principles of Disclosure, Discussion Paper DP/2017/1*. Available at: https://cdn.ifrs.org/-/media/project/disclosure-initative/disclosure-initiative-principles-of-disclosure/discussion-paper/published-documents/discussion-paper-disclosure-initiative-principles-of-disclosure.pdf, accessed 20 October 2020.

Jensen, M.C. and Meckling, W.H. 1976, 'Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure', *Journal of Financial Economics*, 3 (4): 305–60.

Jung, S.H. 2016, 'Audit Effort and Market-perceived Risk: Evidence from South Korea', *Australian Accounting Review*, 26 (3): 255–70.

Kane, G.D. and Velury, U. 2004, 'The Role of Institutional Ownership in the Market for Auditing Services: An Empirical Investigation', *Journal of Business Research*, 57 (9): 976–83.

Kang, P.K. and Kim, Y.C. 2014, 'South Korea's Efforts for Structural Changes in Corporate Governance of Large Korean Business Groups after the Asian Financial Crisis', *International Journal of Disclosure and Governance*, 11 (3): 211–230.

Khan, A., Muttakin, M.B. and Siddiqui, J. 2015, 'Audit Fees, Auditor Choice and Stakeholder Influence: Evidence from a Family-firm Dominated Economy', *The British Accounting Review*, 47 (3): 304–20.

Kisgen, D.J. 2006, 'Credit Ratings and Capital Structure', *The Journal of Finance*, 61 (3): 1035–72.

Knechel, W.R., Niemi, M. and Sundgren, S. 2008, 'Determinants of Auditor Choice: Evidence from a Small Client Market', *International Journal of Auditing*, 12 (1): 65–88.

Knechel, W.R., Vanstraelen, A. and Zerni, M. 2015, 'Does the Identity of Engagement Partners Matter? An Analysis of Audit Partner Reporting Decisions', *Contemporary Accounting Research*, 32 (4): 1443–78.

Kraft, P. 2015, 'Rating agency adjustments to GAAP financial statements and their effect on ratings and credit spreads', *The Accounting Review*, 90 (2): 641–674.

Kwon, S.A., Lim, Y. and Simnett, R. 2014, 'The Effect of Mandatory Audit Firm Rotation on Audit Quality and Audit Fees: Empirical Evidence from the Korean Audit Market', *Auditing: A Journal of Practice and Theory*, 33 (4): 167–96.

Lambert, T.A., Jones, K.L., Brazel, J.F. and Showalter, D.S. 2017, 'Audit Time Pressure and Earnings Quality: An Examination of Accelerated Filings', *Accounting, Organizations and Society*, 58: 50–66.

Lee, J.W., Kang, M., Oh, Y. and Pyo, G. 2014, 'Does Continuous Auditing Enhance the Quality of Financial Reporting? Korean Evidence', *Asia-Pacific Journal of Accounting & Economics*, 21 (3): 284–307.

Lee, P., Stokes, D., Taylor, S. and Walter, T. 2003, 'The Association Between Audit Quality, Accounting Disclosures and Firm-specific Risk: Evidence from Initial Public Offerings', *Journal of Accounting and Public Policy*, 22 (5): 377–400.

Lev, B. and Thiagarajan, S.R. 1993, 'Fundamental Information Analysis', *Journal of Accounting Research*, 31 (3): 190–215.

Leverty, J.T. and Grace, M.F. 2012, 'Dupes or Incompetents? An Examination of Management's Impact on Firm Distress', *Journal of Risk and Insurance*, 79 (3): 751–83.

Lim, H.J. and Mali, D. 2018, 'Does Relative Efficiency Matter? An Analysis of Market Uncertainty', *Investment Analysts Journal*, 47 (2): 127–48.

Lim, H.J. and Mali, D. 2020, 'Does the Productivity of Labor Influence Credit Risk? New Evidence from South Korea', *Asia-Pacific Journal of Accounting & Economics*, 27 (3): 280–99.

Lobo, G.J. and Zhao, Y. 2013, 'Relation Between Audit Effort and Financial Report Misstatements: Evidence from Quarterly and Annual Restatements', *The Accounting Review*, 88 (4): 1385–412.

Lyon, J.D. and Maher, M.W. 2005, 'The Importance of Business Risk in Setting Audit Fees: Evidence from Cases of Client Misconduct', *Journal of Accounting Research*, 43 (1): 133–51.

McWilliams, A. and Smart, D.L. 1993, 'Efficiency v. Structure-conduct-performance: Implications for Strategy Research and Practice', *Journal of Management*, 19 (1): 63–78.

Mali, D. and Lim, H.J. 2018, 'Conservative Reporting and the Incremental Effect of Mandatory Audit Firm Rotation Policy: A Comparative Analysis of Audit Partner Rotation vs Audit Firm Rotation in South Korea', *Australian Accounting Review*, 28 (3): 446–63.

Mali, D. and Lim, H.J. 2019, 'The Influence of Firm Efficiency on Agency Credit Ratings', *Journal of Credit Risk*, 15 (1): 67–102.

Mitra, S. and Hossain, M. 2007, 'Ownership Composition and Non-audit Service Fees', *Journal of Business Research*, 60 (4): 348–56.

Nam, H.J. 2018, 'The Impact of Mandatory IFRS Transition on Audit Effort and Audit Fees: Evidence from Korea', *Australian Accounting Review*, 28 (4): 512–24.

Nguyen, G.X. and Swanson, P.E. 2009, 'Firm Characteristics, Relative Efficiency, and Equity Returns', *Journal of Financial and Quantitative Analysis*, 44 (1): 213–36.

Niemi, L. 2005, 'Audit Effort and Fees Under Concentrated Client Ownership: Evidence from Four International Audit Firms', *The International Journal of Accounting*, 40 (4): 303–23.

O'Keefe, T.B., Simunic, D.A. and Stein, M.T. 1994, 'The Production of Audit Services: Evidence from a Major Public Accounting Firm', *Journal of Accounting Research*, 32 (2): 241–61.

Ou, J.A. and Penman, S.H. 1989, 'Financial Statement Analysis and the Prediction of Stock Returns', *Journal of Accounting and Economics*, 11 (4): 295–329.

Park, J.H. and Lee, J.H. 2008, 'A Study on the Effect of Audit Fees Discount on the Audit Quality', *Korean Journal of Business Administration*, 21 (2): 837–63.

Schelleman, C. and Knechel, W.R. 2010, 'Short-term Accruals and the Pricing and Production of Audit Services', *Auditing: A Journal of Practice & Theory*, 29 (1): 221–50.

Schultz Jr, J.J. and Reckers, P.M. 1981, 'The Impact of Group Processing on Selected Audit Disclosure Decisions', *Journal of Accounting Research*, 19: 482–501.

Simunic, D.A. 1980, 'The Pricing of Audit Services: Theory and Evidence', *Journal of Accounting Research*, 18 (1): 161–90.

Simunic, D.A. and Stein, M.T. 1996, 'Impact of Litigation Risk on Audit Pricing: A Review of the Economics and the Evidence', *Auditing: A Journal of Practice & Theory*, 15 (Supplement): 119–34.

Skinner, D.J. and Srinivasan, S. 2012, 'Audit Quality and Auditor Reputation: Evidence from Japan', *The Accounting Review*, 87 (5): 1737–65.

Soliman, M.T. 2008, 'The Use of DuPont Analysis by Market Participants', *The Accounting Review*, 83(3): 823–53.

United Nations 2005, World Economic and Social Survey 2005. Available at: https://www.un.org/en/development/desa/policy/wess/wess_archive/2005wess_eng.pdf, accessed 20 October 2020.

Watts, R.L. and Zimmerman, J.L. 1983, 'Agency Problems, Auditing, and the Theory of the Firm: Some Evidence', *The Journal of Law and Economics*, 26 (3): 613–33.

Weber, J., Willenborg, M. and Zhang, J. 2008, 'Does Auditor Reputation Matter? The Case of KPMG Germany and Com ROAD AG', *Journal of Accounting Research*, 46 (4): 941–72.

Woods, C. 2013, 'Classifying South Korea as a Developed Market', White Paper Report.