Characteristics of statutory internal auditors and operating efficiency

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Abstract

Purpose – The purpose of this paper is to examine the effect of the characteristics of statutory internal auditors on operating efficiency.

Design/methodology/approach – This study investigates three characteristics pertaining to statutory internal auditors, namely, compensation, activity and expertise, based on 1,340 firm observations from 2009 to 2010 using publicly available disclosure data for Korean listed firms.

Findings – The authors find no evidence that statutory internal auditors' compensation is positively associated with operating efficiency. This implies that compensation data on statutory internal auditors in Korea may not directly reflect their competence and ability to enhance operating efficiency. On the other hand, the authors find evidence for a positive association between full-time status for statutory internal auditors and operating efficiency and a positive association between the attendance at board meetings for statutory internal auditors and operating efficiency. The results also show a decrease in operating efficiency when statutory internal auditors are newly appointed. Finally, expertise of statutory internal auditors in financial or legal matters provides no advantage in terms of operating efficiency.

Practical implications – This study contributes to the extant literature on internal audit by examining the advisory role of statutory internal auditors and its effect on operating efficiency, which is one of the objectives established by the Committee of Sponsoring Organizations of the Treadway Commission.

Originality/value – While most prior research on internal audit depends on survey data from statutory internal auditors or experimental data based on a limited sample of firms, this study is based on a large sample of publicly available data of the Korean market.

Keywords Activity, Expertise, Compensation, Operating efficiency, Statutory internal auditors

Paper type Research paper

1. Introduction

The objectives of internal control are to improve the effectiveness and efficiency of operations, ensure reliable financial reporting and comply with applicable laws and regulations. Prior studies pertaining to these objectives have focused on incentives to establish internal control systems (Ge and McVay, 2005; Hass *et al.*, 2006), the impact of weaknesses in material internal control on financial reporting (Lin *et al.*, 2011; Prawitt *et al.*, 2012) and characteristics of internal audits associated with such weaknesses (Glover *et al.*, 2008; Pizzini *et al.*, 2014)[1]. However, issues related to characteristics of statutory internal auditors[2], who oversee management of firm operations, have been neglected in the literature.

In this study, we elucidate the impact of certain characteristics of statutory auditors on operating efficiency. Three characteristics associated with statutory internal

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auditors are examined: compensation, activity and expertise, based on Korean empirical data. The Korean market has several characteristics that make it particularly suitable for our investigation. In 2002, the Financial Supervisory Service of Korea (the Korean equivalent of the USA Securities and Exchange Commission) released a set of regulations in the spirit of the USA SOX, to enhance transparency over Korean accounting systems. In the following year, the Korean Congress amended internal control-related regulations in Articles 2-2-3, 2-2-4, and 2-2-5 of the External Audit of Stock Companies Act, which mandated that firms with total assets of more than KRW 100 billion must implement and maintain rules and regulations related to internal control over financial reporting. The External Audit of Stock Companies Act requires chief executive officers (CEOs) and chief financial officers (CFOs) to be responsible for their firms' internal control over financial reporting and to appoint full-time directors to oversee internal control accounting systems. These directors report on the operation of internal control accounting systems directly to the statutory internal auditors or an audit committee.

A listed firm with total assets less than KRW two trillion may voluntarily maintain an audit committee or may appoint a full-time statutory internal auditor in accordance with the Financial Investment Services and Capital Markets Act, Article 25 (Appointment of Outside Directors and Composition of Board of Directors) and Article 27 (Standing Auditors)[3]. Listed firms in Korea with statutory internal auditors are required to disclose information about these auditors, including amount of compensation, full-time versus part-time status, participation in meetings of the board of directors, appointment of new statutory internal auditors and financial or legal expertise of statutory internal auditors. In essence, the function of statutory internal auditors is equivalent to that of audit committees.

In Korea, the role of statutory internal auditors is unique. The most critical duty of the statutory internal auditor is to monitor management and to ensure that fiduciary duties for shareholders are properly executed; however, there are differences in elective, legal and operational status between statutory internal auditors and audit committees.

Statutory internal auditors are elected by shareholders during annual shareholder meetings by ordinary resolution[4]. In contrast, audit committees are elected and supervised by the board of directors. Statutory internal auditors may attend board meetings, express their opinions and sign the meeting minutes (Korean Commercial Code Article 391-2-1). According to Korean Commercial Code Article 412-2, statutory internal auditors review the efficiency and effectiveness of operation and directly report to shareholders. By contrast, the audit committee monitors internal control over financial reporting.

Statutory internal auditors also interact with sub-firm-level department managers to find potential cost-saving opportunities, reporting the results to senior managers (i.e. the CEO, CFO) to enhance firm-level operating efficiency. When conflict arises between the statutory internal auditor and the senior management team, the auditor has the authority to initiate shareholder meetings and directly report to the shareholders (Korean Commercial Code Article 412-3-1). Their advisory role does not interfere with their monitoring role. As part of their advisory role, statutory internal auditors prioritize audit activities based on firm characteristics. For example, they may consider input from senior management and the board of directors and adjust audit plans to achieve firm-specific operating objectives during an operational audit. At the fieldwork stage,

statutory internal auditors interact with sub-firm-level department managers to confirm that the decisions of senior management are well-executed. They seek cost-savings opportunities to improve operating efficiency. In essence, statutory internal auditors monitor the execution of decisions made by senior management, but do not participate in making these decisions as part of the management team.

We examine the characteristics of statutory internal auditors in Korean firms with total assets less than KRW two trillion (approximately USA $1.9 billion) and their effects on operating efficiency using the ordinary least square regression. While most prior research on internal audit depends on survey data (Abbott *et al.*, 2010; Lin *et al.*, 2011) from the chief audit executive (CAE), or experimental data from a limited sample of firms, this study is based on a large sample of publicly available data. We provide a comprehensive look at the association between characteristics of statutory internal auditors and operating efficiency for new economy firms.

We find no association between operating efficiency and compensation, but positive associations between full-time status and the participation ratio of statutory internal auditors, which indicates their level of activity. A negative association is evident between operating efficiency and first-year appointment of statutory internal auditors. Finally, statutory internal auditor expertise in finance or law is not associated with operating efficiency. The results of a subsample analysis of the data adjusted for firm size suggest that operating efficiency increases for smaller firms when statutory internal auditors have full-time status, participate frequently in board meetings and offer legal expertise. In addition, newly appointed statutory internal auditors are less effective in enhancing operating efficiency. However, these facts about statutory internal auditors are not true for larger firms.

This study has several implications for researchers, practitioners and regulators. For researchers, in contrast to prior studies of the impact of internal control on financial reporting as an outcome of Section 404 of the Sarbanes–Oxley Act (SOX) of 2002 (Ge and McVay, 2005; Lin *et al.*, 2011; Choi *et al.*, 2013), we identify characteristics of statutory internal auditors that improve the efficiency of firm operations, which is one of the objectives established by The Committee of Sponsoring Organizations of the Treadway Commission (COSO) (2013). For practitioners, studies investigating internal control have largely focused on its contribution to external audit (Glover *et al.*, 2008; Prawitt *et al.*, 2011; Pizzini *et al.*, 2014). However, no studies have examined the connection between statutory internal auditors as internal advisors and operating efficiency. For regulators, this study continues the discussion on the costs versus benefits of SOX 404 reporting for non-accelerated filers[5] and the high costs of compliance with regulations concerning internal control reporting.

The remainder of this paper is organized as follows. Section 2 describes the relevant literature. Section 3 develops testable hypotheses based on the findings of the studies discussed in Section 2. Section 4 describes the sample selection process and the research design. Section 5 reports the empirical results. Section 6 offers conclusions and implications.

2. Related literature

2.1 Characteristics of internal auditors

Cooperation between external auditors and in-house auditors yields cost savings for both parties. Direct interaction between internal and external auditors facilitates

sharing of firm-specific knowledge (The Institute of Internal Auditors, IIA hereafter; Practice Advisories 2110-1; Glover *et al.*, 2008; Prawitt *et al.*, 2011). In many firms, operating efficiency may also be enhanced through an operational audit focusing on issues related to risk-based internal auditing (IIA Practice Advisories 2010-3). For example, statutory internal auditors may evaluate the performance of senior management to determine the underlying cause of difficulty in various departments or business processes, suggesting solutions to improve operational effectiveness and efficiency (IIA, Korea Chapter, 2014). Thus, statutory internal auditors require insight into value-creating activities from the perspective of shareholders to maximize firm value. In essence, statutory internal auditors are expected to appraise and challenge inefficient internal control designs and processes, refine the company's business model and achieve operating efficiency. Several studies have examined the monitoring role of statutory internal auditors using survey data, but the association between statutory internal auditor characteristics and operating efficiency has been neglected due to a lack of publicly available data. Given the importance of statutory internal auditors as internal advisors, we choose to focus on the advisory role of statutory internal auditors in this study.

Many scholars have examined the association between internal auditor characteristics and the effectiveness of external auditing. Pizzini *et al.* (2014) found that audit delays decrease when internal auditors contribute relevant work to an external audit. Similarly, Prawitt *et al.* (2011, 2012) found that the presence of highly competent in-house auditors results in higher audit quality and lower external audit fees. Lin *et al.* (2011) showed a negative association between the competence of internal auditors and the effectiveness of their quality assurance techniques in addressing material internal control weaknesses. Several studies have investigated the advisory role of internal auditors. For example, internal auditors make good future candidates for management positions because of their firm-specific knowledge, which is useful to employees working on consulting projects (Messier *et al.*, 2011; Dezoort *et al.*, 2001). These previous studies relied on survey data obtained directly from statutory internal auditors or experimental data and limited samples. Unlike previous studies, we use publicly available data, which are subject to surveillance by the Financial Supervisory Service of Korea and all interested parties, and are therefore more reliable than the survey data used in previous studies.

2.2 Operating efficiency

We define operating efficiency as a firm's ability to transform corporate resources into revenue better than its competitors. In determining the effect of operating efficiency, prior studies (Dopuch *et al.*, 2003; Leverty and Grace, 2012; Demerjian *et al.*, 2012, 2013) utilized two primary statistical methods: stochastic frontier estimation (SFE hereafter) and data envelopment analysis (DEA hereafter). SFE is a parametric approach in which measurement noise is considered separately from the effects of inefficiency depending on the distribution type – normally distributed, exponential or truncated (Anderson *et al.*, 1999; Kalirajan and Shand, 1999). By contrast, DEA is a non-parametric approach in which all deviations from the linear model are assumed to be the effect of inefficiency and the efficient frontier model is used (Anderson *et al.*, 1999; Kalirajan and Shand, 1999; Demerjian *et al.*, 2012). The major difference between SFE and DEA is that while SFE is influenced by different types of models (resulting in inconsistent estimates), DEA is

immune to functional misspecifications in performance measurement. Thus, DEA is utilized in this study to estimate the amount of output given certain inputs in the evaluation of operating efficiency.

Previous studies examined how CEO performance affects firm performance using DEA estimates. Leverty and Grace (2012) looked at CEO performance over time, basing their evaluation on the CEO's ability to deploy firm resources. Using property – liability insurance data on firms in distress, the authors reported that capable CEOs spend fewer resources in distressed firms and deploy resources better to enhance performance. Similarly, Baik *et al.* (2011) found that capable CEOs exhibit greater accuracy and frequency in earnings forecasts, which reflects their ability to foresee changes in the underlying economics of firms.

Demerjian *et al.* (2012, 2013) incorporated DEA estimates as new measures of managerial ability to determine the association between firm performance and earnings quality. The authors found that capable managers generate higher revenue. They examined a series of resources such as the cost of goods sold, general and administrative costs, fixed assets, operating leases, research and development costs and intangible assets. In addition, for firms with capable managers, high earnings quality and persistent accruals are ensured and fewer subsequent restatements are necessary.

3. Hypotheses development

The updated Internal Control – Integrated Framework of the COSO (2013) links a principle-based approach to the design and evaluation of internal controls that is applicable in the current business environment. The major difference between this framework (COSO, 2013) and the previous version (COSO, 1992) is that the former explicitly states 17 principles that flesh out the primary concepts of the five components of internal control[6]. Among these 17 principles, the fourth principle emphasizes the commitment of firms to find, develop and retain competent internal auditors in pursuing the objectives specified in the framework[7]. As the COSO (2013) focuses increasingly on operations, compliance and non-financial reporting objectives, an understanding of the characteristics of statutory internal auditors corresponding with these objectives becomes more and more important.

Recent studies on internal audit have mostly been related to financial statements. For instance, Pizzini *et al.* (2014) and Lin *et al.* (2011) argued that internal auditor attributes such as experience, certification, education level and refined assurance techniques not only reduce audit delay, but also minimize material internal control weaknesses. These results suggest that certain characteristics of internal auditors are critical to ensure that effective and efficient audits are performed.

In addition to their monitoring role, internal auditors may also occupy an advisory role (IIA Practice Advisories 2,110-3). For example, in assessing the effectiveness and efficiency of operations, internal auditors must also possess a comprehensive understanding of their firms when evaluating internal controls across the organization and its divisions, operational units or functions (Internal Control –Integrated Framework; COSO, 2013). To maximize profits, they are expected to provide internal reports to management on how to improve operations based on a thorough understanding of those operations (Hermanson and Rittenberg, 2003; Allegrini *et al.*, 2006; Cooper *et al.*, 2006).

3.1 Compensation of statutory internal auditors

Compensation is determined based on competency of internal auditors (Keizer, 2009; Abbott *et al.*, 2012). The importance of the role of internal auditors in the organization and attention from the management and board of directors has been frequently emphasized. Abbott *et al.* (2012) suggested that salary, training and differences in per hour internal audit costs, respectively, correspond to qualification, tools and experience of internal auditors.

Compensation represents internal auditor's competency, which directly measures his provision in enhancing operating efficiency of the firm. We predict that compensation for statutory internal auditors generally reflects the degree to which they fit in the organization and their effort expended on behalf of the firm. Thus, we posit the first hypothesis:

H1. Compensation of statutory internal auditors is positively associated with operating efficiency.

3.2 Statutory internal auditor activity

The Practice Advisories published by the IIA and other prior studies indicate that in-house auditors have more frequent interaction with key personnel within the firm than outsourced internal auditors (Rittenberg and Covaleski, 1997; Glover *et al.*, 2008). This interaction gives them more opportunity to discover problems, helps them to build relationships with employees and aids in revealing critical issues in or barriers to improving operating efficiency.

Thus, our second hypothesis has to do with the association between the working status of statutory internal auditors and their interaction with key personnel within the firm. A statutory internal auditor who interacts daily with managers and executives is more likely to have effective communication with them, which will enhance operating efficiency. We posit that a statutory internal auditor who works full-time is likely to have a more effective advisory role and ability to enhance operating efficiency compared to a part-time auditor. Thus, we predict that full-time status of statutory internal auditors is positively associated with operating efficiency.

Statutory internal auditors who frequently participate on the board of directors (BOD hereafter) by attending meetings have more opportunity to be exposed to discussions about critical strategic issues and to participate in decision-making (Lee *et al.*, 2013). Thus, we expect that attendance at BOD meetings is associated with operating efficiency. We therefore present our second and third hypotheses:

H2. Full-time status of statutory internal auditors is positively associated with operating efficiency.

H3. More frequent attendance of statutory internal auditors at BOD meetings is positively associated with operating efficiency.

3.3 Statutory internal auditor expertise

The main responsibilities of statutory internal auditors are as follows:

- to perform audits and risk assessments;
- to identify areas of improvement; and

- to reduce significant procedural weaknesses (Lin *et al.*, 2011; Pizzini *et al.*, 2014; Prawitt *et al.*, 2012).

As an advisor, a statutory internal auditor possesses extensive firm knowledge that enables him or her to provide valuable advice and improve operating efficiency. However, newly hired statutory internal auditors will know less about their firms and industries than statutory internal auditors who have had many years of experience. We therefore posit our fourth hypothesis as follows:

H4. Statutory internal auditor newness is negatively associated with operating efficiency.

Traditionally, statutory internal auditors rely on a control-based approach in their overseeing of financial accounts to verify adherence with policies and procedures (Lindow and Race, 2002). If a statutory internal auditor is a financial or legal expert, his or her strengths may increase control over the financial reporting process or compliance with laws and regulations. We posit that increased control over financial reporting and compliance with laws and regulations may reduce operating efficiency. At the same time, statutory internal auditors with financial or legal expertise may understand and detect potential inefficiencies better and be better able to provide relevant solutions to improve operating efficiency than statutory internal auditors without such expertise. These two effects may cancel each other out. This leads to our fifth research hypothesis:

H5. Financial or legal expertise of statutory internal auditors is not associated with operating efficiency.

4. Research design

4.1 Research model

We use the following empirical model to test the hypotheses:

$$\begin{aligned} DEA_{it} = {} & \beta_0 + \beta_1 COMP_{it} + \beta_2 FULL_{it} + \beta_3 ACT_{it} + \beta_4 NEW_{it} + \beta_5 FIN_{it} \\ & + \beta_6 LAW_{it} + \beta_7 SIZE_{it} + \beta_8 LEV_{it} + \beta_9 MB_{it} + \beta_{10} BETA_{it} + \beta_{11} MS_{it} \\ & + \beta_{12} AGE_{it} + \beta_{13} FCFI_{it} + \beta_{14} FCI_{it} + \beta_{15} CEOCOMP_{it} + \beta_{16} CEOOWN_{it} \\ & + \beta_{17} CEOSO_{it} + \beta_{18} LIST_{it} + \beta_{19} Year2009_{it} + \sum_{i=1}^{15} Industry\,Dummy + \varepsilon \end{aligned} \quad (1)$$

where: DEA: the relative operating efficiency based on an empirical model from Demerjian *et al.* (2012). Each firm is evaluated as a separate entity, termed "decision-making units" (DMUs), where each DMU transfers inputs (cost of goods sold; sales, general and administrative expenses; property, plant and equipment; research and development expenses; goodwill and other intangible assets) into outputs (sales). DEA efficiency is defined as the ratio of outputs over inputs, as shown below:

$$\mathrm{Max}_{v,u}\theta = \sum_{i=1}^{s} u_i\, y_{ik} \Big/ \sum_{j=1}^{m} v_j\, x_{jk}\; k = 1, \ldots, n.$$

where s and m represent outputs and inputs, indexed by i and j , respectively. The objective function measures the efficiency of k , which here represents a firm or firms. The outputs i , j for firms k are y_{ik} and x_{ik} , respectively, which refer to the quantities of inputs and outputs of comparable firms. The DEA maximizes the objective function by choosing implicit weights on each output (u_{ik}) and input (v_{jk}). Efficiency is measured by the quantity of the weighted outputs to the quantity of the weighted inputs. The most efficient firm produces the highest level of output given the fixed level of input. DEA calculates a unique implicit weight for each firm, k:

COMP:	natural logarithm of compensation of statutory internal auditors;
FULL:	an indicator variable coded as 1 if at least one of the statutory internal auditors works full-time, and 0 otherwise;
ACT:	the participation ratio of a statutory internal auditor in BOD meetings (number of BOD meetings a statutory internal auditor attended/total number of BOD meetings);
NEW:	an indicator variable coded as 1 if a statutory internal auditor is in his/her first year in the firm, and 0 otherwise;
FIN:	an indicator variable coded as 1 if a statutory internal auditor is a financial expert, and 0 otherwise;
LAW:	an indicator variable coded as 1 if a statutory internal auditor is a legal expert, and 0 otherwise;
SIZE:	natural logarithm of market value;
LEV:	long-term debt divided by total assets;
MB:	market value of equity divided by book value of equity;
BETA:	market model systematic risk estimate obtained over 60 months;
MS:	percentage of revenues earned by the firm within its industry;
AGE:	natural logarithm of the number of years the firm has been listed on the KSE or KOSDAQ;
FCFI:	an indicator variable coded as 1 if a firm has non-negative free cash flow less the change in working capital less capital expenditure, and 0 otherwise;
FCI:	an indicator variable coded as 1 if a firm reports a non-zero value for foreign currency adjustment, and 0 otherwise;
CEOCOMP:	natural logarithm of CEOs' compensation;
CEOOWN:	common stock ownership of CEOs;
CEOSO:	an indicator variable coded as 1 if CEOs are awarded stock options, and 0 otherwise;
LIST:	an indicator variable that equals 1 if a firm trades its shares on the KSE, and 0 if it trades on the KOSDAQ;
Year 2009:	an indicator variable coded as 1 if the sample is from the year 2009; and
Ind:	industry dummies.

4.2 Operating efficiency

Our measure of operating efficiency (DEA) is borrowed from Demerjian *et al.* (2012). DEA is a statistical method used in assessing the efficiency of entities, termed "decision-making units" (DMUs). DEA generates an ordinal ranking of relative efficiency compared to the Pareto-efficient frontier (Leverty and Grace, 2010; Kalirajan

and Shand, 1999). DEA transforms inputs such as the cost of goods sold, property and equipment into outputs such as revenue or income. Each output and input is allocated a weight in calculating the efficiency score, where the weight is between 0 and 1. The highest bound on the DEA efficiency score is 1. For example, an efficiency score of 0.9455 indicates higher efficiency than a score of 0.2201. The dependent variable in the equation is operating efficiency, as measured by input and output. All financial data to construct the portfolio of inputs were obtained from KISVALUE, which is the Korean equivalent of COMPUSTAT in the USA.

4.3 Characteristics of statutory internal auditors

The main variables of interest are statutory internal auditor compensation, full-time work status, a participation ratio in BOD meetings, newness and expertise in financial or legal matters. Compensation (COMP) is measured by the natural log of statutory internal auditors' annual compensation. We use an indicator variable to identify a statutory internal auditor who works full-time (FULL). If the statutory internal auditor works full-time, FULL is 1, otherwise 0. In addition, a statutory internal auditor's participation ratio (ACT) is the number of BOD meetings a statutory internal auditor attended over total number of BOD meetings.

A statutory internal auditor's newness (NEW) is coded as 1 if a statutory internal auditor is in his first year at the firm, and 0 otherwise. In a similar vein, a statutory internal auditor's expertise (FIN, LAW) is also measured with indicator variables. FIN is coded as 1 if a statutory internal auditor is a financial expert, and 0 otherwise. LAW is an indicator variable coded as 1 if a statutory internal auditor is a legal expert, and 0 otherwise.

4.4 Control variables

Similar control variables were selected to those utilized in prior studies (Lin *et al.*, 2011; Demerjian *et al.*, 2012; Lee *et al.*, 2013; Feng *et al.*, 2015). We control for key firm-specific and industry characteristics expected to assist or challenge a statutory internal auditor in his or her efforts to attain efficiency, such as the natural log of total assets (SIZE), the percentage of revenues earned by the firm within its industry (MS), positive free cash flow (FCFI) and the natural logarithm of the number of years the firm (AGE) has been listed on the KSE or KOSDAQ. Firms with statutory internal auditors often rely more on the work of an individual statutory internal auditor rather than applying consistent procedures and policies with a systematic audit approach taken by an established internal audit, and such firms' internal control over financial reporting is unwarranted (Feng *et al.*, 2015). This suggests that smaller firms may have more problems with operating efficiency. It is therefore expected to be low. Following prior studies, we expect that a higher value for FCFI and greater AGE will be positively associated with operating efficiency. Statutory internal auditors employed by smaller, well-established firms with available cash are more likely to be effective in their performance of internal audit projects if all other characteristics of statutory internal auditors are held constant.

On the other hand, we assume a negative correlation between operating efficiency and MS measured as the percentage of revenues earned by a firm within its industry, as high revenue does not always translate into gains in operating efficiency. Conversely, a decrease in operating efficiency does not always lead to a decline in revenue. We also use long-term debt divided by total assets (LEV), the market-to-book ratio (MB) and the

market model systematic risk (BETA) to control for systematic risk because firm performance based on riskier operations challenges CAEs (Demerjian *et al.*, 2013). We expect that LEV will be negatively associated with operating efficiency, and that MB and BETA will be positively associated with operating efficiency. In addition, we include an indicator variable for firms that report a foreign currency adjustment (FCI) to signify foreign operations, and an indicator variable of the type of Korean stock market (LIST) to reflect the different characteristics of each market (Demerjian *et al.*, 2012; Yoon, 2005). We also include CEOs' compensation level (CEOCOMP), stock ownership (CEOOWN) and stock option awards (CEOSO) as variables in our analysis. Studies have shown that executive compensation structure and ownership are significantly related to firm performance and value (Morck *et al.*, 1988; Mehran, 1995; Core *et al.*, 1999). We predict that a relationship exists between operational complexity and stringent regulatory environments, and between these constructs and the characteristics of statutory internal auditors. Finally, industry dummies and year dummies are included.

5. Empirical analyses

5.1 Sample selection

The sample consists of firms listed on the KSE and KOSDAQ during the period 2009–2010. We exclude observations of firms with non-December 31 fiscal year-ends, financial institutions and International Financial Reporting Standards early-adopter firms to avoid potential compounding effects. We exclude firms with assets of more than KRW two trillion, the standard above which firms are required to have audit committees instead of statutory internal auditors, to eliminate the potential compounding effect of audit committees in the analysis. Finally, we exclude observations for which data about statutory internal auditor characteristics, financial data and other necessary data related to control variables were unavailable in the FNGUIDE database provided by NICE Credit Evaluations, Inc. Information about the characteristics of statutory internal auditors was manually collected from annual reports. Table I presents details on the sample selection criteria and attrition.

Sample selection criteria	No. of firm-years
Total listed firms in the sample for 2009-2010	3,772
Less	
(1) Non-December 31 fiscal year-end firms	(455)
(2) Financial institutions	(113)
(3) IFRS early-adopter firms	(76)
(4) Firms with assets exceeding KRW two trillion (the point above which firms are required to have audit committees instead of internal auditors) or firms that chose to have audit committees voluntarily	(152)
(5) Firms missing data for statutory internal auditors	(1,449)
(6) Firms without other necessary data for control variables	(187)
Total	1,340

Note: IFRS: International Financial Reporting Standards

Table I. Sample selection criteria and attrition

5.2 Descriptive statistics

Table II presents descriptive statistics for the sample of 1,340 firm-year observations[8]. The mean (median) for the operating efficiency (DEA) variable is 0.512 (0.489), and the scores range from 0.367 to 0.760. These average DEA scores are greater than the 0.264 reported by Leverty and Grace (2010) and lower than the 0.57 recorded by Demerjian *et al.* (2012). This difference may be explained as follows: prior studies either relied on US data from

(N = 1,340) Variable	Mean	SD	Minimum	First quartile	Median	Third quartile	Maximum
DEA	0.512	0.076	0.367	0.463	0.489	0.558	0.760
COMP	10.525	0.981	7.901	9.798	10.597	11.260	12.450
FULL	0.607	0.489	0.000	0.000	1.000	1.000	1.000
ACT	0.809	0.324	0.000	0.686	1.000	1.000	1.000
NEW	0.223	0.417	0.000	0.000	0.000	0.000	1.000
FIN	0.137	0.344	0.000	0.000	0.000	0.000	1.000
LAW	0.046	0.210	0.000	0.000	0.000	0.000	1.000
SIZE	11.005	1.049	9.130	10.269	10.898	11.627	14.004
LEV	0.099	0.090	0.000	0.033	0.074	0.137	0.432
MB	1.292	0.848	0.097	0.662	1.117	1.706	4.673
BETA	1.038	0.378	0.157	0.791	1.022	1.271	1.985
MS	10.586	20.618	0.000	0.000	0.000	11.000	88.000
AGE	3.180	0.640	1.099	2.708	3.296	3.664	4.190
FCFI	0.435	0.496	0.000	0.000	0.000	1.000	1.000
FCI	0.029	0.168	0.000	0.000	0.000	0.000	1.000
CEOCOMP	13.364	0.662	11.806	12.909	13.322	13.771	15.130
CEOOWN	0.188	0.157	0.000	0.023	0.185	0.302	0.593
CEOSO	0.069	0.253	0.000	0.000	0.000	0.000	1.000
LIST	0.431	0.495	0.000	0.000	0.000	1.000	1.000

Notes: DEA is the relative operating efficiency based on data envelopment analysis (DEA); COMP is the natural logarithm of compensation of statutory internal auditors; FULL is an indicator variable coded as 1 if at least one of the statutory internal auditors works full-time, and 0 otherwise; ACT is the participation ratio of statutory internal auditors in BOD meetings (number of BOD meetings a statutory internal auditor attended/total number of BOD meetings); NEW is an indicator variable coded as 1 if a statutory internal auditor is in his first year at the firm, and 0 otherwise; FIN is an indicator variable coded as 1 if a statutory internal auditor is a financial expert, and 0 otherwise; LAW is an indicator variable coded as 1 if a statutory internal auditor is a legal expert, and 0 otherwise; SIZE is the natural logarithm of market value; LEV is long-term debt divided by total assets; MB is market value of equity divided by book value of equity; BETA is the market model systematic risk estimate obtained over 60 months; MS is the percentage of revenues earned by the firm within its industry; AGE is the natural logarithm of the number of years the firm has been listed on the KSE or KOSDAQ; FCFI is an indicator variable coded as 1 if a firm has non-negative free cash flow less the change in working capital less capital expenditure, and 0 otherwise; FCI is an indicator variable coded as 1 if a firm reports a non-zero value for foreign currency adjustment, and 0 otherwise; CEOCOMP is the natural logarithm of CEOs' compensation; CEOOWN is the common stock ownership of CEOs; CEOSO is an indicator variable coded as 1 if CEOs are awarded stock options, and 0 otherwise; LIST is an indicator variable that equals 1 if a firm trades its shares on the KSE, and 0 if it trades on the KOSDAQ. Observations with values greater than the 99th percentile (less than the 1st percentile) of their respective distributions were winsorized and set to be equal to the value at the 99th percentile (or 1st percentile)

Table II.
Descriptive statistics

insurance-specific companies or utilized data collected over longer periods than that specified in this study. The mean of COMP is 10.525, which indicates that the mean value for annual compensation of statutory internal auditors is KRW 116 million (approximately US$108,000). Sixty-one per cent of statutory internal auditors have full-time status (FULL), and 80.9 per cent regularly attend BOD meetings (ACT). According to the data, 22.3 per cent of statutory internal auditors were newly hired (NEW) during the sample period. Fourteen per cent of the sample firms had statutory internal auditors who were financial experts (FIN), and 4.6 per cent had statutory internal auditors who were legal experts (LAW). The mean firm size (SIZE), measured by the natural logarithm of total assets, is 11.005, which represents KRW 122 billion (approximately USA $113 million). The mean values of leverage (LEV) and the market-to-book ratio (MB) are 9.9 per cent and 129 per cent, respectively. The sample firms exhibit a systematic risk (BETA) of 1.038, which implies that the selected firms fairly represent the current market risk. The average firm age is 27 years. The percentage of revenue earned by a firm within its industry (MS) is, on average, 10.6 per cent, and 43.5 per cent of firms reported positive cash flow (FCF1) in the sample year. The mean of CEOCOMP is 13.364, which indicates that the mean annual compensation for CEOs is KRW 817 million (approximately USA $760,000). The percentage of shares owned by CEOs (CEOOWN) is, on average, 18.8 per cent, and 6.9 per cent of CEOs are awarded executive stock options. Finally, approximately 43.1 per cent of the sample firms trade their shares on the KSE, and 56.9 per cent of them trade shares on the KOSDAQ.

Table III provides the Pearson correlation matrix for the variables used in the regression model. Operating efficiency (DEA) is positively associated with compensation of statutory internal auditors (COMP). The result indicates that it is necessary to consider other control variables pertaining to firm risk and investment opportunities to assess compensation accurately. Operating efficiency (DEA) is positively and significantly associated with full-time status (FULL) and the attendance rate at BOD meetings (ACT). As expected, newness of CAEs (NEW) is negatively and significantly associated with operating efficiency (DEA). In accordance with our prediction, operating efficiency (DEA) is not associated with financial expertise (FIN) and legal expertise (LAW) of statutory internal auditors.

Following previous studies (Demerjian *et al.*, 2012; Anderson and Reeb, 2003), we control for total assets (SIZE) and debt in a firm's capital structure by dividing long-term debt by total assets (LEV). No significant association of these two variables with operating efficiency is evident. As in Core *et al.* (1999), we estimate operating efficiency by including a proxy for firm risk and investment opportunity by dividing the market value of equity by the book value of equity (MB). The result is a positive and significant correlation with operating efficiency. The market model beta (BETA) was included to control for systematic risk in the sample firms. BETA is not significantly associated with operating efficiency. Following Demerjian *et al.* (2012), the percentage of revenues earned by the firm within its industry (MS), firm age (AGE), signs of the positive free cash flow indicator (FCFI) and the foreign exchange adjustment indicator (FCI) are controlled. The signs for FCFI and FCI are consistent with those in a previous study by Demerjian *et al.* (2012), but in this study, the differences are not significant.

A firm with a longer life cycle (AGE) is expected to be positively associated with operating efficiency, as predicted by Demerjian *et al.* (2012). We also include CEO compensation level (CEOCOMP), stock ownership (CEOOWN) and stock option awards (CEOSO) as control variables, according to the procedure in previous studies

Table III.
Pearson correlation matrix

$N = 1{,}340$ Variable	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) DEA	0.083 (0.003)	0.147 (<0.0001)	0.100 (0.000)	−0.063 (0.021)	−0.012 (0.670)	−0.027 (0.322)	−0.015 (0.579)	−0.038 (0.169)	0.159 (<0.0001)
(2) COMP		0.573 (<0.0001)	0.235 (<0.0001)	0.018 (0.503)	0.063 (0.021)	−0.059 (0.031)	0.432 (<0.0001)	0.101 (0.000)	0.131 (<0.0001)
(3) FULL			0.233 (<0.0001)	0.043 (0.120)	0.116 (<0.0001)	−0.092 (0.001)	0.419 (<0.0001)	0.139 (<0.0001)	0.228 (<0.0001)
(4) ACT				−0.040 (0.145)	−0.032 (0.241)	−0.060 (0.028)	0.152 (<0.0001)	0.030 (0.280)	0.098 (0.000)
(5) NEW					0.043 (0.119)	0.053 (0.054)	0.024 (0.373)	0.010 (0.719)	−0.016 (0.564)
(6) FIN						−0.036 (0.189)	0.024 (0.377)	0.072 (0.009)	0.014 (0.617)
(7) LAW							0.027 (0.321)	0.006 (0.825)	−0.113 (<0.0001)
(8) SIZE								0.052 (0.057)	−0.287 (<0.0001)
(9) LEV									0.063 (0.022)
(10) MB									
(11) BETA									
(12) MS									
(13) AGE									
(14) FCFI									

(continued)

$N = 1,340$ Variable	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
(1) DEA	0.003	−0.013	0.161	0.032	−0.009	0.052	0.018	−0.111	0.173
	(0.910)	(0.644)	(<0.0001)	(0.247)	(0.741)	(0.055)	(0.507)	(<0.0001)	(<0.0001)
(2) COMP	0.009	0.051	0.329	0.053	0.042	0.409	−0.156	−0.015	0.376
	(0.752)	(0.063)	(<0.0001)	(0.053)	(0.126)	(<0.0001)	(<0.0001)	(0.574)	(<0.0001)
(3) FULL	0.088	−0.007	0.317	0.063	0.021	0.282	−0.133	−0.053	0.426
	(0.001)	(0.807)	(<0.0001)	(0.022)	(0.437)	(<0.0001)	(<0.0001)	(0.051)	(<0.0001)
(4) ACT	0.029	−0.006	0.144	0.052	0.020	0.121	−0.046	0.029	0.181
	(0.295)	(0.838)	(<0.0001)	(0.060)	(0.470)	(<0.0001)	(0.092)	(0.293)	(<0.0001)
(5) NEW	0.038	−0.031	0.031	−0.011	−0.029	−0.053	−0.092	−0.004	0.037
	(0.170)	(0.257)	(0.250)	(0.683)	(0.292)	(0.052)	(0.001)	(0.891)	(0.175)
(6) FIN	0.022	−0.008	0.029	0.050	0.022	0.035	−0.029	0.004	0.032
	(0.415)	(0.765)	(0.281)	(0.068)	(0.429)	(0.200)	(0.291)	(0.891)	(0.248)
(7) LAW	−0.053	−0.074	−0.069	0.000	0.046	−0.053	−0.053	0.081	−0.048
	(0.052)	(0.007)	(0.011)	(0.995)	(0.090)	(0.051)	(0.052)	(0.003)	(0.079)
(8) SIZE	0.146	0.024	0.147	0.109	0.094	0.496	−0.134	0.080	0.286
	(<0.0001)	(0.382)	(<0.0001)	(<0.0001)	(0.001)	(<0.0001)	(<0.0001)	(0.003)	(<0.0001)
(9) LEV	0.105	0.010	0.094	−0.151	0.062	0.009	−0.069	−0.006	0.076
	(0.000)	(0.726)	(0.001)	(<0.0001)	(0.024)	(0.756)	(0.011)	(0.814)	(0.006)
(10) MB	−0.014	0.013	0.335	0.016	−0.014	− −0.004	0.027	−0.143	0.325
	(0.597)	(0.638)	(<0.0001)	(0.569)	(0.600)	(0.872)	(0.319)	(<0.0001)	(<0.0001)
(11) BETA		−0.034	−0.035	−0.005	0.085	−0.017	−0.093	0.061	0.062
		(0.208)	(0.199)	(0.850)	(0.002)	(0.526)	(0.001)	(0.025)	(0.024)
(12) MS			0.026	−0.042	−0.016	0.031	−0.034	−0.037	0.016
			(0.339)	(0.128)	(0.551)	(0.254)	(0.214)	(0.176)	(0.564)
(13) AGE				0.025	0.039	0.122	−0.145	−0.101	0.525
				(0.362)	(0.158)	(<0.0001)	(<0.0001)	(0.000)	(<0.0001)
(14) FCFI					0.018	0.108	0.068	0.006	0.094
					(0.506)	(<0.0001)	(0.012)	(0.832)	(0.001)

(continued)

Table III.

$N = 1,340$ Variable	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(15) FCI									
(16) CEOCOMP									
(17) CEOOWN									
(18) CEOSO									
(19) LIST									

(continued)

Table III.

$N = 1,340$ Variable	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
(15) FCI						0.054	0.001	0.041	0.020
						(0.048)	(0.967)	(0.136)	(0.469)
(16) CEOCOMP							0.038	0.021	0.251
							(0.166)	(0.444)	(<0.0001)
(17) CEOOWN								−0.044	−0.166
								(0.109)	(<0.0001)
(18) CEOSO									−0.063
									(0.021)
(19) LIST									

Notes: *P*-values are in parentheses. The definitions of variables are presented in Table II

Table III.

(Morck *et al.*, 1988; Mehran, 1995; Core *et al.*, 1999). CEO compensation level is positively associated with operating efficiency, and stock option awards are negatively correlated with operating efficiency. To investigate differences in operating efficiency between KSE- and KOSDAQ-listed firms, we include an indicator variable of listed stocks (LIST) following Yoon (2005). The result is positively associated with operating efficiency. An evaluation of the variance inflation factors associated with our regression analysis suggests that multicollinearity is not a concern[9].

5.3 Main results

Table IV shows the results of the empirical analysis in equation (1). Column (1) presents the results using the full model and Columns (2), (3) and (4) show the results with the reduced model. In Column (1), the coefficient of COMP is not significant. Thus, *H1*, which stated that compensation of statutory internal auditors is positively associated with operating efficiency, is not supported. This implies that information about statutory internal auditors' total compensation does not fully reflect their competency or ability to enhance operating efficiency. Without information pertaining to performance targets, standards and measures and pay-for-performance information, which is lacking in this Korean database, this association is very difficult to prove. Such information is critical to assessment of the competence of statutory internal auditors.

The coefficients for full-time working status (FULL) and attendance rate at BOD meetings (ACT) of statutory internal auditors are significant and positive, as predicted in *H2* and *H3*. These results imply that operating efficiency increases with the auditors' activity level. The coefficient for the variable representing recent appointment (NEW) is negative and significant, supporting *H4*. This result suggests that inexperienced statutory internal auditors lack sufficient firm-specific operational knowledge compared to statutory internal auditors who have been with the firm longer. The coefficients of FIN and LAW are not significant.

Finally, results for financial (FIN) and legal (LAW) expertise of statutory internal auditors prevent rejection of *H5*, possibly because of a tradeoff between control and operating efficiency. Thus, an increase in internal control over financial activities or compliance with regulations may lead to a decrease in operating efficiency. The results for these control variables are generally consistent with those in prior studies (Core *et al.*, 1999; Demerjian *et al.*, 2012; Mehran, 1995). The coefficients for leverage (LEV) and CEO stock options (CEOSO) are significantly negative, and the coefficients for firm (AGE) and listed firms (LIST) are significantly positive.

5.4 Subsample analysis by firm size

We partition our sample by total assets (SIZE). We conjecture that statutory internal auditors employed by larger firms are more likely to work in internal audit departments in which human resource investments are greater and professional qualifications are higher. To differentiate the characteristics of statutory internal auditors by size, we divide the sample firms into two groups according to:

(1) total assets equal to or greater than the median value for the entire sample; and

(2) total assets less than the median value.

Table V presents the results of the estimated regression model specified in equation (1) by firm size. The results shown in Column (1) indicate that the characteristics of

	Dep. = DEA[10]							
	Full model		Reduced model (1) CAE compensation		(2) CAE activity		(3) CAE expertise	
Variable	Coefficient	*T*-value	Coefficient	*T*-value	Coefficient	*T*-value	Coefficient	*T*-value
Intercept	0.545	14.260***	0.504	14.580***	0.529	15.660***	0.510	15.820***
COMP	−0.002	−0.750	0.001	0.380				
FULL	0.013	2.360**			0.011	2.080**		
ACT	0.013	1.940**			0.013	1.970**		
NEW	−0.010	−2.010**					−0.010	−1.990**
FIN	−0.002	−0.390					−0.001	−0.230
LAW	0.007	0.760					0.005	0.520
SIZE	−0.007	−2.360**	−0.005	−1.720*	−0.007	−2.490**	−0.004	−1.610
LEV	−0.058	−2.480**	−0.054	−2.330**	−0.058	−2.520**	−0.053	−2.280**
MB	0.003	0.880	0.004	1.470	0.003	0.860	0.005	1.550
BETA	0.002	0.270	0.001	0.250	0.001	0.190	0.002	0.340
MS	0.000	−0.650	0.000	−0.790	0.000	−0.670	0.000	−0.830
AGE	0.007	1.900*	0.007	1.890*	0.006	1.760*	0.007	2.010**
FCFI	0.002	0.420	0.002	0.520	0.002	0.420	0.002	0.520
FCI	−0.005	−0.390	−0.004	−0.340	−0.004	−0.320	−0.005	−0.410
CEOCOMP	0.006	1.560	0.006	1.550	0.005	1.520	0.006	1.580
CEOOWN	0.019	1.390	0.019	1.390	0.021	1.540	0.017	1.240
CEOSO	−0.023	−2.800***	−0.022	−2.770***	−0.023	−2.780***	−0.023	−2.790***
LIST	0.014	2.660***	0.016	2.990***	0.014	2.630***	0.016	3.060***
Industry Dummy	Included		Included		Included		Included	
Year Dummy	Included		Included		Included		Included	
Adj R^2 (%)	10.05		9.51		10.14		9.80	
F-value	4.79***		5.11***		5.28***		4.91***	
N	1,340		1,340		1,340		1,340	

Notes: ***, ** and * represent significance of gray shading at the 1, 5 and 10% levels, respectively; the definitions of variables are presented in Table II;

$$DEA_{it} = \beta_0 + \beta_1 COMP_{it} + \beta_2 FULL_{it} + \beta_3 ACT_{it} + \beta_4 NEW_{it} + \beta_5 FIN_{it} + \beta_6 LAW_{it} + \beta_7 SIZE_{it} + \beta_8 LEV_{it} + \beta_9 MB_{it} + \beta_{10} BETA_{it} + \beta_{11} MS_{it} + \beta_{12} AGE_{it} + \beta_{13} FCFI_{it} + \beta_{14} FCI_{it} + \beta_{15} CEOCOMP_{it} + \beta_{16} CEOOWN_{it} + \beta_{17} CEOSO_{it} + \beta_{18} LIST_{it} + \beta_{19} Year2009_{it} + \sum_{i=1}^{15} Industry\ Dummy + \varepsilon \quad (1)$$

Table IV. Characteristics of statutory internal auditors and operating efficiency

Variable	Dep. = DEA (1) SIZE ≥ Median Coefficients	*T*-value	(1) SIZE < Median Coefficient	*T*-value
Intercept	0.636	10.280***	0.593	7.960***
COMP	−0.006	−1.440	0.000	0.030
FULL	0.012	1.310	0.013	1.760*
ACT	0.011	1.050	0.017	2.040**
NEW	0.000	−0.030	−0.017	−2.480**
FIN	0.007	0.800	−0.009	−0.990
LAW	−0.012	−0.880	0.029	1.930*
SIZE	−0.009	−2.030**	−0.015	−2.510**
LEV	−0.077	−2.210**	−0.049	−1.520
MB	0.002	0.420	0.003	0.750
BETA	0.003	0.340	0.002	0.200
MS	0.000	−0.870	0.000	−0.160
AGE	0.008	1.630	0.005	0.970
FCFI	−0.008	−1.260	0.008	1.360
FCI	0.012	0.780	−0.031	−1.330
OUT	0.000	0.080	0.011	1.920*
LIST	0.005	0.250	0.030	1.590
Industry Dummy	Included		Included	
Year Dummy	Included		Included	
Adj R^2 (%)	12.75		14.69	
F-value	2.91***		3.43***	
N	670		670	

Table V.
Characteristics of statutory internal auditors and operating efficiency: subsample analysis by firm size

Notes: ***, ** and *represent significance of gray shading at the 1, 5 and 10% levels, respectively; the definitions of variables are presented in Table II; $DEA_{it} = \beta_0 + \beta_1 COMP_{it} + \beta_2 FULL_{it} + \beta_3 ACT_{it} + \beta_4 NEW_{it} + \beta_5 FIN_{it} + \beta_6 LAW_{it} + \beta_7 SIZE_{it} + \beta_8 LEV_{it} + \beta_9 MB_{it} + \beta_{10} BETA_{it} + \beta_{11} MS_{it} + \beta_{12} AGE_{it} + \beta_{13} FCFI_{it} + \beta_{14} FCI_{it} + \beta_{15} CEOCOMP_{it} + \beta_{16} CEOOWN_{it} + \beta_{17} CEOSO_{it} + \beta_{18} LIST_{it} + \beta_{19} Year2009_{it} + \sum_{i=1}^{15} Industry\ Dummy + \varepsilon$ (1)

statutory internal auditors are not significantly associated with operating efficiency for larger firms. Thus, more emphasis may be placed on the characteristics of the internal audit department as a whole, rather than on characteristics of statutory internal auditors individually in terms of enhancing operating efficiency for larger firms. Column (2) shows that the coefficients of FULL and ACT are significantly positive and that of NEW is significantly negative, which is consistent with the main results. In addition, the coefficient of LAW is significantly positive. This result indicates that statutory internal auditors with legal expertise detect potential difficulties in compliance with laws and regulations, which enhances operating efficiency for small firms.

6. Conclusion

In this study, we examine the association between characteristics of statutory internal auditors and operating efficiency. The study was motivated by one of the main internal control objectives of the COSO framework: enhancing efficiency and effectiveness of operations. Focusing on three key characteristics, compensation, activity and expertise,

we show that compensation of statutory internal auditors is not associated with operating efficiency because compensation data on statutory internal auditors in Korea may not directly reflect their competency and ability to enhance operating efficiency due to a lack of performance measures, performance targets or disclosure of pay-for-performance information. On the other hand, their activity (as measured by full-time work status) enhances operating efficiency. In addition, newness of the statutory internal auditor lowers operating efficiency. Finally, no association is evident between statutory internal auditors' expertise in accounting or law and operating efficiency.

Our results indicate that auditor compensation is not associated with operating efficiency, possibly because the level of compensation variable is unable to capture the competence of these workers accurately. We find a positive association between full-time work and enhanced operating efficiency. This result suggests that frequent day-to-day interactions between statutory internal auditors and firm personnel allow development of in-depth, firm-specific knowledge that aids them in enhancing operating efficiency. In addition, we find a positive association between frequent participation of statutory internal auditors in BOD meetings and increased operating efficiency. Newness of a statutory internal auditor is negatively associated with operating efficiency, suggesting that a lack of firm-specific and industry knowledge reduces operating efficiency. Finally, statutory internal auditor expertise in accounting or legal matters is not associated with operating efficiency. This result may suggest that a tradeoff exists between financial or legal expertise and internal controls over operating efficiency. Therefore, we speculate that an emphasis on internal control over financial matters or compliance with laws and regulations does not always result in increased operating efficiency.

This study adds to the extant literature on internal audit by examining the advisory role of statutory internal auditors in enhancing operational efficiency. The study provides practical insights for regulators, internal audit practitioners and firms, suggesting that statutory internal auditors can be utilized as in-house advisors to enhance operational efficiency.

This study has several limitations. First, as the qualifications of statutory internal auditors and how they enhance operating efficiency are not directly observable; our proxies for statutory internal auditor characteristics may include measurement noise. A better measure of qualification would be based on the employment background of statutory internal auditors. Second, due to data limitations, the results presented in this study reflect the characteristics of statutory internal auditors and not the characteristics of the internal audit department as a whole. Interesting avenues for future research may include the effect on audit efficiency of the characteristics of statutory internal auditors, coordination between internal and external auditors, the differences between statutory internal auditors and audit committees and the possible alternative roles of statutory internal auditors and audit committees.

Notes

1. Recently, several studies explored the impact of the high compliance costs due to internal control over financial reporting (ICFR) based on the Sarbanes–Oxley Act (SOX) on efficiency of firms' operations (Alexander *et al.*, 2013; Feng *et al.*, 2015; Kim and Goh, 2014). Alexander *et al.* (2013) report that managers who responded to a survey on SOX Section 404(b) conducted

by the US Securities and Exchange Commission between December 2008 and January 2009 deemed that ICFR improved the quality of financial reporting, but lowered operating efficiency.

2. The role of a statutory internal auditor is similar to that of a chief audit executive, but there are differences as well. Statutory internal auditors serve as independent representatives on shareholders' behalf. They inspect and supervise managers' performance and audit accounting firms according to the law.
3. Firms whose total asset amounts are less than KRW 100 billion are not required to appoint one or more full-time statutory internal auditors in accordance with the Article 27 (Standing Auditors) of the Financial Investment Services and Capital Market Act and the Article 30 (Standing Auditors) of the Enforcement Decree of the Act. We include the Financial Investment Services and Capital Market Act and the Enforcement Decree of the Act associated with full-time statutory internal auditors in Appendix.
4. A shareholder with more than three percent of voting shares is prohibited from participating in votes concerning statutory internal auditors (Korean Commercial Code Article 409-3). This regulation ensures impartiality in the election of statutory internal auditors from the influence of major shareholders.
5. According to SEC Release No. 33-8644 (Revisions to Accelerated Filer Definition and Accelerated Deadlines for Filing Periodic Reports) of December 21, 2005, non-accelerated filers are issuers with public floats of less than $75 million. Additionally, according to SEC Release No. 33-9142 (Internal Control Over Financial Reporting in Exchange Act Periodic Reports of Non-accelerated Filers) of September 15, 2010, non-accelerated filers are exempted from Section 404(b) of the Sarbanes–Oxley Act, which requires firms' external auditors to attest to, and report on, management's assessment of its internal control under the Dodd–Frank Wall Street Reform and Consumer Protection Act of July 2010.
6. The five components of internal control are control environment, risk assessment, control activities, information and communication and monitoring. The COSO board found that guidance as to fundamental internal control principles was necessary in today's ever-changing environment. COSO undertook a two-year revision process that resulted in its Internal Control – Integrated Framework, released in May 2013. The revised framework not only provides more guidance for implementation, but, if implemented correctly, it helps establish more effective internal controls at lower costs to the organization (Rittenberg, 2013).
7. The COSO (2013) framework focuses on three types of objectives: operations objectives, reporting objectives and compliance objectives. Operations objectives relate to the effectiveness and efficiency of the firm's operations, meeting operational and financial performance goals and safeguarding assets against losses. Reporting objectives pertain to internal and external financial and non-financial reporting and may be associated with reliability, timeliness, transparency or other terms as set forth by regulators, standard setters or the firm's policies. Compliance objectives are associated with the adherence to laws and regulations to which the firm is subject. More information is available at: www.coso.org/documents/990025P_Executive_Summary_final_may20_e.pdf
8. Observations with values greater than the 99th percentile (less than the 1st percentile) of their respective distributions were winsorized and set to equal the value at the 99th percentile (or 1st percentile) for continuous variables.

9. The Pearson correlation matrix reveals no large correlations between the independent variables used in our regression analyses, with the exception of COMP and FULL (p-value $<.001$), for which a high correlation of 0.573 is found. The maximum variance inflation factor is 2.14 when both COMP and FULL variables are included in the regression model. When these variables are excluded and the analysis is conducted again, our conclusions remain unchanged.
10. We additionally tested DEA efficiency using operating income instead of sales revenue. The results remained qualitatively the same.

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Appendix 1: Act on external audit of stock companies

Article 2-2 (Operation, etc., of Internal Accounting Management System)
(3) The representative of a company shall assume the responsibility for control and operation of the internal accounting management system, and designate one of the permanent directors to be in charge of said system (where there exists no director in charge, referring to any person who performs the duties of a relevant director) as an internal accounting manager (hereinafter referred to as an "internal accounting manager").

(4) An internal accounting manager shall make semiannually a report on the actual status of operation of the internal accounting management system of the relevant company to the board of directors and the statutory auditor (including the auditing committee; hereinafter the same shall apply).

(5) The statutory auditor of a company shall evaluate the actual status of the internal accounting management system, and file an annual report thereon with the board of directors, and keep a written report on said evaluation at the main office of the relevant company for five years. In such case, if they have any corrective opinions on the control and operation of the internal accounting management system, they shall make a report including them.

Appendix 2

Table A2.
Comparison of statutory internal auditors and audit committees in Korea

Category	Statutory internal auditor	Audit committee
Election	Elected by ordinary resolution during the annual shareholders meeting	Elected by the board of directors
Legal status	Equivalent to directors, board of directors or CEO of the company	Board of directors elects and supervises
Operational status	Represents shareholders from a financial perspective From the perspective of operations, maintains a neutral position	A self-corrective corporate governance mechanism

Appendix 3: Financial Investment Services and Capital Markets Act and Enforcement Decree of the Act

Financial Investment Services and Capital Markets Act

Article 27 (Standing auditors)

(1) *Each financial investment business entity (excluding those specified by Presidential Decree, considering the size of assets, etc.) shall have one or more standing auditors:* Provided, That it shall not have a standing auditor if there is an audit committee formed in accordance with this Act (including cases where a financial investment business entity has established an audit committee in compliance with the requisites of Article 26 (2) and (3), although it is not obligated to have an audit committee). *<Amended by Act No. 9,407, Feb. 3, 2009>*
(2) Article 26 (3) shall apply mutatis mutandis to the qualifications for standing auditors under paragraph (1).

Enforcement Decree of the Financial Investment Services and Capital Markets Act

Article 30 (Standing auditors)

The term "financial investment business entities specified by Presidential Decree" in the main sentence of Article 27 (1) of the Act means those falling under any of the following subparagraphs:
1. *A financial investment business entity whose total assets amount to less than 100 billion won as of the end of the latest business year*, provided that cases where the total amount of collective investment property, discretionary investment property, or trust property managed by a financial investment business entity as of the end of the latest business year reaches or exceeds three trillion won shall be excluded here from;
2. A person falling under any provision of Article 28 (1) 2 through 5.

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