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ORIGINAL ARTICLE

The Impact of Cumulative Career Experience of Internal Control Managers on Firms' Efficiency in Different Information Environments

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Abstract

This study investigates the effect of internal control (IC) managers' cumulative career experience on the operational efficiency of Korean listed firms between 2018 and 2020. Building on the premise that managers with extensive experience positively influence ICs and the internal information environment, this study hypothesises that cumulative career experience of an IC manager is also positively associated with a firm's operational efficiency. To empirically assess efficiency, this study applies data envelopment analysis (DEA), a nonparametric technique that evaluates relative efficiency based on multiple input and output measures. The results suggest that IC managers with greater cumulative experience significantly enhance a firm's efficiency. Moreover, this effect is more pronounced in firms operating within weaker accounting information environments, where managerial experience plays a critical role in improving efficiency.

Keywords: Internal control, Internal control manager, Operational efficiency, Information environment, Data envelopment analysis (DEA)

JEL classification: D02, G34, M10

1 Introduction

The effectiveness of a firm's internal control (IC), integrated with corporate governance, has recently gained increased importance. Environmental, social, and governance (ESG) factors have emerged as critical considerations for businesses, influencing financial stability, growth, and stakeholder value. The emphasis on IC among accounting professionals and researchers intensified following high-profile accounting scandals, such as those involving Enron and WorldCom. In response, the U.S. Congress enacted the Sarbanes–Oxley (SOX) Act in 2002 to restore market trust and enhance transparency. The SOX Act highlights the critical role of IC in improving the integrity and quality of financial reporting. Sections 302 and 404 of the SOX Act require management to disclose significant changes or deficiencies in IC and

obligate firms to submit an assessment report on the structure and effectiveness of IC, accompanied by an external audit attestation (Securities and Exchange Commission, 2002, 2003).

Since the enactment of the SOX Act in 2002, stakeholders have gained the ability to identify IC deficiencies within companies. Extensive research has explored various topics related to IC, particularly through disclosures of material weaknesses. Numerous studies have demonstrated that effective IC improves firm performance, enhances the reliability of financial information, and promotes compliance with legal requirements (Ashbaugh-Skaife et al., 2007, 2008; Chalmers et al., 2019; Cheng et al., 2018; Feng et al., 2015; Lawson et al., 2017; Li et al., 2010; Ogneva et al., 2007). Additionally, research has highlighted that both the quantitative and qualitative aspects of

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IC-related human resources play critical roles in business operations and performance (D. J. Choi et al., 2021; J. H. Choi et al., 2013; Shin et al., 2017).

When examining the influence of IC-related human resources on a firm's IC system, it is essential to consider the cumulative career experience of IC managers. These managers are responsible for establishing and maintaining the overall IC framework. As such, their qualifications can be a crucial factor in determining both the effectiveness of a company's IC system and the impact that system has on the firm's performance.

Research on the impact of IC managers' characteristics on firm performance remains relatively limited. Shin and Park (2020) explore the influence of an IC manager's tenure and concurrent role as CFO on a company's efficiency. This study extends their work by focusing on the cumulative work experience IC managers have acquired at the current company prior to their appointment, as well as the accounting-related experience gained from previous firms. In contrast to Shin and Park (2020), who emphasise the concurrent roles and tenure of managers, this study expands the scope by examining the broader cumulative career experience, incorporating both firm-specific and external accounting experience. Even when newly appointed, IC managers can manage and operate the control system effectively if they develop firm-specific knowledge through extended roles within the company or possess prior experience in IC and accounting from other firms (Coff, 1997; Cohen & Levinthal, 1989; Grant, 1996; Hitt et al., 2001; Kor & Mahoney, 2005; Lazear, 2009; Wang et al., 2009). This study confirms that accumulated experience enhances the capabilities of IC managers, improving the company's information environment and ultimately contributing to increased operational efficiency. Additionally, the experience of IC managers proves to be more valuable when the quality of the information environment is suboptimal.

This study contributes to the existing literature in several key ways. It offers new insights into the impact of IC managers' characteristics on firm efficiency, with a specific emphasis on their cumulative career experience—an area that has received relatively limited attention. Additionally, the study presents empirical evidence demonstrating that the importance of cumulative career experience becomes more pronounced in environments where the quality of information is weaker. These findings suggest that IC managers with extensive cumulative experience play a critical role in enhancing a firm's operational efficiency by improving the internal information environment. From a practical perspective, this research highlights the importance of investing in the devel-

opment and retention of experienced IC managers, especially in firms with suboptimal information environments. Furthermore, these results provide useful insights for regulators and policymakers aiming to improve corporate governance and IC standards by emphasising the role of experienced human capital in strengthening operational efficiency.

The remainder of this paper is structured as follows. Section 2 reviews prior literature and formulates our primary hypotheses. Section 3 outlines the research design and provides descriptive statistics. Section 4 presents the empirical findings, and Section 5 offers the conclusion.

2 Literature review and research hypothesis

Operational efficiency is fundamental to profit maximisation, as it directly influences overall firm performance (Demerjian et al., 2012). The imperative for efficiency has intensified in response to mounting competitive pressures, fuelled by an expanding number of market participants (Lin & Tsai, 2016) and the accelerating pace of globalisation (Ensari, 2018). This heightened global competition compels firms to pursue operational excellence as a strategic necessity (Kulkarni et al., 2019). Recent research highlights that operational efficiency is significantly enhanced by supply chain integration practices (Agyei-Owusu et al., 2022), employee-level operational engagement and training (Al Doghan & Sundram, 2023), and effective working-capital management supported by information technology infrastructure (Deb et al., 2023). These findings underscore the multifaceted drivers of operational efficiency in contemporary firms. Consequently, improving operational efficiency has become indispensable for maintaining firm viability in increasingly dynamic and competitive environments (Samoilenko & Osei-Bryson, 2013).

The operational efficiency measure employed in this study reflects a firm's ability to optimise the transformation of inputs into outputs, thereby capturing its resource utilisation effectiveness (Demerjian et al., 2012; Yu et al., 2018). Traditional measures of firm performance, such as share returns, Tobin's Q, and return on assets (ROA), are heavily influenced by external factors, including investor expectations, managerial discretion, and broader market conditions (Faleye et al., 2013). In contrast, the operational efficiency metric employed in this study is based solely on the relationship between operational inputs and outputs, thereby enabling a more direct evaluation of how improvements in IC quality, driven by the expertise of IC managers, impact firm performance.

As Baik et al. (2013) argue, operational efficiency is positively associated with both current and

future profitability, which makes it a reliable indicator of performance that reduces the influence of external variables and isolates the contribution of internal managerial characteristics. This study utilises data envelopment analysis (DEA) to measure operational efficiency; DEA is a nonparametric efficiency ranking score based on a firm's distance from the Pareto-efficient frontier. This score reflects how effectively a firm utilises its operational resources to generate outputs (Mali & Lim, 2021). Firms that convert inputs into outputs more efficiently are generally regarded as achieving superior performance compared to their less efficient counterparts (Derouiche et al., 2021).

IC managers are tasked with establishing and maintaining an effective IC system, while also assessing and ensuring its efficacy within a firm. Existing research highlights the critical role of IC as a key factor in enhancing a firm's operational efficiency, with an emphasis on the importance of the IC manager's qualifications in ensuring streamlined operations (Cheng et al., 2018; Shin & Park, 2020). Drawing from human capital theory, studies suggest that the quality of human resources is indispensable in elevating and sustaining IC effectiveness (Pennings et al., 1998; Wang et al., 2009). Human capital characterised by superior knowledge and extensive experience is more likely to provide high-quality services. Such individuals enhance a firm's operational procedures by optimising resource allocation and designing efficient organisational structures (Williams, 2013).

Recent studies have also underscored that human capital in the IC domain is evolving in response to emerging demands, such as ESG reporting and digitalisation. Moffitt et al. (2024) show that firms with superior ESG performance tend to have fewer material weaknesses in IC systems. This suggests that ESG initiatives are not peripheral but embedded in core risk management functions, highlighting the expanded role of IC personnel in ensuring ESG-related reporting quality. Similarly, Feng and Mohd Saleh (2024) find that the effectiveness of ESG risk management, conditioned by managerial ability, is significantly enhanced when IC quality is high, illustrating the strategic complementarity between human capital and control infrastructure in ESG contexts.

Prior research demonstrates that firm-specific knowledge and expertise enhance managers' ability to address challenges through innovative solutions, grounded in a deep understanding of their organisation (Coff, 1997; Cohen & Levinthal, 1989; Grant, 1996; Wang et al., 2009). Consistent with these findings, studies on CFOs, who oversee IC systems in the U.S., confirm that a CFO's attributes, such as financial knowledge, expertise, and experience, significantly impact the quality of ICs. For example,

Aier et al. (2005) find a negative relationship between CFO quality, as measured by past and current financial knowledge, and the incidence of earnings restatements. Similarly, Krishnan (2005) highlights a link between CFO quality and IC quality, showing that high-quality CFOs are considerably less likely to be associated with material weaknesses in ICs. Given the role of CFOs in designing, establishing, and maintaining IC systems in the U.S., these studies suggest that IC managers with firm-specific knowledge and accounting expertise are well-positioned to manage IC systems more effectively and efficiently.

Individuals in decision-making or managerial positions hold the ability to influence a firm's operating systems. Accordingly, when an IC manager possesses extensive cumulative career experience, the effectiveness of the firm's IC is enhanced, which results in more reliable and accurate internal information. Improvements in the quality of internal information facilitate more efficient resource allocation (Francis et al., 2009), which, in turn, boosts a firm's overall efficiency. Firm-specific knowledge and expertise are typically acquired through hands-on experience within the company and specific tasks (Hitt et al., 2001; Kor & Mahoney, 2005; Lazear, 2009). Moreover, the required competencies of IC managers now extend beyond traditional accounting expertise. Ditkaew and Suttipun (2023) demonstrate that audit data analytics adoption substantially improves audit quality and continuity, suggesting that digital fluency has become a core component of effective IC and assurance functions. Supporting this trend, guidance from professional standard-setting bodies, such as the Institute of Internal Auditors (IIA, 2021) and the European Confederation of Institutes of Internal Auditing (Debruyne, 2022), emphasise the growing expectation for internal audit and control functions to incorporate ESG assurance, digital governance, and data analytics capabilities. These evolving expectations necessitate that IC managers possess a broader portfolio of skills encompassing ESG literacy and analytical proficiency. Within this context, cumulative career experience, especially experience that integrates accounting expertise and firm-specific knowledge, is likely to enhance the manager's ability to design and operate effective control systems, thereby improving the firm's operational efficiency.

Research on the effects of IC on a firm's operational efficiency has consistently demonstrated that ineffective ICs are more likely to result in errors in internal management reports, which in turn negatively affect the firm's operational decisions. For instance, Cheng et al. (2018) document that firms with IC material weaknesses exhibit lower operational efficiency, as measured by frontier analysis, compared

to firms without such weaknesses. Their findings reveal that the negative impact of material weaknesses on operational efficiency is more pronounced for firms with a greater demand for high-quality information, more severe weaknesses, and, to some extent, smaller firms. Moreover, their study shows that remediation of material weaknesses leads to improvements in operational efficiency. Similarly, [D. J. Choi et al. \(2021\)](#) affirm that human resource investment in IC, particularly in the IT department, significantly enhances investment efficiency by improving the quality of the firm's information environment. [Shin and Park \(2020\)](#) find that operational efficiency increases when IC managers possess task-related and diverse firm knowledge, consistent with human capital theory. These findings suggest that the establishment and maintenance of effective ICs enhance operational efficiency by improving a firm's internal information environment, which positively influences overall performance and decision-making processes. Given that the quality of IC affects a firm's operational efficiency by improving the internal information environment and that the qualitative aspects of IC managers play a crucial role in determining the standard of ICs, the impact of IC managers' qualitative traits on a firm's operational efficiency is likely to be more pronounced in firms with weaker information environments.

H1. *There is a positive relationship between the cumulative career experience of an IC manager and a firm's efficiency.*

H2. *The positive relationship between the cumulative career experience of an IC manager and a firm's efficiency is more pronounced in weak information environments.*

3 Research design

3.1 Data sources and sample selection

Following the enactment of the SOX Act in the United States, the Financial Supervisory Service (FSS) of Korea revised its accounting regulations. These revisions mandated that listed firms with assets exceeding KRW 50 billion disclose IC information in their annual reports, including material weaknesses.

The reform also led to amendments to the External Audit Act of 2003, which now requires detailed reports on IC personnel, including department names, personnel counts, the presence of Certified Public Accountants, and their average work experience. In addition, the FSS strengthened disclosure requirements by mandating firms to report information about IC managers. Firms must disclose the career information of IC managers, including total firm-specific and accounting-related work experience, as well as the qualifications and procedures for their appointment and dismissal. These enhanced disclosure requirements were designed to encourage firms to appoint IC managers with essential qualifications, including firm-specific knowledge and accounting expertise. The objective was to fortify ICs by ensuring that IC managers possess the necessary skills to effectively oversee these processes.

Korea is the only country that mandates the disclosure of such detailed information on IC personnel. Notably, 2018 marks the first year in which Korean listed firms were required to report detailed information on IC managers, including their personal backgrounds and professional qualifications. As a result, this study meticulously collected data on IC managers from the "Report on the Operation of the IC System," which is included in the annual reports of firms for the years 2018 to 2020. Financial data and employee counts were obtained from the TS2000 and FnGuide databases, which are comparable to Compustat in the United States. After excluding financial firms, due to their unique characteristics, and firms lacking sufficient data, the final sample consisted of 4021 firms. [Table 1](#) provides an overview of the sample selection process and its composition.

3.2 Research model

The primary objective of this study is to examine the effect of IC managers' qualifications on a firm's operational efficiency. Utilising the research methodologies of [Cheng et al. \(2018\)](#) and [Cho et al. \(2015\)](#), this study applies the following model to test the hypothesis. To control for variables known to influence efficiency and firm-level IC characteristics, and to account for the potential impact of COVID-19, a COVID indicator variable is included. The model also incorporates industry and year fixed effects.¹ Detailed descriptions

¹ To determine the appropriate analytical methodology, the Hausman test ([Hausman, 1978](#)) was employed, confirming the fixed-effects model as the most suitable approach for the sample. Given the observed variation in the dependent variable, Efficiency, across industries, an ANOVA test was subsequently conducted to rigorously assess industry-specific differences. Results indicate significant variation in Efficiency between industries ($F = 40.15$, $p = .000$). Additionally, Bartlett's chi-square test yielded a value of 352.03 ($p = .000$), leading to the rejection of the null hypothesis of equal variances across industries. These findings highlight statistically significant differences in Efficiency across industries within the sample, warranting the inclusion of industry fixed effects. Although a random-effects model with industry fixed effects was considered, the short sample period poses limitations under the random-effects assumption, which assumes that variations across observations are random ([Arellano & Carrasco, 2003](#)). Consequently, a pooled OLS model with year and industry fixed

Table 1. Sample selection and distribution of sample.

Panel A. Sample selection process.		
Sample selection process		Obs.
Korean listed firms in 2018 to 2020 (KSE and KOSDAQ)		5158
Less: samples without data to compute operational efficiency variable		175
Less: samples without internal control manager data		562
Less: samples with fewer than 10 observations by industry		83
Less: samples without other financial data		317
Total		4021
Panel B. Composition of sample by year.		
Year	Obs.	%
2018	1260	31.34%
2019	1346	33.47%
2020	1415	35.19%
Total	4021	100.00%

of all variables are provided in [Appendix A](#).

$$\begin{aligned} \text{Efficiency}_t = & \beta_0 + \beta_1 \text{ICAE}_t + \beta_2 \text{ICFE}_t + \beta_3 \text{SIZE}_t + \beta_4 \text{LEV}_t \\ & + \beta_5 \text{AGE}_t + \beta_6 \text{FCF}_t + \beta_7 \text{FOR}_t + \beta_8 \text{MS}_t \\ & + \beta_9 \text{LARGE}_t + \beta_{10} \text{OUT}_t + \beta_{11} \text{ROA}_t \\ & + \beta_{12} \text{MB}_t + \beta_{13} \text{KSE}_t + \beta_{14} \text{COVID}_t \\ & + \sum \text{IND} + \sum \text{YEAR} + \varepsilon_t \end{aligned} \quad (1)$$

$$\begin{aligned} \text{Efficiency}_t = & \beta_0 + \beta_1 \text{ICAE}_t + \beta_2 \text{ICFE}_t + \beta_3 \text{INFO}_t + \beta_4 \text{SIZE}_t \\ & + \beta_5 \text{LEV}_t + \beta_6 \text{AGE}_t + \beta_7 \text{FCF}_t + \beta_8 \text{FOR}_t \\ & + \beta_9 \text{MS}_t + \beta_{10} \text{LARGE}_t + \beta_{11} \text{OUT}_t \\ & + \beta_{12} \text{ROA}_t + \beta_{13} \text{MB}_t + \beta_{14} \text{KSE}_t \\ & + \beta_{15} \text{COVID}_t + \sum \text{IND} + \sum \text{YEAR} + \varepsilon_t \end{aligned} \quad (2)$$

The dependent variable, Efficiency, represents a firm's relative operational efficiency. This study conceptualises operational efficiency as a firm's ability to convert corporate resources into revenue, based on the definition provided by [Demerjian et al. \(2012\)](#). In alignment with [Demerjian et al. \(2012\)](#), operational efficiency is measured using DEA, a widely applied technique for assessing the relative efficiency of decision-making units (DMUs), with each firm treated as an individual DMU. Efficiency score in the DEA model is calculated as the ratio of output to input. This study employs an input-oriented DEA under the assumption of constant returns to scale (CRS), reflecting that managers primarily control input levels and that firms are assumed to operate at a constant scale within the same industry and year. Consistent

with the methodologies of [Demerjian et al. \(2012\)](#) and [Cheng et al. \(2018\)](#), this study uses sales revenue as the output variable. The input variables include the cost of goods sold, selling, general, and administrative expenses, net property, plant, and equipment, right-of-use assets, and intangible assets, including research and development (R&D) and goodwill.

To examine how the experience of IC managers influences a firm's operational efficiency, this study utilises manually collected data on IC managers, sourced from the "Report on the Operation of the IC System," which has been included in firms' annual reports since 2018. The IC managers' total accounting-related expertise (ICAE) is measured by their cumulative working experience in months. The current firm-related experience (ICFE), also measured in months, captures their firm-specific knowledge. [Appendix A](#) provides detailed descriptions of each variable.

This study accounts for factors that may affect corporate operational efficiency and the qualifications of IC managers. Furthermore, to address potential sample selection bias associated with focusing on firms that disclose IC manager information and preliminary earnings data, the inverse Mills ratio was calculated and incorporated as a control variable.

4 Results

4.1 Main analysis

[Table 2](#) presents the descriptive statistics for each variable. In this study, outliers for all variables are winsorised at the 1% level on both tails. The average Efficiency score is .7927. The mean values for ICAE

Table 2. Descriptive statistics.

Variables	N	Mean	Median	Max	Min	SD
Efficiency	4021	.7927	.7913	1.0000	.3732	0.0613
ICAE	4021	5.1286	5.4381	6.1485	2.4849	0.8845
ICFE	4021	4.6302	5.0499	6.1485	0.6931	1.2158
INFO	4021	.7272	1.0000	1.0000	.0000	0.4455
SIZE	4021	19.2973	19.0633	23.4751	16.3673	1.3584
LEV	4021	.3681	.3666	.9260	.0269	0.2046
AGE	4021	31.2863	26.0000	78.0000	3.0000	17.6377
FCF	4021	.5750	1.0000	1.0000	.0000	0.4944
FOR	4021	.5262	1.0000	1.0000	.0000	0.4994
MS	4021	.0290	.0042	.4681	.0000	0.0721
LARGE	4021	.2833	.2549	.7768	.0499	0.1456
OUT	4021	.2440	.2500	.6667	.0000	0.1613
ROA	4021	.0022	.0189	.3700	–.6136	0.1264
MB	4021	1.9271	1.2472	13.6117	0.2917	2.1136
KSE	4021	.3949	.0000	1.0000	.0000	0.4889
COVID	4021	.3519	.0000	1.0000	.0000	0.4776
IMR	4021	.2760	.2669	.9407	.0003	0.1495

Note. (1) All continuous variables are winsorised at the 1% level. (2) Variable definitions are presented in [Appendix A](#).

and ICFE, the key variables of interest, are 5.1286 and 4.6302, respectively. These values indicate that, before the natural logarithm was applied, IC managers had an average of 168.78 months of accounting-specific work experience and 102.53 months of tenure within the firm.

[Table 3](#) presents the Pearson correlation coefficients. The results indicate that Efficiency is significantly and positively correlated with both ICAE and ICFE, which capture the IC manager's experience. Additionally, larger firm size (SIZE), older firm age (AGE), and higher free cash flow (FCF) are all positively correlated with increased efficiency, which aligns with previous research on operational efficiency. The INFO variable, representing the firm's information environment, does not exhibit a significant relationship with either the dependent variable, Efficiency, or the independent variables, ICAE and ICFE. This suggests that the firm's information environment alone does not significantly impact its efficiency or the IC manager's experience. However, as shown in the empirical analysis in [Section 4](#), the information environment exerts a differential effect on the relationship between a firm's efficiency and the IC manager's experience.

[Table 4](#) illustrates the direct relationship between IC managers' experience and a firm's operational efficiency, analysed using the ICAE and ICFE variables. The results indicate that both qualitative aspects of IC managers' careers, accounting-specific expertise (.0025, $t = 2.85$) and firm-specific working experience (.0021, $t = 3.20$), are significantly and positively associated with operational efficiency. Specifically, increasing ICAE from the 25th percentile value of 4.828 to the 75th percentile value of 5.743 is associ-

ated with an estimated .0023 increase in Efficiency. Similarly, increasing ICFE from the 25th percentile value of 3.871 to the 75th percentile value of 5.617 corresponds to an estimated 0.0037 increase in Efficiency. These findings suggest that IC managers with extensive accounting-related expertise and cumulative firm-specific knowledge significantly enhance a firm's operational efficiency.

Further analysis was conducted to verify the argument that higher-quality IC managers enhance a firm's operational efficiency by improving the internal information environment through robust ICs. This study incorporates an interaction term between the variables of interest (ICAE and ICFE) and INFO, an indicator variable. INFO was assigned a value of 1 if the discrepancy between preliminary and actual earnings was below the industry average, and 0 otherwise. A value of 1 for INFO signifies a superior internal information environment.

The literature underscores that the accuracy of earnings forecasts and preliminary earnings is positively correlated with the quality of internal information ([Clinton et al., 2014](#); [Feng et al., 2009](#)). Consequently, if high-quality IC managers play a critical role in enhancing a firm's operational efficiency through improvements in internal information, the positive impact of their cumulative career experience on firm efficiency is expected to be more pronounced in environments where the firm's information quality is comparatively suboptimal.

[Table 5](#) shows that the coefficients of the interaction terms between the variables of interest (ICAE and ICFE) and INFO are $-.0046$ ($t = -2.35$) and $-.0040$ ($t = -2.80$), respectively, both of which are

Table 3. Pearson correlations.

	Efficiency	ICAE	ICFE	INFO	SIZE	LEV	AGE	FCF	FOR	MS	LARGE	OUT	ROA	MB	KSE	COVID	IMR
Efficiency	1.000																
ICAE	.018 (.250)	1.000															
ICFE	.123 (.000)	.172 (.000)	1.000														
INFO	.027 (.091)	-.004 (.821)	.011 (.492)	1.000													
SIZE	.063 (.000)	.000 (.981)	.123 (.000)	.135 (.000)	1.000												
LEV	.050 (.002)	-.017 (.296)	.000 (.276)	.004 (.800)	.162 (.000)	1.000											
AGE	.185 (.000)	.043 (.006)	.225 (.000)	.011 (.481)	.193 (.000)	.033 (.035)	1.000										
FCF	.117 (.000)	.001 (.941)	.073 (.000)	-.014 (.381)	.096 (.000)	-.102 (.000)	.036 (.021)	1.000									
FOR	.043 (.007)	.010 (.511)	.059 (.000)	-.006 (.685)	.037 (.020)	.046 (.004)	.044 (.005)	.022 (.173)	1.000								
MS	-.003 (.847)	-.048 (.002)	.052 (.001)	.021 (.181)	.535 (.000)	.134 (.000)	.094 (.000)	.043 (.007)	.052 (.001)	1.000							
LARGE	.105 (.000)	-.071 (.000)	-.027 (.091)	.067 (.000)	.163 (.000)	-.056 (.000)	-.097 (.000)	.059 (.000)	.003 (.853)	.085 (.000)	1.000						
OUT	.024 (.133)	-.022 (.161)	-.020 (.210)	-.008 (.626)	-.049 (.002)	.035 (.028)	.027 (.091)	-.011 (.491)	-.021 (.195)	-.005 (.745)	-.034 (.031)	1.000					
ROA	.288 (.000)	.017 (.274)	.128 (.000)	.077 (.000)	.219 (.000)	-.288 (.000)	.014 (.375)	.148 (.000)	.034 (.030)	.085 (.000)	.179 (.000)	-.034 (.033)	1.000				
MB	-.295 (.000)	.025 (.114)	-.156 (.000)	-.050 (.002)	-.201 (.000)	.101 (.000)	-.202 (.000)	-.114 (.000)	-.021 (.182)	-.056 (.000)	-.119 (.000)	.056 (.000)	-.237 (.000)	1.000			
KSE	.104 (.000)	-.024 (.127)	.129 (.000)	.038 (.016)	.590 (.000)	.117 (.000)	.329 (.000)	.080 (.000)	-.006 (.714)	.291 (.000)	.132 (.000)	-.054 (.001)	.063 (.000)	-.178 (.000)	1.000		
COVID	-.100 (.000)	.021 (.180)	-.025 (.107)	.014 (.372)	.000 (.998)	.002 (.885)	.014 (.384)	-.015 (.330)	-.016 (.302)	-.010 (.522)	-.002 (.885)	-.010 (.526)	-.035 (.028)	.136 (.000)	-.025 (.108)	1.000	
IMR	-.003 (.862)	-.020 (.214)	-.082 (.000)	-.137 (.000)	-.877 (.000)	-.142 (.000)	-.124 (.000)	-.066 (.000)	-.008 (.608)	-.373 (.000)	-.125 (.000)	-.090 (.000)	-.190 (.000)	.163 (.000)	-.314 (.000)	-.026 (.099)	1.000

Note. (1) The number in parentheses is the *p* value. (2) All continuous variables are winsorised at a 1% level. (3) Variable definitions are presented in [Appendix A](#).

Table 4. Effect of cumulative career experience of IC managers on firms' operational efficiency.

	Dependent variable: Efficiency			
	(1)		(2)	
	Coeff.	t	Coeff.	t
ICAE	.0025	2.85***		
ICFE			.0021	3.20***
SIZE	.0140	6.20***	.0139	6.17***
LEV	.0113	2.64***	.0113	2.65***
AGE	.0002	4.06***	.0002	3.72***
FCF	.0080	4.99***	.0078	4.87***
FOR	.0017	1.05	.0014	0.91
MS	−.1036	−5.97***	−.1055	−6.08***
LARGE	.0376	6.65***	.0377	6.68***
OUT	.0271	5.18***	.0268	5.11***
ROA	.0291	10.02***	.0290	9.98***
MB	−.0031	−7.20***	−.0030	−6.91***
KSE	−.0109	−3.97***	−.0110	−3.99***
COVID	−.0082	−4.27***	−.0081	−4.19***
IMR	.1333	8.54***	.1320	8.45***
Constant	.5136	10.87***	.5198	11.05***
Industry and year FE	Included		Included	
# Obs.	4021		4021	
Adj. R ²	.3652		.3655	

Note. (1) All continuous variables are winsorised at the 1% level. (2) Variable definitions are presented in [Appendix A](#).

* $p < .1$. ** $p < .05$. *** $p < .01$.

statistically significant and negative. These results suggest that the positive impact of IC managers' cumulative career experience on a firm's efficiency is more pronounced in environments where the information quality is lower.

4.2 Robustness test

Given the revision of the lease accounting standard in 2019, consistent comparisons across years, particularly involving 2018, may be limited. To mitigate this concern, the main analysis computed operational efficiency on a year-by-year basis. Nevertheless, to further alleviate concerns about comparability, we conducted an additional analysis using only the post adoption period of 2019 and 2020, based on a subsample of 2,456 firm-year observations. In [Table 6](#), Columns (1) and (2) address [Hypothesis 1](#), while Columns (3) and (4) relate to [Hypothesis 2](#). The results remain consistent with the main analysis.²

To address potential concerns about omitted variable bias, this study employed a two-stage least

Table 5. Effect of cumulative career experience of IC managers on firms' operational efficiency in different information environments.

	Dependent variable: Efficiency			
	(1)		(2)	
	Coeff.	t	Coeff.	t
ICAE	.0059	3.51***		
INFO	.0275	2.67***		
ICAE*INFO	−.0046	−2.35**		
ICFE			.0051	4.08***
INFO			.0222	3.22***
ICFE*INFO			−.0040	−2.80***
SIZE	.0137	6.10***	.0137	6.08***
LEV	.0112	2.62***	.0119	2.78***
AGE	.0002	4.02***	.0002	3.74***
FCF	.0080	5.01***	.0078	4.84***
FOR	.0017	1.08	.0015	0.93
MS	−.1050	−6.05***	−.1058	−6.11***
LARGE	.0367	6.49***	.0362	6.39***
OUT	.0267	5.10***	.0268	5.12***
ROA	.0291	10.03***	.0291	10.03***
MB	−.0031	−7.09***	−.0029	−6.75***
KSE	−.0108	−3.90***	−.0107	−3.90***
COVID	−.0082	−4.29***	−.0081	−4.23***
IMR	.1333	8.54***	.1331	8.53***
Constant	.4991	10.47***	.5069	10.72***
Industry and year FE	Included		Included	
# Obs.	4021		4021	
Adj. R ²	.3664		.3671	

Note. (1) All continuous variables are winsorised at the 1% level.

(2) Variable definitions are presented in [Appendix A](#).

* $p < .1$. ** $p < .05$. *** $p < .01$.

squares (2SLS) procedure to mitigate endogeneity issues. In the 2SLS approach, the average wage of employees and total sales were used as instrumental variables for the cumulative career experience of IC managers, based on established literature. [Wagner \(2012\)](#) identifies the average wage of employees as a suitable proxy for the qualification of human capital within a firm, while [Antoncic and Antoncic \(2011\)](#) find a significant association between employee tenure, loyalty, and firm growth, as measured by total sales.

Additionally, the validity of these instrumental variables was supported by the Sargan test, which failed to reject the null hypothesis of no correlation with the error term in the main regression, indicating their appropriateness.³ The results in [Table 7](#), which present the second-stage findings of the 2SLS using the fitted values of ICAE and ICFE, are qualitatively consistent with the primary analysis. This consistency

² To account for the potential effects of the lease accounting standard revision, we tested our main hypothesis using alternative specifications of the efficiency measure, including industry-year-based efficiency with lease assets, industry-year-based efficiency without lease assets, and year-based efficiency without lease assets. Results in [Appendix B](#) reveal no material differences from the main findings.

³ In the first-stage regressions, the instrumental variables, average wage of employees and total sales, yielded coefficients of −.122 and .065 for ICAE, and −.091 and .105 for ICFE, respectively. The first-stage F statistic of 10.75 (ICAE) and 15.09 (ICFE), along with the Sargan test results in [Table 7](#), support the validity of the instruments.

Table 6. Subsample analysis for the post-2019 period.

	Dependent variable: Efficiency							
	(1)		(2)		(3)		(4)	
	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t
ICAE	.0025	2.22**			.0079	3.67 ***		
INFO					.0417	3.19***		
ICAE*INFO					−.0073	−2.92***		
ICFE			.0026	3.13***			.0058	3.70 ***
INFO							.0240	2.78***
ICFE*INFO							−.0044	−2.42**
SIZE	.0162	5.80***	.0159	5.72***	.0159	5.70 ***	.0156	5.61 ***
LEV	.0100	1.91*	.0101	1.93*	.0101	1.94*	.0107	2.05**
AGE	.0002	3.70***	.0002	3.34***	.0002	3.55 ***	.0002	3.33 ***
FCF	.0078	3.92***	.0075	3.79***	.0078	3.92 ***	.0075	3.78 ***
FOR	.0014	.74	.0011	0.58	.0015	.78	.0011	0.56
MS	−.1074	−4.95***	−.1087	−5.02***	−.1103	−5.09 ***	−.1082	−5.00 ***
LARGE	.0393	5.62***	.0395	5.65***	.0386	5.52 ***	.0378	5.40 ***
OUT	.0214	3.34***	.0211	3.29***	.0210	3.28 ***	.0211	3.29 ***
ROA	.0258	8.37***	.0257	8.34***	.0258	8.39 ***	.0260	8.42 ***
MB	−.0027	−5.28***	−.0026	−5.00***	−.0027	−5.19 ***	−.0025	−4.83 ***
KSE	−.0122	−3.57 ***	−.0121	−3.56***	−.0119	−3.49 ***	−.0119	−3.48 ***
COVID	−.0104	−5.38***	−.0103	−5.33***	−.0103	−5.35 ***	−.0104	−5.40 ***
IMR	.1449	7.45***	.1423	7.32***	.1445	7.44 ***	.1431	7.37 ***
Constant	.4725	8.07***	.4796	8.23***	.4474	7.56 ***	.4668	7.98 ***
Industry and year FE	Included		Included		Included		Included	
# Obs.	2761		2761		2761		2761	
Adj. R ²	.3575		.3587		.3598		.3603	

Note. (1) All continuous variables are winsorised at the 1% level. (2) Variable definitions are presented in [Appendix A](#).

* $p < .1$. ** $p < .05$. *** $p < .01$.

supports the main argument and suggests that endogeneity does not significantly compromise the validity of the results.⁴

In addition, this study utilised the system generalised method of moments (system GMM; [Arellano & Bond, 1991](#); [Blundell & Bond, 1998](#)) to effectively address endogeneity in panel data and ensure consistent estimates. By incorporating the lagged dependent variable (LagEfficiency) as an instrument, a two-step estimation approach was employed to generate the results. The findings are detailed in [Table 8](#) and exhibit consistency with prior analyses. Additionally, the Hansen J test produced a p value above .05, thereby validating the exogeneity of the instrumental variables.

4.3 Additional test

This study conducts an additional analysis using ROA as a simpler and more general performance measure, rather than operational efficiency, to assess the impact of an IC manager's cumulative career experience from various perspectives. As shown in

Columns (1) and (2) of [Table 9](#), the results indicate that while ICAE does not significantly affect ROA, ICFE has a significant positive impact on ROA (.0093, $t = 6.14$). Furthermore, in Column (4), the ICFE*INFO variable shows a significant negative effect (−.0083, $t = -2.58$), suggesting that the less favourable the company's information environment, the more the IC manager's experience contributes to improving ROA. These findings suggest that the accumulated experience of IC managers within a specific company is more effective in enhancing ROA, as ROA, calculated by dividing net income by total assets, captures the unique characteristics of each company more strongly than relative operational efficiency. The results also indicate that this effect becomes more pronounced when the company's information environment is weaker.

5 Discussion

This study investigates the role of IC managers' cumulative career experience in enhancing firm-level operational efficiency, drawing on human capital

⁴ Since the dependent variable, Efficiency, is bounded between 0 and 1, marginal effects may diminish near the boundaries, leading to attenuated OLS estimates. 2SLS mitigates this issue and corrects for potential measurement error, which may explain the larger coefficients observed under 2SLS compared to OLS.

Table 7. Effect of cumulative career experience of IC managers on firms' operational efficiency: two-stage least squares regressions.

	Dependent variable: Efficiency			
	(1)		(2)	
	Coeff.	z	Coeff.	z
ICAE_fitted	.3055	3.34***		
ICFE_fitted			.1719	4.97***
SIZE	-.0032	-0.24	-.0017	-0.18
LEV	.0537	2.03**	.0430	2.31**
AGE	-.0005	-1.29	-.0016	-3.70***
FCF	.0067	0.76	-.0089	-1.20
FOR	.0004	0.05	-.0178	-2.33**
MS	.1871	1.52	-.0881	-1.26
LARGE	.1546	3.32***	.1229	4.27***
OUT	.0725	2.28**	.0299	1.39
ROA	.0260	1.64	.0160	1.31
MB	-.0059	-2.39**	.0049	2.03**
KSE	.0162	0.95	.0014	0.12
COVID	-.0180	-1.65*	-.0033	-0.42
IMR	.1639	1.91*	.0559	0.85
Constant	-.9188	-1.91*	-.0562	-0.26
Industry and year FE	Included		Included	
# Obs.	4021		4021	
Sargan test (p value)	.0705		.4098	

Note. (1) All continuous variables are winsorised at the 1% level. (2) Variable definitions are presented in [Appendix A](#).

* $p < .1$. ** $p < .05$. *** $p < .01$.

theory and leveraging DEA as the primary efficiency measure. To ensure robustness and mitigate potential endogeneity concerns, the empirical analysis incorporates alternative estimation methods, including 2SLS and the system GMM approach. The findings across these methodologies are consistent and mutually reinforcing, offering theoretical and practical implications.

First, the DEA-based efficiency scores reveal a positive and statistically significant association between IC managers' experience and firm operational efficiency. This supports the premise that experienced managers, through accumulated firm-specific knowledge and functional expertise, improve IC quality, which in turn strengthens the internal information environment and facilitates more effective resource utilisation. The association is particularly pronounced in firms operating in weaker information environments, as evidenced by the significant interaction terms ([Table 5](#)), affirming that managerial experience is more valuable where internal processes are more vulnerable to informational frictions.

The 2SLS analysis, which addresses potential omitted variable bias, yields coefficient estimates that are directionally and statistically consistent with the main DEA results. Similarly, the system GMM approach, which offers further control over endogeneity by modelling the unobserved heterogeneity, confirms the main findings. The convergence of results across

Table 8. Effect of cumulative career experience of IC managers on firms' operational efficiency: system GMM (generalised method of moments).

	Dependent variable: Efficiency			
	(1)		(2)	
	Coeff.	z	Coeff.	z
ICAE	.0026	2.44**		
ICFE			.0117	2.11**
LagEfficiency	.2940	2.19**	.2410	1.81*
SIZE	.0129	3.31***	.0125	3.07***
LEV	.0126	2.16**	.0138	2.22**
AGE	.0001	2.14**	.0000	0.48
FCF	.0027	2.07**	.0025	1.77*
FOR	.0002	0.13	-.0012	-0.55
MS	-.0710	-2.80***	-.0789	-2.78***
LARGE	.0231	3.00***	.0289	3.16***
OUT	.0183	2.95***	.0198	2.85***
ROA	.0611	5.51***	.0553	4.90***
MB	-.0007	-1.34	-.0004	-0.69
KSE	-.0100	-2.36**	-.0099	-2.20**
COVID	-.0102	-10.10***	-.0097	-8.68***
IMR	.1276	4.59***	.1224	4.20***
Constant	.2519	2.02**	0.2642	2.27**
Industry and year FE	Included		Included	
# of Obs.	2450		2450	
Hansen J test (p value)	.8970		.8450	

Note. (1) All continuous variables are winsorised at the 1% level. (2) Applying the system GMM method reduces the final sample size due to the exclusion of certain observations.

* $p < .1$. ** $p < .05$. *** $p < .01$.

these empirical strategies, including DEA, 2SLS, and system GMM, strengthens the validity of the study and reinforces confidence in the interpretation of the relationship between IC manager experience and firm efficiency.

Beyond statistical robustness, these findings contribute to human capital and IC literature by updating the theoretical framing in light of evolving expectations for IC personnel. As the role of IC expands to encompass ESG reporting, digital audit tools, and data governance, the evidence supports a broader conceptualisation of human capital, one that incorporates not just traditional accounting knowledge but also adaptability to new regulatory and technological demands. The observed effects in the study are consistent with recent literature that highlights the strategic role of IC professionals in navigating post-SOX governance challenges and ESG accountability.

Practically, the findings carry meaningful implications for corporate governance and talent management. Boards and audit committees may consider placing greater emphasis on the depth and breadth of IC managers' professional backgrounds, particularly in firms facing complex operational environments or operating under weak information environments. Regulatory bodies may also benefit from recognising the strategic value of IC personnel disclosures

Table 9. Effect of cumulative career experience of IC managers on firms' ROA.

	Dependent variable: ROA							
	(1)		(2)		(3)		(4)	
	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t
ICAE	.0022	1.11			.0018	0.46		
INFO					.0073	0.32		
ICAE*INFO					.0007	0.16		
ICFE			.0093	6.14***			.0153	5.47***
INFO							.0494	3.19***
ICFE*INFO							-.0083	-2.58***
SIZE	.0473	9.32***	.0466	9.22***	.0468	9.22***	.0460	9.10***
LEV	-.1875	-19.66***	-.1859	-19.58***	-.1875	-19.67***	-.1849	-19.49***
AGE	-.0001	-0.56	-.0002	-1.31	-.0001	-0.57	-.0002	-1.30
FCF	.0171	4.72***	.0161	4.48***	.0174	4.81***	.0162	4.49***
FOR	0.0059	1.65*	.0049	1.36	.0060	1.67*	.0050	1.39
MS	-.1556	-3.97***	-.1569	-4.02***	-.1573	-4.01***	-.1582	-4.06***
LARGE	.0878	6.88***	.0915	7.21***	.0857	6.70***	.0877	6.89***
OUT	.0104	0.88	.0103	0.87	.0105	0.89	.0102	0.87
MB	-.0074	-7.59***	-.0069	-7.13***	-.0073	-7.52***	-.0067	-6.97***
KSE	-.0424	-6.82***	-.0419	-6.77***	-.0421	-6.77***	-.0413	-6.68***
COVID	-.0094	-2.16**	-.0090	-2.09**	-.0095	-2.19**	-.0092	-2.14**
IMR	.1283	3.64***	.1240	3.53***	.1295	3.67***	.1266	3.61***
Constant	-.8376	-7.85***	-.8526	-8.06***	-.8311	-7.72***	-.8782	-8.26***
Industry and year FE	Included		Included		Included		Included	
# Obs.	4021		4021		4021		4021	
Adj. R ²	.2370		.2440		.2381		.2463	

Note. (1) All continuous variables are winsorised at the 1% level. (2) Variable definitions are presented in Appendix A.

* $p < .1$. ** $p < .05$. *** $p < .01$.

in strengthening transparency and accountability frameworks.

In summary, the integration of DEA-based efficiency measures with several empirical analyses provides evidence that experienced IC managers serve as a key intangible asset, directly contributing to the firm's operational excellence. The findings offer valuable practical implications for key stakeholders, including investors, board members, and regulatory authorities, by highlighting the strategic importance of experienced IC managers in enhancing firm efficiency. Moreover, the results provide firms with actionable evidence that effective oversight and management of IC personnel can yield tangible operational benefits.

6 Conclusion

This study investigates the extent to which the cumulative career experience of IC managers affects firms' operational efficiency. While IC quality has long been recognised as essential for enhancing the reliability of internal information and supporting effective decision making, relatively little attention has been given to the specific human capital characteristics of the personnel responsible for designing and implementing these systems. By focusing on IC

managers, this study fills an important gap in the literature and provides evidence on how managerial experience, particularly firm-specific knowledge and accounting-related expertise, can improve firm-level efficiency outcomes.

The results find that IC managers' cumulative career experience is positively associated with firm efficiency. The findings remain robust across various empirical specifications, including 2SLS and system GMM models, which address concerns related to endogeneity. Additionally, the effect is significantly stronger in firms with weaker information environments, suggesting that managerial experience plays an especially vital role in contexts where the IC system must compensate for poor external or internal informational clarity.

This study leverages a unique institutional setting, South Korea's mandated disclosure of IC manager qualifications, to provide evidence that would be difficult to obtain in other jurisdictions. This enhances the external validity of the findings while also suggesting policy implications for regulators in other countries. The positive association between IC managers' experience and operational efficiency lends support to initiatives encouraging firms to formalise IC roles and ensure that such positions are filled by qualified personnel.

Moreover, robustness tests, including adjustments for the COVID-19 shock and accounting standard revisions, indicate that the results are both statistically and economically significant, validating the robustness of the results. Nonetheless, future research could benefit from longer panels, broader cross-country comparisons, or more granular categorisations of experience, such as digital fluency or ESG-related expertise.

In sum, this study offers new empirical evidence that the career attributes of IC managers materially affect operational efficiency, particularly in environments where information asymmetry poses a risk. These findings underscore the strategic relevance of human capital in IC functions and open several pathways for future research in accounting, governance, and performance management.

Conflicts of interest

The authors declare that they have no known competing financial interests or personal relationships.

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Data availability statement

Data is available at request. Please contact the corresponding author for any additional information on data access or usage.

References

- Agyei-Owusu, B., Asamoah, D., Nuerter, D., & Acquah, I. N. (2022). Examining the relationship between dimensions of supply chain integration, operational performance and firm performance: Evidence from Ghana. *Management Research Review*, 45(12), 1644–1669. <https://doi.org/10.1108/MRR-06-2021-0464>
- Aier, J. K., Comprix, J., Gunlock, M. T., & Lee, D. (2005). The financial expertise of CFOs and accounting restatements. *Accounting Horizons*, 19(3), 123–135. <https://doi.org/10.2308/acch.2005.19.3.123>
- Al Doghan, M. A., & Sundram, V. P. K. (2023). Organization operational efficiency and Innovativeness: Exploring the role of employees' task-based training, operational task commitment, operational engagement, and supervisor support. *International Journal of Operations and Quantitative Management*, 29(1), 108–127.
- Antonic, J. A., & Antonic, B. (2011). Employee loyalty and its impact on firm growth. *International Journal of Management & Information Systems*, 15(1), 81–88. <https://doi.org/10.19030/ijmis.v15i1.1598>
- Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58(2), 277–297. <https://doi.org/10.2307/2297968>
- Arellano, M., & Carrasco, R. (2003). Binary choice panel data models with predetermined variables. *Journal of Econometrics*, 115(1), 125–157. [https://doi.org/10.1016/S0304-4076\(03\)00095-2](https://doi.org/10.1016/S0304-4076(03)00095-2)
- Ashbaugh-Skaife, H., Collins, D. W., & Kinney Jr, W. R. (2007). The discovery and reporting of internal control deficiencies prior to SOX-mandated audits. *Journal of Accounting and Economics*, 44(1–2), 166–192. <https://doi.org/10.1016/j.jacceco.2006.10.001>
- Ashbaugh-Skaife, H., Collins, D. W., Kinney Jr, W. R., & LaFond, R. (2008). The effect of SOX internal control deficiencies and their remediation on accrual quality. *The Accounting Review*, 83(1), 217–250. <https://doi.org/10.2308/accr.2008.83.1.217>
- Baik, B., Chae, J., Choi, S., & Farber, D. B. (2013). Changes in operational efficiency and firm performance: A frontier analysis approach. *Contemporary Accounting Research*, 30(3), 996–1026. <https://doi.org/10.1111/j.1911-3846.2012.01179.x>
- Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), 115–143. [https://doi.org/10.1016/S0304-4076\(98\)00009-8](https://doi.org/10.1016/S0304-4076(98)00009-8)
- Chalmers, K., Hay, D., & Khelif, H. (2019). Internal control in accounting research: A review. *Journal of Accounting Literature*, 42, 80–103. <https://doi.org/10.1016/j.jacclit.2018.03.002>
- Cheng, Q., Goh, B. W., & Kim, J. B. (2018). Internal control and operating efficiency. *Contemporary Accounting Research*, 35(2), 1102–1139. <https://doi.org/10.1111/1911-3846.12409>
- Cho, M. K., Lee, H. Y., & Park, H. Y. (2015). Characteristics of statutory internal auditors and operating efficiency. *Managerial Auditing Journal*, 30(4–5), 456–481. <https://doi.org/10.1108/MAJ-05-2014-1037>
- Choi, D. J., Lee, H. S., Lee, H. Y., & Park, H. Y. (2021). The association between human resource investment in IT controls over financial reporting and investment efficiency. *International Journal of Accounting Information Systems*, 43, Article 100534. <https://doi.org/10.1016/j.accinf.2021.100534>
- Choi, J. H., Choi, S., Hogan, C. E., & Lee, J. (2013). The effect of human resource investment in internal control on the disclosure of internal control weaknesses. *Auditing: A Journal of Practice & Theory*, 32(4), 169–199. <https://doi.org/10.2308/ajpt-50514>
- Clinton, S. B., Pinello, A. S., & Skaife, H. A. (2014). The implications of ineffective internal control and SOX 404 reporting for financial analysts. *Journal of Accounting and Public Policy*, 33(4), 303–327. <https://doi.org/10.1016/j.jaccpubpol.2014.04.005>
- Coff, R. W. (1997). Human assets and management dilemmas: Coping with hazards on the road to resource-based theory. *The Academy of Management Review*, 22(2), 374–402. <https://doi.org/10.2307/259327>
- Cohen, W. M., & Levinthal, D. A. (1989). Innovation and learning: The two faces of R&D. *The Economic Journal*, 99(397), 569–596. <https://doi.org/10.2307/2233763>
- Deb, P., Naskar, S., Devaraj, S., & Basu, P. (2023). Impact of working capital on firm performance: Does IT matter? *Journal of Operations Management*, 69(6), 983–1007. <https://doi.org/10.1002/joom.1244>
- Debruyne, D. (2022). ESG - sustainability: A risk or an opportunity for Internal Audit? European Confederation of Institutes of Internal Auditing. <https://theiia.se/wp-content/uploads/2022/07/ESG-sustainability-a-risk-or-an-opportunity-for-Internal-Audit-10.pdf>
- Demerjian, P., Lev, B., & McVay, S. (2012). Quantifying managerial ability: A new measure and validity tests. *Management Science*, 58(7), 229–248. <https://doi.org/10.1287/mnsc.1110.1487>
- Derouiche, I., Manita, R., & Muessig, A. (2021). Risk disclosure and firm operational efficiency. *Annals of Operations Research*, 297(1–2), 115–145. <https://doi.org/10.1007/s10479-020-03520-z>
- Ditkaew, K., & Suttipun, M. (2023). The impact of audit data analytics on audit quality and audit review continuity in Thailand. *Asian Journal of Accounting Research*, 8(3), 269–278. <https://doi.org/10.1108/AJAR-04-2022-0114>
- Ensari, M. S. (2018). Competitive dynamics in Turkey. In S. Ozturkcan & E. Yolbulan Okan (Eds.), *Marketing Management in Turkey* (pp. 165–198). Emerald Publishing. <https://doi.org/10.1108/978-1-78714-557-320181013>
- Faleye, O., Reis, E., & Venkateswaran, A. (2013). The determinants and effects of CEO–employee pay ratios. *Journal of Banking*

- & Finance, 37(8), 3258–3272. <https://doi.org/10.1016/j.jbankfin.2013.03.003>
- Feng, M., Li, C., & McVay, S. (2009). Internal control and management guidance. *Journal of Accounting Economics*, 48(2–3), 190–209. <https://doi.org/10.1016/j.jacceco.2009.09.004>
- Feng, M., Li, C., McVay, S. E., & Skaife, H. (2015). Does ineffective internal control over financial reporting affect a firm's operation? Evidence from firms' inventory management. *The Accounting Review*, 90(2), 529–557. <https://doi.org/10.2308/accr-50909>
- Francis, J. R., Huang, S., Khurana, I. K., & Pereira, R. (2009). Does corporate transparency contribute to efficient resource allocation? *Journal of Accounting Research*, 47(4), 943–989. <https://doi.org/10.1111/j.1475-679X.2009.00340.x>
- Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17(S2), 109–122. <https://doi.org/10.1002/smj.4250171110>
- Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica: Journal of the Econometric Society*, 1251–1271. <https://doi.org/10.2307/1913827>
- Hitt, M. A., Bierman, L., Shimizu, K., & Kochhar, R. (2001). Direct and moderating effects of human capital on strategy and performance in professional service firms: A resource-based perspective. *The Academy of Management Journal*, 44(1), 13–28.
- The Institute of Internal Auditors. (2021). *Internal audit's role in ESG reporting*. <https://www.theiia.org/globalassets/documents/communications/2021/june/white-paper-internal-audits-role-in-esg-reporting.pdf>
- Kor, Y. Y., & Mahoney, J. T. (2005). How dynamics, management, and governance of resource deployments influence firm-level performance. *Strategic Management Journal*, 26(5), 489–496. <https://doi.org/10.1002/smj.459>
- Krishnan, J. (2005). Audit committee quality and internal control: An empirical analysis. *The Accounting Review*, 80(2), 649–675. <https://doi.org/10.2308/accr.2005.80.2.649>
- Kulkarni, S., Verma, P., & Mukundan, R. (2019). Assessing manufacturing strategy definitions utilising text-mining. *International Journal of Production Research*, 57(14), 4519–4546. <https://doi.org/10.1080/00207543.2018.1512764>
- Lawson, B. P., Muriel, L., & Sanders, P. R. (2017). A survey on firms' implementation of COSO's 2013 Internal Control-Integrated Framework. *Research in Accounting Regulation*, 29(1), 30–43. <https://doi.org/10.1016/j.racreg.2017.04.004>
- Lazear, E. (2009). Firm-specific human capital: A skill-weighted approach. *Journal of Political Economy*, 117(5), 914–940. <https://doi.org/10.1086/648671>
- Li, C., Sun, L., & Ettredge, M. (2010). Financial executive qualifications, financial executive turnover, and adverse SOX 404 opinions. *Journal of Accounting Economics*, 50(1), 93–110. <https://doi.org/10.1016/j.jacceco.2010.01.003>
- Feng, X., & Mohd Saleh, N. (2024). Managerial ability and ESG risks: The moderating effect of internal control quality. *Sustainability*, 16(22), Article 9838. <https://doi.org/10.3390/su16229838>
- Lin, C., & Tsai, H. L. (2016). Achieving a firm's competitive advantage through dynamic capability. *Baltic Journal of Management*, 11(3), 260–285. <https://doi.org/10.1108/BJM-11-2015-0224>
- Mali, D., & Lim, H. J. (2021). Do relatively more efficient firms demand additional audit effort (hours)? *Australian Accounting Review*, 31(2), 108–127. <https://doi.org/10.1111/auar.12327>
- Moffitt, K. C., Burns, J., & Rhoades-Catanach, S. (2024). Corporate environmental, social, and governance (ESG) performance and the internal control environment. *Accounting Horizons*, 38(3), 103–122. <https://doi.org/10.2308/HORIZONS-2020-172>
- Ogneva, M., Subramanyam, K. R., & Raghunandan, K. (2007). Internal control weakness and cost of equity: Evidence from SOX Section 404 disclosures. *The Accounting Review*, 82(5), 1255–1297. <https://doi.org/10.2308/accr.2007.82.5.1255>
- Pennings, J. M., Lee, K., & Witteloostuijn, A. V. (1998). Human capital, social capital, and firm dissolution. *The Academy of Management Journal*, 41(4), 425–440.
- Samoilenko, S., & Osei-Bryson, K. M. (2013). Using data envelopment analysis (DEA) for monitoring efficiency-based performance of productivity-driven organizations: Design and implementation of a decision support system. *Omega*, 41(1), 131–142. <https://doi.org/10.1016/j.omega.2011.02.010>
- Securities and Exchange Commission. (2002). *Final rule: Certification of disclosure in companies' quarterly and annual reports*. Release Nos. 33-8124; 34-46427.
- Securities and Exchange Commission. (2003). *Final rule: Management's report on internal control over financial reporting and certification of disclosure in exchange act periodic reports*. Release Nos. 33-8238; 34-47986.
- Shin, H., & Park, S. (2020). The internal control manager and operational efficiency: Evidence from Korea. *Managerial Auditing Journal*, 35(7), 979–1006. <https://doi.org/10.1108/MAJ-04-2019-2253>
- Shin, I. H., Lee, H. Y., Lee, H. A., & Son, M. (2017). How does human resource investment in internal control affect audit reporting lag? *Asia-Pacific Journal of Accounting & Economics*, 24(1–2), 195–215. <https://doi.org/10.1080/16081625.2015.1135751>
- Wagner, J. (2012). Average wage, qualification of the workforce and export performance in German enterprises: Evidence from KombiFiD data. *Journal for Labour Market Research*, 45(2), 161–170. <https://doi.org/10.1007/s12651-012-0106-x>
- Wang, H. C., He, J., & Mahoney, J. T. (2009). Firm-specific knowledge resources and competitive advantage: The roles of economic- and relationship-based employee governance mechanisms. *Strategic Management Journal*, 30(12), 1265–1285. <https://doi.org/10.1002/smj.787>
- Williams, D. R. (2013). Human and financial capital as determinants of biopharmaceutical IPO de-listings. *Journal of Business Research*, 66(12), 2612–2618. <https://doi.org/10.1016/j.jbusres.2012.05.019>
- Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. MIT Press.
- Yu, W., Ramanathan, R., Wang, X., & Yang, J. (2018). Operations capability, productivity and business performance: The moderating effect of environmental dynamism. *Industrial Management & Data Systems*, 118(1), 126–143. <https://doi.org/10.1108/IMDS-02-2017-0064>

Appendix A: Variable definitions

Variable	Definition
Dependent variable	
Efficiency	Continuous variable of firm efficiency, ranging from 0 to 1, for fiscal year t based on data envelopment analysis (Demerjian et al., 2012)
Independent variables	
ICAE	The natural logarithm of the internal control manager's career in months
ICFE	The natural logarithm of the internal control manager's tenure in months
INFO	Indicator variable that equals 1 if the absolute difference between preliminary operating income and confirmed operating income, divided by sales revenue, is below the industry average; equals 0 if it exceeds the industry average
SIZE	Natural logarithm of total assets
LEV	Total liability divided by total assets
AGE	The number of years a firm has appeared in the database at end of fiscal year t
FCF	Indicator variable that equals 1 if the firm's free cash flow is not negative and 0 otherwise
FOR	Indicator variable that equals 1 if the firm reports a nonzero value for foreign currency adjustment in fiscal year t and 0 otherwise
MS	Percentage of revenue (Sales) earned by firm within its industry for fiscal year t
LARGE	Share of ownership held by largest shareholder
OUT	Ratio of number of outside board members to number of board members
ROA	Net income divided by total assets at the beginning of the year
MB	Market value of equity divided by book value of equity
KSE	Indicator variable that equals 1 if a firm trades its shares on the KSE, and 0 if it trades on the KOSDAQ
COVID	Indicator variable that equals 1 for the year 2020, which was affected by COVID-19, and 0 otherwise
IMR	Inverse Mills ratio obtained from first-stage probit model

Appendix B: Various specifications of Efficiency

Panel A. Results based on Efficiency including lease assets.

	Year-based Efficiency (Main result in Table 4)				Industry-year-based Efficiency			
	(1)		(2)		(3)		(4)	
	Coeff.	<i>t</i>	Coeff.	<i>t</i>	Coeff.	<i>t</i>	Coeff.	<i>t</i>
ICAE	.0025	2.85***			.0031	2.65***		
ICFE			.0021	3.20***			.0027	3.15***
Controls	Included		Included		Included		Included	
Industry and year FE	Included		Included		Included		Included	
Adj. R^2	.3652		.3655		.4522		.4526	

* $p < .1$. ** $p < .05$. *** $p < .01$.

Panel B. Results based on Efficiency excluding lease.

	Year-based Efficiency excluding lease				Industry-year-based Efficiency excluding lease			
	(1)		(2)		(3)		(4)	
	Coeff.	<i>t</i>	Coeff.	<i>t</i>	Coeff.	<i>t</i>	Coeff.	<i>t</i>
ICAE	.0020	1.29			.0030	2.62***		
ICFE			.0035	3.11***			0.0027	3.14***
Controls	Included		Included		Included		Included	
Industry and year FE	Included		Included		Included		Included	
Adj. R^2	.3432		.3434		.4575		.4589	

* $p < .1$. ** $p < .05$. *** $p < .01$.