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Internal control in accounting research: A review

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ABSTRACT

In 2001, the US moved to regulate internal control reporting by management and auditors. While some jurisdictions have followed the lead of the US, many others have not. An important question, therefore, is the relevance of internal control to stakeholders. The more specific issue of the benefits of US-style regulation of internal control reporting is also topical. We review studies on the determinants of internal control quality and its economic consequences for stakeholders including investors, creditors, managers, auditors and financial analysts. We extend previous reviews by focusing on US studies published since 2013 as well as all non-US studies investigating IC quality including countries regulating IC disclosure as well as unregulated settings and both developed and developing economies. In doing so, we identify research questions where evidence remains mixed and new directions in which there are research opportunities.

Three main insights arise from our analysis. First, evidence on the economic consequences of internal control quality suggests that the quality of internal control can have a significant effect on decision making by users of financial information. Second, the results of research on the empirical association between ownership structure, certain board characteristics and internal control quality is generally mixed. Empirical evidence concerning the association between audit committee characteristics and internal control quality generally supports a positive and significant association. Finally, while studies in non-US jurisdictions are increasing, opportunities remain to explore the determinants and consequences of internal control in other jurisdictions. Our review provides evidence for policy makers of whether there are benefits from requiring management and auditors to report on internal control over financial reporting.

1. Introduction

Research exploring the determinants and economic consequences of internal control (IC) quality has gained momentum in recent years. The purpose of our paper is to synthesize the accounting related literature on IC and discuss the implications of the review for policymakers. Our findings are also relevant for managers, investors, creditors and auditors. In order to do this, we extend prior reviews by focusing on US studies published since 2013, and by reviewing studies conducted outside the US setting. In light of increasing global efforts to enhance IC, an updated literature review with an international perspective is warranted. The review is intended to inform the regulatory debate surrounding the enactment of disclosure and attestation rules to enhance the transparency and quality of IC of financial reporting and their relevance to stakeholders.

Prior reviews on IC reporting subsequent to SOX sections 302 and 404 (hereafter, SOX 302 and SOX 404 respectively) are US dominated and focus on the literature up to 2012. Schneider, Gramling, Hermanson, and Ye (2009) limit their review to US, large

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sample size studies during 2005 to mid-2009. Key insights are that weaker IC is associated with smaller, riskier, and more complex firms. Weaker IC is also associated with weaker board and audit committee independence and expertise, increased cost of finance, less accurate earnings forecasts and higher audit fees. Kinney, Martin, and Shepardson (2013) reflect on SOX and the production of IC audits using evidence from public and limited non-public archival data, analytical studies, and numerous personal experiences of audit practitioners. They are interested in understanding how the requirement for IC audits has changed the production of audits. The paper is a commentary rather than a literature review and calls for greater transparency and analysis of how control audits are conducted, and consideration of alternative means to provide IC effectiveness information to investors. Asare et al. (2013) focus primarily on literature examining auditors' evaluation and reporting on IC using a framework considering auditor, client, task and environment attributes, and auditor-client interactions. In doing so, they discuss empirical findings of US studies with their synthesis suggesting that auditors conduct more testing when clients have deficiencies in IC with this manifesting in higher audit fees and delays. Bedard and Graham (2014) discuss the cost-benefit aspects of management and auditor reporting on IC. They review a select number of pre-2013 studies investigating ineffective IC determinants, consequences, and remediation. They conclude that IC issues are more likely in smaller, more complex and financially distressed firms, auditor affiliation and audit quality influence IC quality and reporting, and effective IC are associated with lower cost of capital. Coates and Srinivasan (2015) review a decade of post SOX US literature on IC from accounting, finance and law disciplines concluding that SOX has delivered financial reporting benefits, but research on its net social welfare contribution remains inconclusive.

Our paper extends those previous reviews thereby making a distinct and incremental contribution. First, it provides an update of IC research published since 2013 using US data. Prior reviews focus on the ten-year period post-SOX adoption and there has been a substantial body of research subsequent to this period offering new insights on the value, importance, and efficacy of IC reporting. Second, our review extends the scope to non-US studies investigating IC quality including countries regulating IC disclosure as well as unregulated settings and both developed and developing economies. As noted by Bedard and Graham (2014), regulatory differences in countries can contribute to insights on the benefits and costs of SOX. Third, this study synthesizes IC literature by focusing on consequences for a diverse set of stakeholders. Finally, this review goes beyond a classic literature review by critiquing the IC accounting literature.

Our systematic search of various editorial sources yields 60 published US papers since 2013 and 34 non-US or cross country papers in total.¹ The majority of US papers published during this period were in 2015 and 2016 with 16 and 24 papers published respectively. The international diversity of IC research is increasing with 27 of the 34 papers published since 2013, with seven of these China focused.

Our review of the 94 papers captures: (1) the theoretical underpinnings of IC research; (2) the main proxies and approaches used in accounting and auditing literature to measure IC quality; and (3) a summary of the main empirical findings. In addressing these points, we categorize studies into two streams – determinants and consequences of IC quality. The former focuses on board and board sub-committee characteristics, ownership structure, internal audit characteristics, other firm structural characteristics, external audit related-variables, national culture, and regulatory and market environments. The latter discusses the impact of IC quality on decisions of managers, creditors, investors, auditors, financial analysts, and other stakeholders. For each stream of literature, we discuss the theory underpinning the associations, present recent empirical evidence, and consider any relevant methodological issues.

Our review shows that the measurement of IC quality has evolved in the US setting from general aspects of IC to greater specificity including account-level, information technologies (IT) and tax-related IC aspects. Outside the US setting, researchers generally use survey approaches among internal or external auditors or an internal disclosure index to assess IC quality in the absence of a SOX-like regulation. Synthesis of the studies reveals that empirical results are mixed concerning the effect of ownership structure (e.g., family ownership) and certain board characteristics (CEO duality, gender representativeness) on IC quality, while they are generally supportive of a positive association between audit committee characteristics (financial expertise, activity) and IC quality. Finally, empirical studies provide evidence that IC quality affects decisions and behavior of creditors, investors, managers, financial analysts, auditors and other stakeholders, and that this remains a fertile research area outside of the US.

Our synthesis of the literature's findings suggests that while there are some mixed findings in research on this issue, in general, reporting on IC quality is useful for stakeholders suggesting that SOX-driven IC disclosures are worthwhile. It appears to be the case that similar requirements will be useful in other jurisdictions such as Europe or Australasia, although the studies do not enable a conclusion to be drawn regarding the cost of this type of regulation relative to its benefits. Our review will be relevant to academics interested in IC accounting research, as well as to policymakers, investors, creditors, managers, auditors, financial analysts and other stakeholders.

This study is organized as follows: Section 2 summarizes the main findings of research questions related to the internal and external determinants of IC quality including board and board sub-committee characteristics, ownership structure, external audit, regulatory and market features, and national culture. The research on IC quality and its consequences for management decisions, executive compensation and turnover, equity and bond markets, and other stakeholders is synthesized in Section 3. Section 4 presents the limitations of IC accounting research. Finally, section 5 concludes the paper and provides future research perspectives.

¹ Studies dealing with IC quality but unrelated to the scope of our review are not included such as Fan, Chan, and Raghunandan, 2017. The number of reviewed studies listed in Tables 1–3 is higher than 94 papers given that papers by Haislip, Peters et al. (2016) and Pevzner and Gaynor (2016) each appear twice in the tables as they investigate multiple aspects of IC quality.

Table 1
Internal Determinants of IC Quality (23 studies).

Authors	Association(s) examined	Sample (Firm-years)	Period	Country	IC quality measure	Main findings	Effect of attribute on IC quality
Panel A: Board and Board Sub-Committees (14 studies)							
US Studies							
Balsam et al. (2014)	Board and audit committee characteristics and IC weaknesses	4086	2004–2005	US	SOX 404 IC weakness disclosures	The governance attributes examined are not significantly related to IC weakness disclosures	Not significant
Lin et al. (2014)	CEO characteristics and IC weaknesses	4374	2006–2009	US	SOX 404 IC weakness disclosures	CEO entrenchment and age are negatively associated with IC quality.	Negative
Rich and Zhang (2014)	The presence of municipal audit committees and IC quality	240	2001	US	IC weakness based on Federal Audit Clearinghouse Single Audit Database	Municipalities with audit committees are associated with fewer IC problems	Positive
He (2015)	CEO inside debt holdings and IC quality.	5216	2006–2011	US	SOX 404 IC weakness disclosures	Large CEO inside debt holding is associated with higher IC quality.	Positive
Campbell et al. (2016)	Occupational community of top executives (CEO/CFO tenure) and IC quality	9437	2006–2011	US	SOX 404 IC weakness disclosures	Executive relationship (CEO/CFO joint tenure) is negatively associated with the likelihood of IC weakness	Negative
Chen, Knechel et al. (2017)	Board independence and the likelihood of reporting IC weaknesses	11,226	2004–2012	US	SOX 404 IC weakness disclosures	Board independence is negatively associated with the disclosure of IC weakness and this negative association is more prevailing under CEO duality	Negative
Chen, Eshleman et al. (2016)	Female representation on the board and IC weaknesses	4267	2004–2013	US	SOX 404 IC weakness disclosures	Firms with higher percentage of female representation on boards are less likely to have IC weaknesses	Positive
Lisic et al. (2016)	Whether CEO power affects the association between audit committee expertise and the occurrence of IC weakness	7217	2004–2010	US	SOX 404 IC weakness disclosures	When CEO power is low, audit committee expertise is negatively related to the incidence of IC weakness	Positive
Parker et al. (2017)	Female representation on audit committee and board of directors and disclosure of IC weaknesses	10,888	2007–2012	US	SOX 404 IC weakness disclosures	The proportion of females on the audit committee (board) is significant and positively (negatively) associated with the probability of reporting IC weakness	Positive and negative
Non-US Studies							
Hu et al. (2014)	Independent directors on the board and IC quality	6764	2006–2010	China	The voluntary disclosure of auditors' reports on IC	Independent directors on the board improves IC quality	Positive
Yazawa (2015)	Board and CEO characteristics and the disclosure of material IC weakness	7064	2009–2012	Japan	J-SOX Act IC weakness disclosures	CEO tenure and board size (board independence) have (has) a significant negative (positive) effect on the disclosure of IC weaknesses	Negative and positive
Agyei-Mensah (2016)	Board independence, board size, institutional ownership and IC disclosure	110	2013	Ghana	Content analysis of IC reports	Only board independence has a significant positive effect on such type of disclosure	Positive
Khelif and Samaha (2016)	Audit committee activity and IC quality and whether external auditor size affects such a relationship	344	2007–2010	Egypt	Survey among external auditors	Audit committee activity is positively associated with IC quality and such a relationship is more prevailing when firm is audited by Big-4 auditor	Positive
Cross Country Studies							
Michelon et al. (2015)	Board and audit committee characteristics and IC disclosure	867	2003–2008	Germany, France, Italy, UK	IC disclosure index	CEO duality exerts a negative effect on IC disclosure. Similarly, independent chair on the audit committee has a negative effect on IC disclosure, while expert chair has a positive effect	Negative and positive

(continued on next page)

Table 1 (continued)

Authors	Association(s) examined	Sample (Firm-years)	Period	Country	IC quality measure	Main findings	Effect of attribute on IC quality
Panel B: Ownership Structure (4 studies)							
US Studies							
Bardhan et al. (2015)	Family ownership and IC weaknesses	500	2003	US	SOX 404 IC weakness disclosures	Family firms exhibit more material IC weakness than non-family firms	Negative
Non US Studies							
Deumes and Knechel (2008)	Ownership concentration, managerial ownership and IC disclosure	490	1997–1999	Netherlands	IC disclosure index	Ownership attributes have a significant negative effect on IC disclosure	Negative
Weiss (2014)	Family ownership on IC weakness	573	2010–2011	Israel	SOX 302 IC weakness disclosures	Family ownership is significantly associated with fewer material IC weakness	Positive
Ji et al. (2015)	Ownership structure, board characteristics and audit committee expertise and the voluntary disclosure of IC weakness	2754	2010–2011	China	Content analysis of IC reports	Board size and ownership concentration have a negative effect on the voluntary disclosure of IC weakness, while audit committee expertise has a positive effect	Negative and positive
Panel C: Internal Audit Quality (2 studies)							
Non US Studies							
Fadzil et al. (2005)	Internal audit quality and IC quality	812	2001	Malaysia	Survey among audit committee members	Internal audit department professional proficiency, objectivity and review significantly influence the monitoring aspect of the IC system	Positive
Mazza and Azzali (2015)	Internal audit quality on the severity and persistence of IC deficiencies	4284	2007–2012	Italy	Survey among internal auditors	Increased internal audit quality is associated with reduced severity and persistence of controls deficiencies	Positive
Panel D: Other Firm Structural Determinants (3 studies)							
US studies							
Guo et al. (2016)	Employee treatment policies and IC weakness	7804	2004–2008	US	SOX 404 IC weakness disclosures	Employee-friendly policies significantly reduce the propensity for employee-related IC weakness	Positive
Non US studies							
Chen and Keung (2016)	Corporate diversification, institutional ownership and IC quality	4643	1999–2011	Taiwan	Regulatory IC weakness disclosures in prospectuses	Corporate diversification is positively associated with the likelihood of IC weaknesses	Negative
Mao and Ettredge (2016)	Reverse merger firms and managers' propensity to issue unfavorable SOX 302 reports	1837	2008–2011	China (Chinese firms listed in US)	SOX 302 IC weakness disclosures	Managers of Chinese reverse merger firms have greater propensity to issue adverse SOX 302 reports when material IC problems exist	Negative

2. Determinants of IC quality

Studies examining the determinants of IC quality investigate its internal and external determinants. Beyond firm characteristics (e.g., size, risk, growth, and complexity), these internal determinants include board and board sub-committee characteristics, ownership structure, internal audit characteristics, and other structural variables. External determinants include audit-related characteristics, financial analysts, national culture, and the regulatory and market environment.

2.1. Internal determinants

Our review identifies 23 studies investigating internal determinants of IC quality, of which 11 are US studies published since 2013, 11 are non-US studies and one is a cross country study. The studies reviewed are listed in [Table 1](#). The internal determinants investigated in the studies identified are board and board sub-committee characteristics (14 studies, see [Table 1](#) Panel A), ownership structure (four studies, see [Table 1](#) Panel B), internal audit (two studies, see [Table 1](#) Panel C) and other firm structural characteristics (three studies, see [Table 1](#) Panel D).

2.1.1. Board and board sub-committee characteristics

It is widely believed that the board of directors and audit committee play a key role in shaping the IC environment ([Krishnan, 2005](#)). Audit committees oversee a firm's audit processes including IC activities by reviewing any material weaknesses and monitoring corrective actions. The board of directors assumes ultimate responsibility to provide incremental oversight over IC to improve its quality as part of their fiduciary duties ([Goh, 2009](#)).

CEO characteristics (e.g., duality, power, ownership) can also affect IC quality. For instance, a CEO that has sufficient power in his/her hands has a greater ability to influence the appointment of friendly external directors and passive inside directors ([Thomas, 2004](#)). Accordingly, a powerful CEO may compromise the board's ability to monitor managerial decisions and then weaken IC and corporate monitoring systems to serve his/her own personal interests ([Lin, Wang, Chiou, & Huang, 2014](#)).

In their review, [Schneider et al. \(2009\)](#) identify that US studies have documented that board independence and audit committee independence, expertise, and meeting frequency are associated with higher IC. Recent studies in the US setting, such as [Balsam, Jiang, and Lu \(2014\)](#), investigate the effect of board (size and independence) and audit committee (financial expertise and size) characteristics on SOX 404 IC weakness disclosures, finding no significant associations. However, [Chen, Knechel, Marisetty, Truong, and Veeraraghavan \(2017\)](#) find that board independence is negatively associated with the disclosure of IC weaknesses, and this negative association is more prevailing under CEO duality. The conflicting results are likely attributable to differing time periods with the former study covering 2004–2005 and the latter 2004–2012.

Consistent with earlier studies, audit committee expertise is associated with higher IC quality ([Haislip, Peters, & Richardson, 2016](#); [Lisic, Neal, Zhang, & Zhang, 2016](#)). [Campbell, Li, Yu, and Zhang \(2016\)](#) report that executive relationships (e.g., CEO/CFO joint tenure) are negatively associated with IC weakness disclosed under SOX 404. Also investigating CEO characteristics, [Lin et al. \(2014\)](#) document that CEO entrenchment and age are associated with lower IC quality.² [He \(2015\)](#) explores the effect of CEO inside debt holdings³ on the disclosures of IC deficiencies under SOX 404 in the US setting. The finding of higher CEO inside debt holdings being associated with higher IC quality, implies that a CEO with large inside debt is concerned about the default risk of his/her firm. Accordingly, a CEO will exhibit a strong commitment towards high financial reporting quality through higher IC quality. With respect to the government sector, [Rich and Zhang \(2014\)](#) document that municipalities with audit committees are associated with fewer IC problems.

The literature has subsequently evolved to examine gender representation on boards and audit committees on IC quality. [Parker, Dao, Huang, and Yan \(2017\)](#) examine whether audit and board members' gender influences IC quality. Findings show that the percentage of females on the audit committee (board) is significant and positively (negatively) related to the probability of reporting IC weakness. [Chen, Eshleman, and Soileau \(2016\)](#) also find that the percentage of female board representation is negatively related to the probability of reporting IC weakness. The evidence thus far is insufficient to be conclusive, especially for board sub-committees.

Outside of the US, [Hu, Yuan, and Xiao \(2014\)](#) examine whether the proportion of independent directors on the board affects IC quality, as proxied by the voluntary disclosure of auditors' reports on IC, in China and find that the percentage of independent directors is positively associated with IC quality. In Egypt, [Khlif and Samaha \(2016\)](#) find that audit committee activity is positively associated with external auditors' evaluation of IC quality and the association is more prevalent when a firm is audited by Big-4 auditor.

[Michelon, Bozzolan, and Beretta \(2015\)](#) also examine whether board and audit committee characteristics have an effect on IC disclosures in four European financial markets. With regard to board characteristics (board independence and CEO duality), findings show that only CEO duality exerts a negative effect on IC disclosures. With respect to audit committee characteristics (audit committee expertise, independent chair and expert chair), the results suggest that an independent chair on the audit committee has a negative effect on IC disclosures, while an expert chair has a positive effect. Also focusing on disclosures, [Agyei-Mensah \(2016\)](#) finds

² CEO entrenchment score is the principal component factor (PCF) analysis of the following four CEO characteristics variables (CEO shareholding, CEO duality, CEO compensation and CEO tenure).

³ CEO inside debt is defined as the sum of the actuarial present value of accumulated benefits under defined-benefit pension plans and the total balance in the deferred compensation plans at the end of fiscal year.

that board independence is positively associated with IC disclosures by firms in Ghana. Pursuant to SOX like regulation, [Yazawa \(2015\)](#) examine the effect of board and CEO characteristics on the disclosure of material IC weaknesses in Japanese firms. He documents that CEO tenure and board size have a significant negative effect on such disclosures, while board independence exerts a significant positive effect.

The association between IC quality and board characteristics has been researched widely. Consistent with prior research, recent research generally supports IC quality is positively associated with board composition that is consistent with good governance practices. The results of research on audit committees and IC is also consistent and supports the view that positive aspects of audit committees (such as expertise or independence) are associated with higher IC quality. The literature on CEO characteristics is more mixed as is the emerging literature on the influence of female directors on IC quality.

2.1.2. Ownership structure

Early literature on the effect of ownership concentration and managerial ownership on IC disclosures conducted in the Netherlands, find that these two ownership attributes have a significant negative effect on IC disclosures ([Deumes & Knechel, 2008](#)). More recently, [Bardhan, Lin, and Wu \(2015\)](#) and [Weiss \(2014\)](#) focus on the effect of family ownership on IC quality in the US and Israel, respectively. [Weiss \(2014\)](#) documents family ownership is significantly associated fewer material IC weakness disclosed under SOX 302, whereas [Bardhan et al. \(2015\)](#) provide evidence that family firms exhibit lower IC quality (SOX 404 IC weakness disclosures) than non-family firms. In China, [Ji, Lu, and Qu \(2015\)](#) examine the effect of ownership structure (institutional ownership and ownership concentration) on IC quality, as measured by the voluntary disclosure of material IC weaknesses. They document that ownership concentration has a negative effect on such disclosures. The studies reviewed support both entrenchment and alignment effects. For instance, the entrenchment effect suggests that ownership concentration (block ownership or family ownership) incentivizes a reduction in the effectiveness of IC for the purpose of owners serving their own interests and decreasing the likelihood of their future accountability (e.g., [Bardhan et al., 2015](#)). The alignment effect suggests that dominant shareholders prefer to preserve their reputation and thereby align their interests with those of stakeholders implying higher IC quality (e.g., [Weiss, 2014](#)).

2.1.3. Internal auditors

The role of internal auditors in improving IC quality has also been researched. The internal audit department plays a crucial role in overseeing and detecting IC weaknesses and reporting them to top management in order for corrective actions to be taken in a timely manner. Accordingly, research has examined the question of whether the quality of internal auditing impacts IC quality in the firm ([Mazza & Azzali, 2015](#)). Prior studies use investment in the internal audit function as a proxy for IC quality ([Wan-Hussin & Bamahros, 2013](#)).

The following two papers investigating the internal audit function and its association with IC quality deal with Malaysian and Italian settings, respectively. [Fadzil, Haron, and Jantan \(2005\)](#) examine the effect of internal audit quality on IC quality using a survey methodology. They document that internal audit department professional proficiency, objectivity and review significantly influence the monitoring aspect of the IC system. Similarly, [Mazza and Azzali \(2015\)](#) examine the effect of internal audit quality on the severity and persistence of IC deficiencies in the Italian setting by surveying Italian internal auditors. They document that increased internal audit quality is associated with reduced severity and persistence of IC deficiencies and thus higher IC quality. Both studies in this area show evidence that better internal auditing is associated with better IC quality.

2.1.4. Other firm structural variables

Other variables examined include reverse mergers, employee-friendly policies and diversification. [Mao and Ettredge \(2016\)](#) investigate whether reverse mergers influence managers' propensity to issue unfavorable SOX 302 reports for Chinese firms listed in US. They document that managers of Chinese reverse merger firms have greater propensity to issue adverse SOX 302 reports when material IC problems exist relative to other US listed firms including reverse merger and IPO firms from other countries as well as Chinese IPO firms. Further, in the absence of known IC deficiencies, Chinese reverse merger firms have an equal or greater propensity to issue an adverse report. Studying firms' employee-friendly policies in the US setting, [Guo, Huang, Zhang, and Zhou \(2016\)](#) find that such policies reduce the propensity for employee-related material IC weaknesses. In Taiwan, [Chen and Keung \(2016\)](#) investigate the association between corporate diversification and regulatory IC weakness disclosures in prospectuses and whether institutional ownership affects such an association. They find that corporate diversification is positively associated with regulatory IC weakness disclosures and such an association is more (less) prevailing when firms have higher transient (dedicated) institutional ownership.

2.2. External determinants

Our review identifies 12 studies investigating external determinants of IC quality, of which eight are US studies published since 2013, one is a non-US study, and three are cross country studies. The reviewed studies are listed in [Table 2](#). The external determinants investigated in the reviewed studies are external audit (six studies, see [Table 2](#) Panel A), financial analysts (one study, see [Table 2](#) Panel B), national culture (two studies, see [Table 2](#) Panel C) and the regulatory and market environment (three studies, see [Table 2](#) Panel D).

2.2.1. Audit-related variables

External determinants of IC quality include those related to external auditor characteristics. For instance, increased auditor quality has been hypothesized to be positively associated with IC quality. In this regard, auditor client specific knowledge and IT

Table 2
External Determinants of IC Quality, 12 studies.

Authors	Association(s) examined	Sample (Firm-years)	Period	Country	IC quality measure	Main findings	Effect of attribute on IC quality
Panel A: External Auditor (6 studies)							
US Studies							
López et al. (2013)	Auditor size and IC weaknesses	1180 audit reports	2004–2008	US	IC weakness disclosures in Circular A-133 audit reports in healthcare sector firms	Audits by Big-4 are less likely to disclose IC weaknesses relative to smaller audit firms	Not significant Positive
De Simone et al. (2015)	Auditor provided tax services and IC quality	32,048	2004–2012	US	SOX 302 & 404 IC weakness disclosures	Firms purchasing tax non-audit services are significantly less likely to disclose a material IC weakness	Positive
Albring et al. (2016)	Unexpected fees and material IC weaknesses	11,529	2004–2012	US	SOX 404 IC weakness disclosures	Unexpected fees are associated with company-level IC weakness	Negative
Chen, Gu, et al. (2016)	Auditor's tenure and geographic proximity to the client and IC weaknesses	24, 217	2004–2012	US	SOX 404 IC weakness disclosures	Firms with long auditor tenure and in closer geographic proximity to auditors have lower incidence of IC weakness	Positive
Haislip, Peters et al. (2016)	IT auditor expertise and IT IC weaknesses	20,407	2004–2009	US	SOX 404 IC weakness disclosures	Audit IT expertise is negatively associated with both non-IT and IT material weaknesses in an ex ante reporting setting	Positive
López and Rich (2017)	Geographic distance between U.S. municipalities and their external auditors and IC quality	21,542	1997–2013	US	Circular A-133 IC weakness disclosures	Geographic distance between U.S. municipalities and their external auditors is positively associated with disclosure of IC exceptions	Positive (effect of proximity)
Panel B: Financial Analysts (1 study)							
US Studies							
Mao and Yu (2015)	Analysts' cashflow forecast initiation and IC quality	1646	2000–2010	US	SOX 404 IC weakness disclosures	Providing cash flow forecasts reduces the probability of material IC weakness	Positive
Panel C: National Culture (2 studies)							
Cross Country Studies							
Hooghiemstra et al. (2015)	Individualism and uncertainty avoidance and voluntary IC disclosure	4370	2005–2007	29 countries	Content analysis of IC reports	Individualism (uncertainty avoidance) has a positive (negative) effect on IC disclosures	Positive and negative
Kanagaretnam et al. (2016)	National culture (individualism, uncertainty avoidance, and power distance) and IC weakness	22,627	2000–2008	US-listed firms from 39 countries	SOX 404 IC weakness disclosures	Individualism and power distance are positively related, while uncertainty avoidance is negatively related to IC weakness disclosures	Positive and negative

(continued on next page)

Table 2 (continued)

Authors	Association(s) examined	Sample (Firm-years)	Period	Country	IC quality measure	Main findings	Effect of attribute on IC quality
Panel D: Regulatory and Market Factors (3 studies)							
US Studies							
Kim and Kim (2015)	Product market competition and IC quality	6339	2004–2010	US	SOX 404 IC weakness disclosures	Firms operating in competitive markets have lower IC quality.	Negative
Non US studies							
Zhang and Chen (2016)	Product market competition and IC quality and whether state ownership moderates this relationship	9475	2007–2012	China	Content analysis of annual reports (IC quality index)	Intense product market competition is associated with higher IC quality. This relationship remains stable only for firms with non-state ownership.	Positive
Cross Country Study							
Sarens and Christopher (2010)	The degree of focus of corporate governance guidelines on IC and IC quality	104 chief audit executives (31 from Australia and 101 Belgium)	2006	Australia and Belgium	Survey among chief audit executives	The weaker focus of the Belgian corporate governance guidelines on IC is associated with lower IC quality in Belgian firms than in Australian firms.	Positive

auditor expertise allow auditors to conduct refined audit procedures and appropriate tests to identify risk zones. This can increase audit quality, which reduces the occurrence of IC weaknesses (Chen, Gul., Marisetty, Truong, & Veeraraghavan, 2016; Haislip, Peters et al., 2016). Auditor type (Big-4 versus non-Big-4) can also affect IC quality since Big-4 auditors may enjoy more independence given their diversified client portfolio and thus exert more pressures on management to improve IC (Khelif & Samaha, 2016). For example, in the healthcare sector, López, Rich, and Smith (2013) find firms audited by Big-4 auditors have higher IC quality. The higher reputational capital and visibility of Big-4 auditors also incentivizes high quality audits. Finally, additional audit effort, as proxied by unexpected audit fees or unexpected audit delays, may signal the auditor's discovery of material IC deficiencies implying extended audit procedures. There are thus numerous reasons why a positive association between external audit and IC quality is expected.

In the US setting, Chen, Gul. et al. (2016) find that firms with long auditor tenure have higher IC quality. Furthermore, longer auditor-client geographic distance is associated with lower IC quality but such a relationship is weakened by the length of auditor tenure. Albring, Elder, and Xu (2016) explore the effect of unexpected fees on IC quality, as proxied by the disclosure of IC weaknesses under SOX 404, and distinguish between firm-level and account-specific IC deficiencies. They document that unexpected audit fees are negatively associated with IC quality at firm level, but such an association becomes insignificant for account-specific IC level. Haislip, Peters et al. (2016) test for the effect of IT auditor expertise on IC quality and document a positive association between both variables since the likelihood of firms' reporting IT internal control weaknesses is negatively associated with a firm having an auditor with IT expertise. De Simone, Ege, and Stomberg (2015) consider the association between auditor-provided tax services, as measured by tax fees, and tax IC quality. They document that increased auditor-provided tax services decreases the probability of tax material weaknesses which translates in higher tax IC quality. The overall results generally support the association between higher quality auditing and IC quality. Higher IC quality is associated with proximity, tenure, IT expertise and fees for tax services. While unexpected audit fees are associated negatively or insignificantly with IC quality, that effect is likely to be due to lower IC quality leading to more audit work.

2.2.2. Financial analysts

Financial analysts play an important role as intermediaries between firms and investors (Hope, 2003). When financial analysts follow a firm and publish earnings estimates, this represents an additional external monitoring mechanism and can put more disciplinary constraints on a firm's management to improve IC quality (Mao & Yu, 2015). In this regard, Mao and Yu (2015) examine the relationship between analysts' cash flow forecast initiation and IC quality in the US setting. They document that subsequent to analysts' cash flow forecasts, firms report fewer IC weaknesses under SOX 404 implying that analysts' following focuses managers on IC quality.

2.2.3. National culture

National culture, as identified by Hofstede (2001), with a specific focus on individualism, uncertainty avoidance, and power distance traits, can also affect IC quality. Managers operating in countries characterized by high levels of individualism are more concerned with their own interests than shareholders' wealth and stakeholders' requirements. They are more likely to use discretionary acts to serve their own interests. Managers operating in societies with high levels of power distance have more centralized decisions and they have greater influence on financial reporting choices (Kanagaretnam, Lobo, Ma, & Zhou, 2016). Finally, managers in countries with higher degrees of uncertainty avoidance are more risk averse and have more concerns about litigation costs. Accordingly, empirical literature dealing with this topic generally posits that high levels of individualism and power distance are positively associated with IC deficiencies, while high uncertainty avoidance levels reduce the likelihood of occurrence of IC deficiencies.

Using multi-country samples, cultural determinants of IC disclosures and quality have recently been researched. Hooghiemstra, Hermes, and Emanuels (2015) finds that individualism (uncertainty avoidance) has a positive (negative) effect on voluntary IC disclosures. Kanagaretnam et al. (2016) find individualism and power distance are positively related to increased IC deficiencies, while uncertainty avoidance is negatively related to the same variable. These results, albeit limited, are consistent with the predictions.

2.2.4. Regulatory and market factors

From an institutional perspective, a high level of regulation places pressure on firms to comply with rules and guidelines in order to survive (DiMaggio & Powell, 1983). Sarens and Christopher (2010) suggest that the compliance with institutional norms and requirements may result in a variety of rewards including increased financial stability, legitimacy, social support, internal and external commitment, easy access to finance, and more attraction of personnel. More specifically, when corporate governance guidelines strongly emphasize IC and risk management, this will lead to higher IC quality (Sarens & Christopher, 2010).

Sarens and Christopher (2010) examine whether the reduced focus on IC within the Belgian corporate governance guidelines is associated with lower IC quality of Belgian firms, relative to Australian firms operating under corporate governance guidelines characterized by a stronger focus on IC. They document that the weaker focus of the Belgian corporate governance guidelines on IC is associated with lower IC quality in Belgian firms relative to Australian firms. This evidence suggests that regulatory attention on IC is positively associated with IC quality.

There are alternative possible explanations for the effect of market competition on IC quality. Intense market competition, through product market competition, can increase the likelihood of liquidation for a firm characterized by high product costs, as such a cost structure may reduce its sales in the market leading to lower profitability (Zhang & Chen, 2016). Since the implementation of quality IC requires financial resources, lower profitability will reduce the capability of a firm to improve its IC system (Ge & McVay,

Table 3
Economic Consequences of IC Quality (61 studies).

Authors	Association(s) examined	Sample	Period	Country	IC quality measure	Main findings	Effect of increased IC quality on attribute
Panel A: IC quality and Management Decisions (26 studies)							
US Studies							
Cheng et al. (2013)	Disclosure of IC weakness and investment efficiency	5544	2004–2007	US	SOX 302 & 404 IC weakness disclosures	After SOX IC weakness disclosures, firms' investment efficiency improves significantly	Negative
Dowdell et al. (2014)	Management's IC reports and reporting quality proxied by discretionary accruals	2339	2004–2010	US	SOX 404 IC weakness disclosures	Management's reports on IC quality improve financial reporting quality even in the absence of attestation	Positive
Myllymäki (2014)	IC weakness and misstatements in financial information	5249	2005–2008	US	SOX 404 IC weakness disclosures	IC weaknesses under SOX 404 are positively associated with misstatements in financial information	Positive
Bauer (2015)	Tax-related material IC weakness and firms' corporate tax avoidance	6696	2004–2009	US	SOX 404 IC weakness disclosures	Tax IC weaknesses are positively and significantly associated with effective tax rate. After remediation, tax related IC weakness firms report higher levels of future tax avoidance.	Positive
Feng et al. (2015)	IC quality over inventory and firms' inventory management	8953	2004–2009	US	SOX 404 IC weakness disclosures	Inventory-related material IC weaknesses lower inventory turnover ratios. In addition, firms with inventory-related material IC weaknesses are more likely to report inventory impairments relative to firms with effective IC over financial reporting.	Positive
Gallimore and Labro (2015)	IC effectiveness and tax avoidance	11,606	2004–2010	US	SOX 404 IC weakness disclosures	Effective IC systems are negatively related to effective tax rates	Positive
Huang and Chang (2015)	Auditor-provided tax services and the association between tax related IC and book-tax differences	3705	2005–2011	US	SOX 302 & 404 IC weakness disclosures	Firms reporting tax-related IC problems have larger permanent and temporary differences. Auditor-provided tax services mitigate only the positive association between tax-related IC weaknesses and permanent differences in the post-SOX period.	Positive
Jaggi et al. (2015)	Whether industry-specialist audits moderate the association between IC weakness and earnings quality	7172	2004–2008	US	SOX 404 IC weakness disclosures	Earnings quality of IC weakness firms audited by Big 4 industry specialists is higher than those audited by Big 4 non-specialists	Positive
Mitra et al. (2015)	IC weakness and accounting conservatism	3492	2004–2009	US	SOX 404 IC weakness disclosures	IC weakness firms exhibit greater accounting conservatism in the post-SOX period compared with firms with effective IC	Positive

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Table 3 (continued)

Authors	Association(s) examined	Sample	Period	Country	IC quality measure	Main findings	Effect of increased IC quality on attribute
Positive							
Cho and Chung (2016)	IC weakness disclosures and loan reserves and provisions in banking sector	8167	2002–2013	US	SOX 302 & 404 IC weakness disclosures	Loan reserves and provisions are higher in years of IC weakness disclosures	Positive
Donelson et al. (2017)	IC weakness and corporate fraud	14,093	2005–2010	US	SOX 404 IC weakness disclosures	There is strong positive association between material IC weakness and future fraud revelation	Positive
Holder et al. (2016)	Material information-technology IC weaknesses affect firm's 8-K filing compliance and timeliness	118,808	2005–2010	US	SOX 302 & 404 IC weakness disclosures	IC deficiencies reduce firm's 8-K filing compliance and reporting timeliness	Positive
Järvinen and Myllymäki (2016)	Material IC weakness disclosures and real earnings management	23,409	2004–2012	US	SOX 404 IC weakness disclosures	Firms with material IC weaknesses engage in more manipulation of real activities (e.g. inventory overproduction)	Positive
Lenard et al. (2016)	Material IC weakness disclosures and real earnings management	7475	2004–2010	US	SOX 404 IC weakness disclosures	Positive association between firms reporting IC weaknesses and real activities manipulation	Positive
Pevzner and Gaynor (2016)	IC weaknesses and firms' greater savings of cash from internally generated cash flows	10,214	2005–2010	US	SOX 302 & 404 IC weakness disclosures	IC weaknesses are associated with stronger cash-to-cash flow sensitivities and with weaker impact of higher asset liquidity on stock liquidity	Positive
Sun (2016)	SOX 404 auditor opinions on the effectiveness of IC over financial reporting and firm investment level	16,555	2004–2012	US	SOX 404 IC weakness disclosures	Firms receiving adverse auditor IC opinions have significantly lower investment than firms that receive clean opinions and that firms' investment increases after the weakness remediation	Positive
Non-US Studies							
Lu et al. (2011)	IC weakness disclosures and discretionary accruals	470	2006	Canada	The number of IC weaknesses self-reported by the firm in its Management Discussion & Analysis	A positive and significant association between IC weakness disclosures and discretionary accruals	Positive
Van de Poel and Vanstraelen (2011)	Unaudited management statement of effective IC and IC disclosure score and discretionary accruals	171	2004–2005	Netherlands	Unaudited management statement of effective IC and IC disclosure score	Only unaudited management statement of effective IC is negatively associated with discretionary accruals	Positive
Li et al. (2012)	Auditor's unqualified opinion on IC (ARIC) and accrual quality	2669	2008–2009	China	Chinese – SOX IC weakness disclosures	Firms disclosing ARIC do not have lower abnormal accruals relative to non-ARIC firms	Not significant
Brown et al. (2014)	Effect of IC regulation in Germany on earnings quality	12,984	1994–2002	Germany	A dummy variable: 1 for the post-adoption period and 0 otherwise	German firms experience an increase in timely loss recognition and a decrease in earnings smoothing for the post-adoption period of such regulation	Positive
Oh et al. (2014)	IC over financial reporting regulation and information quality	1856	2002 & 2006	Korea	A dummy variable: 1 for the post-adoption period and 0 otherwise	The level of regulation of IC over financial reporting is negatively associated with discretionary accruals	Positive

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Table 3 (continued)

Authors	Association(s) examined	Sample	Period	Country	IC quality measure	Main findings	Effect of increased IC quality on attribute
Positive Nakashima and Ziebart (2015)	IC weaknesses and earnings quality and earnings management	60	2009–2010	Japan	J-SOX IC weakness disclosures	Accrual and real earnings management remain unchanged (increase) for firms not disclosing (disclosing) IC weaknesses following J-SOX	Positive
Al-Thuneibat et al. (2015)	Compliance with IC legislation on corporate profitability	160	2011	Saudi Arabia	Survey among internal auditors	Two components of IC system (risk assessment and control of procedures) have a positive effect on corporate profitability	Positive
Ji, Lu, and Qu (2016)	IC weaknesses and accounting conservatism	1059	2010–2011	China	Chinese –SOX IC weakness disclosures	IC weaknesses has a negative effect on accounting conservatism	Positive
Zakaria et al. (2016)	The type of IC weaknesses that lead to fraud activities in an oil and gas company based in Malaysia	Case study		Malaysia	Document analysis and interviews among internal auditors	Fraudulent practices resulting from IC weaknesses include the creation of a fictitious invoice and kickbacks on subordinates' overtime pay	Positive
Zhou et al. (2016)	IC quality and firm performance for different stages of a firm's life cycle (introduction, growth, mature, shake-out and decline)	10,945	2007–2012	China	Content analysis of annual reports government documents, and press releases (IC quality index)	The positive effect of IC quality on firm performance vary over different life cycle stages and such a positive effect more significant in maturity and shake-out stages	Positive
Panel B: IC Quality and Management Turnover and Compensation (3 studies)							
US Studies							
Haislip et al. (2015)	IT related IC weakness, CEO/CFO termination and subsequent job opportunities	404	2004–2007	US	SOX 404 IC weakness disclosures	Executives who lose their jobs due to an IT material weakness are less likely to find an equivalent job compared to executives dismissed for material IC weaknesses not related to IT	Positive
Haislip, Masli et al. (2016)	IT IC weakness and CEO/CFO/ Director turnover	822	2004–2008	US	SOX 404 IT IC weakness disclosures	Firms with IT IC weaknesses experience higher CEO, CFO, and director turnover and remediate deficiencies in a timelier fashion when they appoint a new CFO with IT expertise or upgrade their financial reporting system	Positive
Paletta and Alimehmeti (2018)	Material IC weakness disclosures and executive compensation	61,020 executive firm years	2002–2010	US	SOX 302 & 404 IC weakness disclosures	Executives operating in firms with IC weaknesses earn greater compensation	Positive
Panel C: IC Quality and Debt Markets (4 studies)							
US Studies							
El-Mahdy and Park (2014)	IC weakness and the average annual bid-ask spread in the US secondary loan market	1802	2002–2005	US	SOX 302 & 404 IC weakness disclosures	IC deficiencies are positively associated with higher bid-ask spread in the US secondary loan market.	

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Table 3 (continued)

Authors	Association(s) examined	Sample	Period	Country	IC quality measure	Main findings	Effect of increased IC quality on attribute
Positive Tang et al. (2015)	IC quality and derivative pricing with a focus on credit default swaps	887	2004–2007	US	SOX 404 IC weakness disclosures	Credit default swap is positively associated with IC material weaknesses	Positive
Park et al. (2017)	IC deficiencies and municipal borrowing costs	9618	2005–2012	US	IC data from the U.S. Census Single Audit Clearinghouse (content analysis of external auditor report)	Material IC weaknesses are associated with higher borrowing costs for municipal bonds	Positive
Non-US studies Guidara et al. (2016)	IC weakness and cost of debt	150	2009–2013	Tunisia	Content analysis of external auditor report	IC weaknesses increase the cost of debt and that such a relationship is more prevailing under high family ownership	Positive
Panel D: IC Quality and Equity Markets (17 studies)							
US Studies Ashbaugh-Skaife, et al. (2013)	IC weakness and the profitability of insider trading	15,667	2004–2008	US	SOX 404 IC weakness disclosures	The profitability of insider trading is significantly higher in firms disclosing IC weakness relative to those with effective IC	Positive
Dowdell et al. (2013)	IC weakness disclosures on market liquidity proxied by bid-ask spreads	8523	2004–2007	US	SOX 302 & 404 IC weakness disclosures	Firms reporting ineffective IC have higher bid-ask spreads compared to those with effective IC systems	Positive
Hu et al. (2013)	IC weakness and the value relevance of earnings and book value	15,645	2004–2009	US	SOX 404 IC weakness disclosures	The interaction variables between IC weakness and earnings and book values have a significant negative effect on market value	Positive
Kuhn et al. (2013)	IT related IC weaknesses and financial performance and health	278 and 164 matched pairs	2004–2007	US	SOX 404 IT IC weakness disclosures	Firms reporting IT IC weaknesses have a lower ability to pay debts, earn lower profits and have lower mkt value	Positive
Huang et al. (2015)	Association between the value of cash and cash equivalents and IC	15,409	2004–2010	US	SOX 404 IC weakness disclosures	Value of cash and cash equivalents increases for firms with IC weakness	Negative
Koester et al. (2015)	Tax-related material IC weakness in IC and valuation of unrecognized tax benefits	5745	2007–2012	US	SOX 404 IC weakness disclosures	Tax-related material weakness in IC mitigates the positive association between unrecognized tax benefits and firm value	Positive
Bolton et al. (2016)	Industry contagion effect for negative reactions to IC weakness disclosures	49,092	2005–2014	US	SOX 404 IC weakness disclosures	Firms reporting IC weaknesses experience share price decline and peer industry firms experience similar declines	Positive
Church and Schneider (2016)	Effect of IC disclosures (quarterly and annual) on individuals' willingness to invest in a target company	136 participants	Not specified	US	SOX 302 & 404 IC weakness disclosures	Participants react negatively to the disclosure of a material weakness. They invest less in a target company when IC is ineffective rather than effective. Conversely, participants react positively to such disclosure accompanied by a clean (unqualified) audit opinion on IC.	Positive

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Table 3 (continued)

Authors	Association(s) examined	Sample	Period	Country	IC quality measure	Main findings	Effect of increased IC quality on attribute
Positive Gao and Jia (2016)	IC weakness and the valuation of cash holdings	7495	2004–2008	US	SOX 404 IC weakness disclosures	Investors value liquid assets in firms with IC weaknesses significantly less than in firms with no internal weaknesses	Positive
Gupta et al. (2018)	IC weakness disclosures and information asymmetry in capital markets	3262 (SOX 302) 3236 (SOX 404)	First time adoption of SOX 302 and 404	US	SOX 302 & 404 IC weakness disclosures	Subsequent to management's reporting on IC, the information environment improves for U.S. firms through decreased bid-ask spread and price volatility, and increased trading volume. Such results are not confirmed subsequent to the auditors' reporting on a company's IC over financial reporting.	Negative and not significant
Li et al. (2016)	IC weakness disclosures on firm valuation proxied by Tobin's q	1066	2004–2011	US	SOX 404 IC weakness disclosures	Firms reporting IC material weakness have 13% lower valuation than firms with effective IC	Positive
Pevzner and Gaynor (2016)	IC weakness and firms greater savings of cash from internally generated cash flows and stock liquidity effects	10,214	2005–2010	US	SOX 302 & 404 IC weakness disclosures	IC weaknesses are associated with stronger cash-to-cash flow sensitivities and with weaker impact of higher asset liquidity on stock liquidity.	Positive
Gao and Jia (2017)	IC weakness and the cost of raising equity capital	1082	1996–2009	US	SOX 302 & 404 IC weakness disclosures	Underwriters charge a risk premium on IC weakness issuers, especially on those disclosing IC weaknesses in multiple consecutive years	Positive
McNulty and Akhigbe (2017)	IC weakness and banks' stock returns	84	2002–2006	US	Legal expenses as a proxy for IC weakness	IC weaknesses (proxied by legal expenses) are positively (negatively) associated with loan losses (stock returns)	Positive
Qi et al. (2017)	IC weakness disclosures on value of corporate cash holdings and capital expenditures	12,317	2001–2010	US	SOX 404 IC weakness disclosures	IC weaknesses exacerbate agency conflicts	Positive
Non-US Studies Nishizaki et al. (2014)	Market reaction to the disclosure of IC weakness	124	2009–2010	Japan	J-SOX IC weakness disclosures	Material IC weaknesses have a significant negative effect on cumulative abnormal returns	Positive
Chen, Chan et al. (2016)	IC quality and future stock price crash risk	8495	2007–2010	China	Content analysis of annual reports government documents, and press releases (IC quality index)	IC quality (control environment and monitoring) is negatively associated with future stock price crash risk	Positive
Panel E: IC Quality and Auditors (7 studies) US Studies Chen et al. (2014)	IC weaknesses and audit delay and audit fees for high IT capability firms	6381	2004–2007	US	SOX IC weakness disclosures	Material IC weaknesses have a significant positive effect on the percentage of increase of audit delays and audit fees	Positive
Pizzini et al. (2015)	IC quality and audit delays	293	2000–2004	US	A survey data from the Institute of Internal Auditors	Audit delays are a decreasing function of IC quality	(continued on next page)

Table 3 (continued)

Authors	Association(s) examined	Sample	Period	Country	IC quality measure	Main findings	Effect of increased IC quality on attribute
Positive Haislip, Peters et al. (2016)	IT related IC weaknesses and auditor dismissal or switching	20,407	2004–2009	US	SOX 404 IT related IC weakness disclosures	Material IT related IC weaknesses are positively associated with subsequent auditor dismissals or switching	Positive
Lee (2016)	IC deficiencies in initial public offering (IPO) audits and audit fees.	673	2005–2014	US	SOX 302 & 404 IC weakness disclosures	Firms with IC deficiencies regarding pre-IPO financial reporting are likely to pay higher IPO audit fees	Positive
Non-US Studies Wan-Hussin and Bamahros (2013)	IC quality and audit delays	432	2009	Malaysia	The investment in and the sourcing arrangement of internal audit function	IC quality is negatively related to audit delays in the Malaysian setting	Positive
Khelif and Samaha (2014)	IC quality and audit delays	344	2007–2009	Egypt	Survey methodology among auditors to assess IC quality	IC quality is negatively related to audit delays	Positive
Mazza and Azzali (2018)	IT IC quality and audit fees	109	2010	Italy	Survey methodology among corporate governance members	IT IC quality is related to lower audit fees.	Positive
Panel F: IC Quality and Analysts (2 studies) US Studies Clinton et al. (2014)	Disclosures of IC weaknesses and analysts' forecasts coverage decisions	5272	2004–2009	US	SOX 404 IC weakness disclosures	IC weaknesses reduce analysts' forecasts accuracy and analyst's coverage	Positive
Non-US Studies Amping and Sautner (2013)	IC weaknesses and analysts' forecast accuracy and dispersion	7666	2001–2007	US foreign registrants from 15 European countries	SOX 404 IC weakness disclosures	EU cross-listed firms in US experience a significantly stronger decrease in both forecast error and forecast dispersion following SOX compared to non-cross listed EU firms	Positive
Panel G: IC Quality and Other Stakeholders (2 studies) US Studies Su et al. (2014)	IC weakness disclosures and sales growth (customers)	5080	2004–2007	US	SOX 404 IC weakness disclosures	A significant decline in sales growth following SOX 404 IC weakness disclosures. Such a decline is more pronounced for firms with company-level IC weakness disclosures, with industrial customers, in the durable goods industries, with high research and development intensity, or without future IC weakness remediation.	Positive
Non-US Studies Rae and Subramaniam (2008)	Whether IC quality moderates the relationship between organizational justice and employee fraud	64	2003	Australia	Survey methodology among chief accountants	The positive association between organizational justice and the probability to commit fraud becomes negative and significant for the interaction variable between IC quality and organizational justice.	Positive

2005). However, the intense competition may cause managers to reduce discretionary costs, improve inventory management and increase customers' satisfaction through higher IC quality to confer competitive advantages.

In a US setting, [Kim and Kim \(2015\)](#) consider the effect of three proxies for product market competition (the industry concentration index (Herfindahl-Hirschman Index), largest four-firm concentration ratio, and an industry leader indicator) on IC quality. They show that companies operating in highly competitive markets are characterized by lower IC quality (SOX 404 IC weakness disclosures). By contrast, [Zhang and Chen \(2016\)](#), in a Chinese setting, show that intense product market competition is associated with a higher level of IC disclosures. When testing for the moderating effect of state ownership, they provide evidence that the association remains significant only for non-state owned firms. Accordingly, the theoretical and empirical association between market product competition and IC quality, and factors mitigating the association, remains open to further research.

3. Economic consequences of IC quality

IC quality can affect decisions of financial statements users, both internal (e.g., managers) and external (e.g., creditors, investors, auditors, financial analysts and other stakeholders such as customers). This section reviews the effect of IC quality on stakeholders. We identify 61 economic consequence studies, of which 43 are US studies published since 2013 and 18 are non-US studies. The studies reviewed are listed in [Table 3](#). The economic consequence studies are categorized as: management decisions including earnings properties (26 studies, see [Table 3 Panel A](#)); management turnover and compensation (three studies, see [Table 3 Panel B](#)), debt markets (four studies, see [Table 3 Panel C](#)); equity markets (17 studies, see [Table 3 Panel D](#)), external audit (seven studies, see [Table 3 Panel E](#)), financial analysts (two studies, see [Table 3 Panel F](#)) and other stakeholders (two studies, see [Table 3 Panel G](#)).

3.1. IC quality and management decisions

IC quality can impact management behavior through the magnitude of discretionary accruals, earnings conservatism and the accuracy of management forecasts. With respect to discretionary accruals, the existence of material deficiencies in a firm's IC system implies inadequate control over financial reporting which translates into significant risk of material intentional and/or unintentional anomalies in financial statements ([Doyle, Ge, & McVay, 2007](#)). For instance, a weak IC environment (e.g., lack of segregation of duties, lack of experience) may result in the underestimation of bad-debt expense provision. In addition, a non-clear distinction between long-term assets and expenses in a firm's recording policy procedures may give to managers the choice to increase or decrease earnings depending on their personal objectives. This implies that IC quality impacts the magnitude of discretionary accruals ([Chan, Farrell, & Lee, 2008](#)). Further, IC deficiencies may lead to a tardy recognition of impairment losses due to the lack of appropriate accounting policies and procedures or unqualified accounting staff to value a firm's inventory, fixed assets and estimate the future cash flows of assets such as goodwill ([Goh & Li, 2011](#)). Impeding the timely recognition of losses leads to overvalued earnings and thus lower conservatism. Additionally, deficiencies in the IC system can imply that not all transactions are recorded in a timely manner leading to incomplete internal management reports and more uncertainty for management when estimating earnings and thus lowering earnings forecast accuracy ([Feng, Li, & McVay, 2009](#)).

This line of enquiry has continued in recent years with studies in US and non-US settings. It is an important line of enquiry to pursue given the previous mixed evidence on the consequences of IC quality on earnings quality ([Schneider et al., 2009](#)). [Jaggi, Mitra, and Hossain \(2015\)](#) document that earnings quality for firms characterized by SOX 404 IC weakness disclosures audited by Big-4 industry specialists is higher than that of the firms with low IC quality audited by Big-4 non-specialists. [Dowdell, Herda, and Notbohm \(2014\)](#) investigate the association between IC disclosures in management's and auditors' reports and discretionary accruals. They document that management's reports on IC improve financial reporting quality suggesting that such reports are beneficial even in the absence of attestation. [Järvinen and Myllymäki \(2016\)](#) and [Lenard, Petruska, Pervaiz, and Bing \(2016\)](#) investigate whether SOX 404 material weakness disclosures are associated with real earnings management practices. Their findings show that companies with low IC quality (reporting material IC weaknesses under SOX 404) engage in more manipulation of real activities (e.g. inventory over-production) compared to companies with effective IC. [Cho and Chung \(2016\)](#) focus on the banking sector and examine how IC quality, proxied by IC weakness disclosures, may influence loan reserves and provisions. Their findings show that loan reserves and provisions are higher in years of IC deficiency disclosures relative to years without such disclosures.

[Myllymäki \(2014\)](#) documents that the likelihood of misstatements in financial information continues to be significantly higher for two years after the last material IC weaknesses reported under SOX 404 compared to firms that do not report such types of IC deficiencies. Consistent evidence is provided by [Donelson, Ege, and McInnis \(2017\)](#) showing that the disclosure of SOX 404 IC weakness increases the likelihood of future fraud revelations. [Mitra, Jaggi, and Hossain \(2015\)](#) examine the association between IC quality and accounting conservatism in the US. They find that firms with firm-level IC deficiencies significantly changed their conservative reporting practice from the pre- to the post-SOX period and firms with SOX 404 IC weakness disclosure have greater accounting conservatism in the post-SOX period relative to firms with effective IC.

[Feng, Li, McVay, and Ashbaugh-Skaife \(2015\)](#) examine the association between IC quality linked to inventories and firms' inventory management and document that firms with inventory-related material weaknesses have lower inventory turnover ratios and report more inventory impairments compared to firms with effective IC. [Cheng, Dhaliwal, and Zhang \(2013\)](#), focusing on the investment behavior for a sample of firms characterized by disclosure of IC deficiencies under SOX (302 & 404), find firms' investment efficiency significantly improved after such disclosure. Similarly, [Sun \(2016\)](#) reports that firms with adverse SOX 404 opinions, indicating low IC quality, have lower investment than firms with clean SOX 404 reports. Following firm's remediations of IC deficiencies, investment increases.

Bauer (2015) examines the link between tax IC quality and tax avoidance, as measured by the cash effective tax rate. He documents that tax IC weakness disclosure under SOX 404 is associated with higher cash effective tax rates. Similarly, Gallemore and Labro (2015) document that firms disclosing SOX 404 IC weakness have lower effective tax rates. Focusing on disclosure of IT IC quality and 8-K filings, Holder, Lin, and Pinsker (2016) report that the disclosure of material IT IC weakness reduces firms' 8-K filing compliance and reporting timeliness. Huang and Chang (2015) explore how auditor-provided tax services affect the association between tax related IC and book-tax differences (permanent and temporary). Results show that firms characterized by tax IC weakness disclosures under SOX 302 or 404 experience larger permanent and temporary differences. Auditor-provided tax services mitigate the relationship between tax IC weaknesses and permanent differences in the post-SOX period.

Research on the association between IC quality and managers' actions in non-US settings has also expanded. Earlier research in Canada (Lu, Richardson, & Salterio, 2011) and China (Li, Tian, & Qi, 2012) find no association and a positive association between IC weaknesses and discretionary accruals, respectively. In the Netherlands, unaudited management statements of effective IC are associated with reduced discretionary accruals (Van de Poel & Vanstraelen, 2011). This research has been augmented with studies in Saudi Arabia, Germany, Korea, Malaysia and Japan with further studies in China. Using a Korean setting, Oh, Choi, Jeong, and Pae (2014) examine how IC over financial reporting regulation affects discretionary accruals. Following the adoption of SOX in the US, Korean policymakers adopted a regulation stipulating that larger listed firms are subject to stricter IC over financial reporting (ICFR) rules than smaller listed or non-listed large firms since May 2005. Their preliminary evidence suggests, surprisingly, that the adoption of ICFR rules increased discretionary accruals.

Nakashima and Ziebart (2015) examine whether Japanese-SOX equivalent (J-SOX) has an effect on earnings quality and earnings management for Japanese firms. They document an increase (no significant change) in accruals management and real earnings management for the period following J-SOX for firms disclosing (not disclosing) IC deficiencies. Brown, Pott, and Wömpener (2014) examine the effect of IC regulation in Germany (Legislation on Control and Transparency of 1998) on earnings quality. They find that firms experience an increase in timely loss recognition and a decrease in earnings smoothing in the post-adoption period. Al-Thuneibat, Al-Rehaily, and Basodan (2015) examine the effect of compliance with IC legislation on corporate profitability in Saudi Arabia setting. They document that only two components of the IC system, risk assessment and control of procedures, have a positive effect on corporate profitability, while control environment, information and communication and monitoring have non-significant effects on the same variable. Zhou, Chen, and Cheng (2016) investigate the effect of IC disclosure index on firm performance for different stages of a firm's life cycle (introduction, growth, mature, shakeout and decline) in Chinese setting. They document a positive effect of IC disclosure on firm performance that varies over different life cycle stages and is more significant in maturity and shakeout stages. Finally, Zakaria, Nawawi, and Salin (2016) using a Malaysian case study concerning an oil and gas company, find that IC weaknesses related to poor supervision and improper documentation process quality lead to fraudulent practices.

Collectively, this recent stream of literature, in conjunction with that prior to 2013, suggests that IC quality influences management behavior and is generally consistent with better financial reporting (e.g., higher earning quality, reduced discretionary accruals, more accurate earnings forecasts, tax avoidance, more efficient inventory management). With regard to accounting conservatism, empirical evidence is mixed.

3.2. IC quality, management turnover and executive compensation

Lower IC quality can have an adverse effect on management status inside the firm through higher turnover (e.g., Johnstone, Li, & Rupley, 2011) and reduced compensation (e.g., Hoitash, Hoitash, & Johnstone, 2012; Hsu & Liao, 2012). For instance, low IC quality can reduce earnings quality and its credibility among investors in the stock market and result in the replacement of top management or the reduction of executive compensation through lower bonuses based on the realized results.

Previous review papers (e.g., Bedard & Graham, 2014 and Schneider et al., 2009) suggest that US-empirical evidence documents that lower IC quality leads to higher management turnover (e.g., Johnstone et al., 2011) and reduced compensation (e.g., Hoitash et al., 2012). Our review identifies more recent US studies examining these associations, with nuances or moderating effects. Focusing on firms with and without IT-related IC deficiencies, Haislip, Masli, Richardson, and Sanchez (2016) report that firms with lower IT-IC quality experience higher CEO/CFO/Director turnover with remediation occurring timelier with the appointment of a new CFO with IT expertise. Haislip, Masli, Richardson, and Watson (2015) find that CFOs/CEOs losing their job due to lower IT-IC quality are less likely to subsequently find an equivalent job relative to CEOs/CFOs who lose their job due to non-IT related IC problems. Extending previous studies on the association between IC quality and executives' compensation, Paletta and Alimehmeti (2018) include all executives in their analysis and find that executives of firms with SOX 302 & 404 IC weakness disclosures earn higher compensation relative to executives in firms with quality IC systems. Despite this one piece of recent evidence, the overall conclusion from research to date is that lower IC quality has adverse consequences for executives.

3.3. IC quality and debt markets

It has been suggested that low IC quality can also have an adverse effect on creditors' lending decisions. Schneider and Church (2008) posit that adverse opinions on IC introduce concerns as to the reliability of financial data and increase the uncertainty associated with the loan applicant, thereby impacting the credit risk assessment. Costello and Wittenberg-Moerman (2011) suggest that low IC quality may affect loan pricing due to increased uncertainty regarding the firm's creditworthiness implying higher agency costs of debt and loan monitoring costs reflected in a higher interest rate. Verrecchia (2001) posits that managers' information advantage relative to lenders' increases uncertainty and information asymmetry for lenders, which in turn, translates into an

increased interest rate.

In their literature review, [Schneider et al. \(2009\)](#) conclude that US based empirical and experimental evidence supports the adverse effect of lower IC quality on the cost of debt. More recently, [El-Mahdy and Park \(2014\)](#) investigate the association between disclosure of IC deficiencies and average annual bid-ask spread in the US secondary loan market. They document that low IC quality is positively associated with higher information asymmetry in this market. [Tang, Tian, and Yan \(2015\)](#) investigate the association between IC quality and derivatives pricing using credit default swaps. They find that firms with SOX 404 IC weakness disclosures have higher credit default swap spread and that firm-level material IC problems are associated with higher credit default swap spreads than account-specific IC deficiencies. In the municipal bond market, [Park, Matkin, and Marlowe \(2017\)](#) find that IC deficiencies identified in external auditors' reports are associated with higher borrowing costs for municipal bonds with the association remaining stable before and after the financial crisis. [Guidara, Achek, and Dammak \(2016\)](#) focus on the cost of debt using a Tunisian setting and find that low IC quality, as proxied by an auditor's adverse opinion on IC system, increases the cost of debt and the association is stronger under high family ownership.

US studies dealing with creditors' perceptions of IC quality, proxied by credit spreads, contractual debt terms and credit default swaps, generally support that IC quality plays an important role in estimating default risks for creditors. Low IC quality is associated with higher costs. Limited international evidence exists to generalize these findings beyond the US.

3.4. IC quality and equity markets

IC quality is also believed to affect investors' perception of risk. For instance, when a firm's IC system has weaknesses, the quality and the precision of its accounting signals are impaired ([Ashbaugh-Skaife, Collins, Kinney, & LaFond, 2009](#)). Theoretical work by [Easley and O'Hara \(2004\)](#) suggests that poor information quality, mainly caused by material weaknesses in the IC system, has a non-diversifiable component that is priced by market participants, and more specifically, uninformed investors. Low IC quality may also lead to inadequate decisions by managers (e.g., investing in high risk projects during a poor performance period) which increases cash flow variability and failure probability ([Ogneva, Raghunandan, & Subramanyam, 2007](#)). This implies more uncertainty about a firm's future cash flows and translates to a higher cost of equity capital.

In their literature review, [Schneider et al. \(2009\)](#) suggest that lower IC quality generally leads to higher cost of equity capital and negative stock price reactions. In a recent study, [Gao and Jia \(2017\)](#) focus on the effect of IC quality on firms' cost of raising equity capital, documenting that underwriters charge firms reporting IC deficiencies (SOX 302 & 404 IC weakness disclosures) with higher risk premium. [McNulty and Akhigbe \(2017\)](#), in one of the few industry specific studies, report that banks characterized by legal expenses, as a proxy for IC weakness, experience lower stock returns. [Bolton, Lian, Rupley, and Zhao \(2016\)](#) investigate the industry contagion effect for negative reactions to IC weakness disclosures. They report that firms with lower IC quality experience share price declines and peer industry firms experience similar declines. [Dowdell, Kim, Klamm, and Watson \(2013\)](#) test for the effect of IC quality on market liquidity as proxied by bid-ask spreads. They find that firms with lower IC quality, as proxied by the disclosures of IC deficiencies, have higher bid-ask spreads compared to those with effective IC systems. Also interested in information asymmetry in capital markets, [Gupta, Sami, and Zhou \(2018\)](#) show that subsequent to management's reporting on IC, the information environment improves for U.S. firms through decreased bid-ask spread and price volatility, and increased trading volume. However, they do not report similar results subsequent to auditors' reporting on a firm's IC over financial reporting.

[Hu, Qi, Tian, Yao, and Zeng \(2013\)](#) explore how IC quality may affect the value relevance of earnings and book value. Using market model linking market value (dependent variable) to earnings and book value (explanatory variables), they document that earnings and book value have a significant negative effect on market value under SOX 404 IC weakness disclosures. Focusing on IT IC quality, [Kuhn, Ahuja, and Mueller \(2013\)](#) find that firms with SOX 404 IT IC weakness disclosures have lower market values. [Li, Yu, Zhang, and Zheng \(2016\)](#) investigate the effect of IC quality on firm valuation as proxied by Tobin's q. They provide evidence that firms with ineffective IC have 13 per cent lower valuation than firms with effective IC.

[Ashbaugh-Skaife, Veenman, and Wangerin \(2013\)](#) explore the effect of IC weaknesses under SOX 404 on the profitability of insider investors' trading as proxied by the capital gain after purchases and the losses avoided by selling shares. They provide evidence that the profitability of such trading is significantly higher in firms with IC deficiencies relative to those with effective IC. Investigating investment in target companies, [Church and Schneider \(2016\)](#) find that investment in target companies is lessened for firms with IC weakness disclosures.

More recent literature has focused on the effect of IC quality on aspects of cash holdings. [Huang, Gue, and Zhang \(2015\)](#) report that the value of cash improves for firms with IC weaknesses suggesting that precautionary cash and cash equivalent holdings in the presence of deficiencies in IC is valued. In contrast, [Gao and Jia \(2016\)](#) report that investors value liquid assets in firms reporting IC weaknesses significantly less relative to firms with effective IC. Similarly, [Qi, Li, Zhou, and Sun \(2017\)](#) document that the marginal value of corporate cash holdings and the contribution of capital expenditures to shareholder value, proxied by excess return, are significantly less for firms with ineffective IC. Investigating the impact of IC quality on firms' cash policies, [Pevzner and Gaynor \(2016\)](#) suggest that the presence of SOX 404 IC weaknesses increases a firm's reliance on internal financing. The increased uncertainty about future uses of cash reduces the positive impact of higher relative cash balance on stock liquidity. [Koester, Lim, and Vigeland \(2015\)](#) test whether tax IC weaknesses under SOX 404 influence investors' valuation of unrecognized tax benefits. They document that investors positively value unrecognized tax benefits and this association is less pronounced for firms characterized by tax IC weakness disclosures.

Outside of the US, [Nishizaki, Takano, and Takeda \(2014\)](#) utilize the introduction of J-SOX and find that firms disclosing J-SOX IC weaknesses experience lower cumulative abnormal returns over the period of 2009–2010. [Chen, Chan, Dong, and Zhang \(2016\)](#),

using a self-constructed IC quality index based on Chinese firms' annual reports, find IC quality is negatively associated with future stock price crash risk.

In sum, IC quality has an impact on the decisions made by investors proxied by several measures including cost of equity capital, market reactions (e.g., cumulative abnormal returns), bid-ask spreads and value relevance of earnings and book value with limited investigation beyond the US. Findings remain mixed regarding the association between IC quality and the value of cash holdings.

3.5. IC quality and auditors

IC quality is expected to impact the work of external auditors, indicated by audit fees and audit report lag. The detection of IC deficiencies heightens audit risk, necessitates more audit testing through corroborative approaches and increases audit scope and effort. Increased audit risk will be compensated by higher audit fees (Hogan & Wilkins, 2008), while increased audit effort will translate into longer audit delays (Khelif & Samaha, 2014).

Reviews by Asare et al. (2013), Bedard and Graham (2014) and Schneider et al. (2009) focus on the effect of IC quality on auditors in a US setting. Results from reviewed studies generally show that lower IC quality is associated with longer audit delays, higher audit fees and increased likelihood of auditor change. Recent literature investigating IC quality and audit delays suggests that higher IC quality leads to shorter audit delays. Chen, Smith, Cao, and Xia (2014) focus on high Information Technology (IT) capable firms measuring IC effectiveness of both the overall IC and five components of IC – control environment, risk assessment, control activities, information and communication and monitoring. They document that low IC quality has a significant positive effect on the percentage of increase of audit delays. Pizzini, Shu Lin, and Ziegenfuss (2015) investigate whether internal audit function quality, proxying for IC quality, affects audit delay for the pre-SOX 404 period. They document that audit delays are a decreasing function of IC quality. IC and audit delay studies have also been conducted in developing economies. Wan-Hussin and Bamahros (2013) document a negative association between the costs incurred for the internal audit function and audit delay. Similarly, Khelif and Samaha (2014) find a significant negative association between IC quality and external audit delays. Focusing on the geographical distance between audit firms and municipal clients, López and Rich (2017) report a positive association between disclosure of IC weaknesses and distance, suggesting longer distance is associated with greater audit rigor.

With respect to the literature relating IC quality and audit fees, Chen et al. (2014) analyze the association between SOX IC weakness disclosures and audit fees for high IT capable firms between 2004 and 2007 documenting that the disclosure of IC weakness is associated with higher audit fees. Lee (2016) investigates the relation between IC deficiencies in initial public offering (IPO) audits and audit fees. He finds that firms revealing IC deficiencies for the pre-IPO period are likely to pay higher IPO audit fees, implying that auditors revise audit fees in response to higher IC risk. A non-US study investigating audit fees and IC quality using a survey instrument among internal auditors in Italy reports a negative association between IC quality and audit fees (Mazza & Azzali, 2018).

With regard to auditor dismissal, Haislip, Peters et al. (2016) test whether firms with revealed IT IC deficiencies employ a strategy of disassociation with their current auditor. They document a positive association between firms reporting IT material weaknesses and subsequent auditor dismissals or switching. They further show firms hiring new audit firms with higher IT expertise have a greater likelihood of material weakness remediation within one year of reporting IC weaknesses.

Collectively, this literature supports the view that higher IC quality reduces audit delays and increases audit fees. Empirical evidence is limited outside of the US concerning the effect of IC quality on auditors' opinions, resignations and dismissals.

3.6. IC quality and financial analysts

IC quality could affect the decisions of financial analysts. Financial analysts strongly rely on firms' financial information to shape their earnings forecasts (Clinton, Pinello, & Ashbaugh-Skaife, 2014; Xu & Tang, 2012). When forming their earnings estimates, financial analysts base their predictions on earnings-related information, disaggregated segmental information and information provided by management (Rogers & Grant, 1997). Low IC quality can compromise the reliability of financial information via the introduction of noise, due to the lack of appropriate oversight, or proper documentation increasing the likelihood of unintentional errors in the accounting cycle introducing a bias into earnings quality (Clinton et al., 2014). Accordingly, financial analysts will face more difficulties in estimating accurately future earnings implying lower analysts' forecasts accuracy and greater analysts' earnings forecast dispersion.

Arping and Sautner (2013) study the effect of IC weakness disclosures under SOX 404 on analyst earnings forecasts for a sample of European firms that are cross-listed in the US and subject to SOX regulation and firms that are not cross-listed. They document cross-listed and non-cross-listed firms experience lower analyst earnings forecasts errors and dispersion with the decrease significantly larger for the former. Clinton et al. (2014) investigate the impact of SOX 404 IC weakness disclosures on analysts' forecasts and coverage decisions. They provide evidence that IC weakness disclosures reduce analysts' forecast accuracy and analysts' coverage.

Based on these two studies, financial analysts' earnings forecasts are impacted by the quality of firms' IC over financial reporting. Reducing information opacity by disclosing information related to the quality of the IC systems, increases forecast accuracy.

3.7. IC quality and other stakeholders

Employees in any firm have an explicit contract to receive compensation and rewards in line with the effort provided. If employees feel that are not treated fairly in their job, this will increase their motivation to commit fraud. In this regard, Rae and Subramaniam (2008) examine the moderating effect of IC quality on organizational justice and employee fraud in the Australian

setting. Using a survey among 64 chief accountants, they document the positive association between organizational justice and the probability to commit fraud becomes negative and significant for the interaction variable between IC quality and organizational justice.

Customers represent an important stakeholder with whom firms have an implicit contract (Su, Zhao, & Zhou, 2014). Customers' willingness to buy from firms is influenced by their perception of firms' ability and incentive to fulfill implied commitments (Maksimovic & Titman, 1991). Since IC deficiencies can signal the possibility of future litigation risks, this can compromise the capability of a firm to meet its commitments causing customer concern about firms' product quality and incentive to continue honoring implicit contracts (Su et al., 2014). Su et al. (2014) explore the possible effect of IC quality, as proxied by firms' IC weakness disclosures under SOX 404, on customers' perceptions of firms' ability to meet implicit commitments to customers as proxied by sales growth. Their findings show that lower IC quality, following SOX 404 IC weakness disclosures, is associated with a decline in sales growth. Such a decline is more prevalent for firms with firm-level IC deficiency disclosures, with industrial customers, in the durable goods industries, with high research and development intensity, or without future IC weakness remediation.

4. Limitations of IC accounting research

Prior to SOX, IC quality was typically measured using survey methodology among auditors (e.g., Ashton, Willingham, & Elliott, 1987; Wright & Wright, 1996). Post-SOX, research on the determinants and economic consequences of IC characteristics in the US proliferated. SOX 302 requires management to issue a report assessing the effectiveness of a firm's IC. Under SOX 404, external auditors must attest to management's IC reporting and are responsible for issuing a report on the effectiveness of IC over financial reporting. A potential limitation of studies using SOX disclosure requirements is that some material weaknesses might not be detected and disclosed as managers' and auditors' incentives to identify and report IC deficiencies play an important role in whether or not existing problems are ultimately disclosed. Rice and Weber (2012) provide evidence that the majority of firms that later report misstatements (and their auditors) do not report existing IC weaknesses and instead report that controls are effective.

Studies often measure IC quality as a dichotomous variable with 1 being disclosure of IC deficiencies and 0 otherwise. According to Oh et al. (2014, p. 413) *"this approach does not fully address the effect of the degree of regulation on accounting information quality, and yields only partial evidence of the benefits of having strong internal controls on accounting information quality"*. Reducing IC quality to a dummy variable represents a reductionist approach (Chen, Eshleman et al., 2016) and can omit firm's policies in terms of: (1) communication and enforcement of integrity and ethical values; (2) the procedures used to analyze risks and how manage them; (3) actions undertaken to achieve entity's objectives; (4) information tools and systems used to communicate and gather information; and (5) supervisory activities conducted to evaluate the effectiveness of IC. In addition, empirical studies dealing with U.S. setting generally focus on IC weaknesses and there is an opportunity to find an empirical proxy for excellent IC through the five IC components listed above.

The use of disclosure indices (content analysis) to measure IC disclosure/quality suffers from limitations. It can be difficult to replicate as it is self-constructed and the researcher relies on judgement during the coding process, which introduces potential bias (Hassan & Marston, 2010). In addition, self-constructed disclosure index studies dealing employ small sample sizes due to the labour-intensive data collection process (Hassan & Marston, 2010). Another potential limitation of applying such an approach is that the results are only valid if index items are appropriate since the type and number of items of information to be included in a self-constructed disclosure index is subject to judgment (Hassan, Romilly, Giorgioni, & Power, 2009).

Survey methodology has also been used in IC accounting research, especially in emerging economies where data on IC remains limited. For instance, Khlif and Samaha (2014) use a survey of auditors to assess the effectiveness and the quality of IC in Egypt based on a previously developed IC checklist. Mazza and Azzali (2015) survey internal auditors in Italy finding that increased internal audit quality is associated with reduced severity and persistence of control deficiencies. Surveying internal auditors or external auditors (Mazza & Azzali, 2015; Khlif & Samaha, 2014; Khlif & Samaha, 2016) is also subject to criticism. For instance, Bloomfield, Nelson, and Soltes (2016) state that responses resulting from the survey may be biased by the choice of samples as well as respondent self-selection to participate. They add that survey data can also be biased by how questions are asked, by respondents' lack of self-insight concerning their own judgment processes, and by respondents' desire for particular conclusions.

With respect to the sample selection process, a common methodology used in IC literature consists of the construction of matched samples (firms with low IC quality matched with a control sample including firms with effective IC). This can lead to incorrect inferences. Cram, Karan, and Stuart (2009) suggest that this may introduce a bias into the analysis since it is common for researchers to include all firms reporting IC weaknesses, while control sample (firms with effective IC) are selected using a much lower sampling rate which implies crudely equal 'case' and 'control' samples obtained. Propensity-score matching has become more prevalent in this literature, but this issue remains a limitation that applies especially to earlier studies.

Studies dealing with IC quality generally control for endogeneity and self-selection bias. However, almost all studies conducted in emerging economies (e.g., Agyei-Mensah, 2016; Khlif & Samaha, 2016; Zhou et al., 2016) do not control for endogeneity and do not use the Heckman-two-stage procedure to reduce the adverse effect of this statistical problem on estimating models' parameters.

Cross-country IC studies can suffer from several limitations. For instance, these empirical enquiries use Hofstede's cultural variables and other explanatory variables measured at the country level, while IC quality is a firm-level variable, and applying a country level measure at the firm level can bias the analysis. Further, Hofstede's cultural dimensions have been widely criticized by accounting scholars (e.g., Baskerville, 2003). The criticisms include: (1) outdated data; (2) assumptions of ethnic homogeneity in one country; (3) the close connection of cultural dimensions with socio-economic data; and (4) the inapplicability of the cultural dimensions to all countries and cultures (Baskerville, 2003).

Finally, with the literature continuing to mature, findings of studies using a longer post SOX time window augment those using narrower time windows. Findings from studies using a period very close to SOX adoption (either SOX 302 or SOX 404 or both) or around such an event (e.g. Balsam et al., 2014; Dowdell et al., 2013; El-Mahdy & Park, 2014) can be influenced by managers and auditors unfamiliarity with the application of the new regulation. Accordingly, early evidence reported with respect to the economic consequences of IC reporting can be mitigated later as external auditors and management may gain more experience and confidence in the exercise of judgment when interpreting and applying the SOX regulation either in US or other settings that have adopted similar regulations (e.g. Japan, South Korea).

5. Conclusions and future research

We discuss the development of the empirical literature and provide suggestions for future research on IC quality and its influence on financial statement preparers and users. From a methodological perspective, our review suggests that the regulatory environment determines IC disclosures and thus the availability of reliable information to research this area. In the US, the enactment of SOX allows researchers to proxy for IC quality through the disclosure of IC deficiencies. Where other countries have adopted SOX-like regulation (e.g., Japan, South Korea) knowledge is also emerging on cross-country similarities and differences in the determinants and consequences of IC quality facilitating insights on how economic, political and social factors may be contributing to the differences. In settings where the disclosure of IC data is unregulated, researchers use content analysis to assess IC quality through the voluntary disclosures of IC information prepared either by management (e.g., financial statements) or auditors (audit report on the effectiveness of IC). Researchers also apply survey methodology among auditors or management in emerging economies where IC practices are less developed.

The documentation, synthesis and evaluation of the IC accounting research is timely with our review offering three main insights. First, findings are mixed concerning the association between board characteristics (e.g., CEO duality, gender), ownership structure (e.g., family ownership), and IC quality, while empirical evidence concerning the effect of audit committee characteristics (financial expertise, number of meetings) on IC quality supports a positive and significant association. Second, extant literature concerning the economic consequences of IC quality suggests that the latter can have a significant effect on the decisions and behavior of management, investors, creditors and auditors. Third, US studies are most prevalent in this research domain. This is expected given the data availability pursuant to the introduction of legislation mandating disclosures about IC quality.

Our study contributes to the accounting and auditing literature in several ways. First, our review is informative for policymakers, managers and researchers. For policymakers, it highlights the advances in knowledge enabled by new regulated disclosures. Specifically, SOX disclosures have led to evidence-based assessments of the role of audit committees in improving IC quality. Disclosures under SOX have resulted in enhanced decision making due to reduced information opacity regarding the quality of financial reporting. For managers, our review suggests that lower IC quality increases audit delays, which in turn increase reporting lag and audit fees. Thus, improving IC can increase timely disclosure and reduce the audit costs. It is also relevant for investors, creditors and financial analysts through demonstrating the influence of IC on the cost of finance and earnings forecast accuracy. For researchers, this review represents a comprehensive compilation of the IC literature, identifying directions the IC literature has taken (e.g., gender influences on IC quality), and including suggestions for future research.

Future research on the determinants and effects of IC quality will further assist in understanding the cost-effectiveness of requiring management and auditor reporting on IC quality. There are numerous avenues to pursue. For instance, evidence on the effect of family ownership on IC practices remains mixed and further empirical investigations are needed in both developed and developing economies. Other ownership attributes including foreign, managerial, institutional and state ownerships and their effect on IC quality are also fruitful areas of enquiry. Hautz, Mayer, and Stadler (2013) and Khelif, Ahmed, and Souissi (2017) suggest that ownership identity can influence preferences and priorities with respect to corporate risk, decision making and reporting practices and this may have a direct impact on IC reporting. Political connections in corporate governance attributes (e.g., ownership, board of directors, CEO, CFO) should be also explored as a potential determinant of IC quality. Similarly, further empirical research on the economic consequences of IC quality on the cost of equity, dividend policy, cost of debt, earnings quality, accounting choices (fair value versus cost method) and auditors in developed and emerging economies is warranted to ascertain the importance of IC reporting for the investment community. It is also worthwhile to examine whether IC quality affects social and environmental disclosure policy and intellectual capital disclosures to assess the effect of IC environments on a wide range of stakeholders (e.g. employees, customers, labor unions and environmental organizations). Such research can inform the costs and benefits of IC disclosure requirements and shape the requirements.

Additionally, IC procedures may differ by industry (e.g., industrial, retail and banking and insurance sectors) and by sector (for-profit and not-for-profit) (Mazza & Azzali, 2018). For example, Dechow and Dichev (2002) suggest that the industrial sector is characterized by a longer firm production cycle due to unfinished production activities, and the completion and sale of their products, which is not the case for banks where there is more emphasis on credit management. Therefore, a fruitful area for research is to examine the determinants and economic consequences of IC quality for these specific industries. This is particularly true for the financial services sector, which has experienced a serious crisis in the last decade implying more need for empirical enquiries to assess whether IC effectiveness affect market value. IC quality in the non-listed and not-for-profit sector is a relatively unexplored area and therefore a fruitful avenue to pursue (Petrovits, Shakespeare, & Shih, 2011). Another research avenue is examining the effect of governance attributes on IC practices for governmental organizations and more specifically municipalities in European or Asian settings.

Finally, since IC quality may enhance overall corporate transparency, future research can explore the interaction that may exist

between disclosure policy (voluntary disclosure, timely disclosure, earning quality) and IC quality in shaping cost of debt and cost of equity capital. In addition, for countries that have adopted IFRS, future empirical enquiries may focus on the effect of IC quality on IFRS compliance.

It should be noted that narrative reviews may generally suffer from weaknesses concerning generalizability of their results (Ahmed & Courtis, 1999). Accordingly, we recommend the consolidation of the evidences reported in this literature review by undertaking meta-analyses dealing with the determinants and economic consequences of IC quality when a sufficient number of studies using similar proxies in their empirical analyses is available.

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⁴ *indicates that the paper is an empirical study and summarized in the tables.

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