Can Information Technology Investment Improve Internal Control Effectiveness? Evidence from China

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Abstract

This paper investigates the association between information technology (hereafter IT) investment and internal control effectiveness based on the questionnaire survey of internal control among listed firms, which is conducted by China Securities Regulatory Commission in year 2014. The empirical results show that IT investment is significantly and positively associated with internal control effectiveness. And this positive association is more pronounced when the IT-business strategy alignment is higher or executives' IT-use is more frequent. Additionally, we find that IT improves the effectiveness of internal control mainly by enhancing the efficiency of internal monitoring, which is one of the five components of internal control. Considering the effect of state ownership, we further document that the effect of IT investment on internal control effectiveness can only be held in non-state-owned enterprises. Overall, our results indicate that IT investment can improve internal control effectiveness. Moreover, "well adaptation" between IT and business process as well as human resources can better enhance internal control and protect the interests of stakeholders.

Keywords: IT investment, IT-business strategy alignment, internal control

1. INTRODUCTION

In the early 21st century, the high-profile corporate failures and accounting scandals of Enron, WorldCom and Xerox shocked the world capital markets. To regulate firms' corporate governance and improve investors' confidence in the integrity of financial reporting, the U.S. governments passed the milestone Sarbanes-Oxley Act (hereafter SOX). Subsequently in 2008, China also issued its first internal control norms, the "Enterprise Internal Control Standards," known widely as C-SOX, in order to improve internal control quality, enhance the quality of disclosure information and further make the capital markets more health and stability. Since then, internal control, as a kind of formal investor protection mechanism, has entered the view of stakeholders among listed firms.

With the rapid development of information technology (IT) as well as the widely and deeply use of it among enterprises, internal control has faced new challenges. Considering IT would bring great changes to the enterprises' business environment and patterns, The Committee of Sponsoring Organizations of the Treadway Commission (hereafter COSO) has updated the internal control integrated framework (1992) in 2013. In this updated framework, COSO for the first time proposed that for information technology, the organization shall select and implement general control activities to support the achievement of its goal. And this proposition has been listed as one of the 17 principles. Meanwhile, COSO has released a thought leadership paper titled COSO in the Cyber Age. This research report offers guidance on how to use the COSO framework to help organizations assess cyber risk and implement proper control. Article 7 of C-SOX also proposes that enterprises should use IT to strengthen their internal control, set up information systems adaptive to its operation business and management style, promote the integration of the internal control process and information system to realize

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the automatic control of the operation business and eliminate those manipulation factors. Although internal control framework of COSO and C-SOX have both considered the effect of IT on internal control, the above requirements only stay in the system specification level, they don't point out a specific mechanism or method on how to realize the integration of IT and internal control system.

Making the internal control system work efficiently is a major challenge for economists and management scholars. With the passage of SOX, academic researchers and practitioners have continuously explored the determinants of internal control effectiveness. Researchers documented that firm characteristics (Doyle, Ge, & McVay, 2007; Ashbaugh-Skaife, Collins, & Kinney, 2007), audit committee (Krishnan, 2005; Hoitash, Hoitash, & Bedard, 2009), corporate governance (Li, Sun, & Ettredge, 2010), employee's quality and policies (Call, Campbell, Dhaliwal, & Moon, 2017) etc. are all associated with internal control effectiveness. However, existing research seldom examines the effect of IT on internal control. Some researchers have examined the relationship between IT and internal control effectiveness from relative narrower perspectives, such as IT ability (Chen, Smith, Cao, & Xia, 2014) and the use of a certain technology (Masli, Peters, Richardson, & Sanchez, 2010). However, IT capability is not a proper proxy of IT. It is only a reflection of IT consequences. We need to further explore its front-end. With the gradually promotion of China's "Internet +" strategy and realizing the objectives of building a strong cyber-power nation, the investment on enterprises' IT will demonstrate a steady growth trend, especially with the acceleration development of integration of industrialization and informatization. Hence, in this context, whether and how the IT can improve the internal control effectiveness has become an important research question that is worthy for the academic researchers and practitioners to work on. In this study, we tried to explore the effect of IT investment on internal control in the front-end of IT perspective, aiming to provide empirical evidence on the effectiveness of internal control from IT's point of view. We also expect that our findings can accumulate new knowledge on internal control construction.

In this paper, we find that the level of IT investment in listed firms is positively associated with internal control effectiveness, and this positive relationship varies in different conditions. Specifically, when the IT-business strategy alignment is higher or executives' IT-use is more frequently, IT investment can significantly improve internal control effectiveness, and vice versa. In further analysis, we examine the effect of IT investment on five internal control components. We document that IT improves the effectiveness of internal control mainly through increasing the efficiency of internal monitoring. We also investigate whether the effect of IT investment on internal control varies with state ownership. The empirical results show the effect of IT investment on internal control effectiveness is more pronounced in non-state owned enterprises (hereafter non-SOEs).

This study makes two contributions. First, it complements the literature's findings about the economic consequences of IT investment. Existing research on the stream of IT consequences are mainly conducted on mature corporate governance environment in developed countries, such as U.S. Little is known in developing countries, especially the world's largest emerging market (Yayla & Hu, 2012). As the level of IT investment is not mandatorily disclosed (Henderson, Kobelsky, Richardson, & Smith, 2010), researchers have to employ kinds of indirect measurements of IT investment. Thus, the consequences of IT investment are still inconclusive and the results cannot be generalized due to small sample size. Based on the survey data of China Securities Regulatory Commission (CSRC), we can not only directly and accurately measure the level of IT investment, but also investigate majority of A-share listed firms in China. Hence, to some extent, our study helps to complement previous IT consequences literature by overcoming the measurement limitation and biased sample problems.

Second, this study contributes new empirical evidence to the internal control effectiveness in the context of informatization, enriches internal control theory from the integration of IT and internal control perspective. Taking the initial IT investment as a breakthrough point, we further examined the comprehensive effect of IT-business strategy alignment on internal control. It not only enriches literature on the determinants of internal control, but provides a theoretical basis and new empirical evidence for the integration of IT and traditional internal control methods in the background of informatization. Our results also have important implications for regulators in making policy on establishing sound internal control regulations in future.

2. HYPOTHESES DEVELOPMENT

SAS No.109 (AICPA, 2006) pointed out that IT can help entity to process large volumes of transactions or data consistently, enhance the ability to monitor the performance of the entity's activities, and also enhance the ability to achieve effective segregation of duties by implementing security controls in applications, databases, and operating systems. The adoption of IT system provides potential help in strengthening the effectiveness and efficiency of internal control (Alles, Kogan, & Vasarhelyi, 2002). Stratopoulos, Vance, & Zou (2013) found that

achieving effective control system requires large amount of investment in the aspects of time, resources, and technology tools. On the one hand, establishing a sophisticated information and control system needs a mass of fixed cost. On the other hand, running this system in daily operations also requires a lot of expenditure. Hence, we participate that the extent of IT investment affect entity's ability to establish and maintain a consummate internal control system and propose the first hypothesis as below:

H1: The level of IT investment is positively associated with internal control effectiveness.

IT-business strategy alignment is defined as the fit between IT strategy and business strategy in organizations (Sabherwal & Chan, 2001). Resource-based theory shows that IT alone may not produce sustainable performance advantages in a firm, but it can gain core advantages by using IT to complementary human and business resources (Powell & Dent-Micllef, 1997). Tight IT-strategy linkages create a close work environment for IT manager and business managers, which in turn brings a more effective IT system in a whole, as well as for long-term strategy system (Reich & Benbasat, 1990). It not only promotes a firm to perform more reasonable IT investment in long-term basis, but also makes the IT system more effective and valuable (Henderson & Sifonis, 1988). Moreover, when the IT-business strategy alignment is higher, IT manager and business managers are more likely to work with each other harmoniously. In this condition, business managers are heavily involved in IT activities, which can inspire their creative enthusiasm, promote the effectiveness of IT implementation and further contribute to developing new IT applications that may alter business processes and bring new competitive advantages for a firm (Jarvenpaa & Ives, 1990).

COSO (1992, 2013) pointed out that internal control system will be more effective if a firm properly integrate internal control system with firm-level infrastructure and business processes. Increasingly use of IT system have shifted firms' management and operation to be automatic controlled. And these automated controls further contribute to the extent of business integrated and automated (Curtis, Jenkins, Bedard, & Deis, 2009). Higher IT-business strategy alignment can decrease the possibility of "double-skin phenomena" between IT and business processes. Because IT can better serve strategic business units by timely responding any problems in operation and imbedding controls into automated infrastructure business processes, which can further enhance the effectiveness of internal control. Hence, we posit our second hypothesis as below:

H2: The positive effect of IT investment on internal control effectiveness is more pronounced when the degree of IT-business strategy alignment is higher.

In an enterprise, IT investment should have the support of "head" at all levels in order to better achieve the potential impact of IT investment (Delone & Mclean, 1992). After making the IT investment decision, the extent of users' acceptance and absorption can significantly affect the IT's application effectiveness (Liang & Xue, 2009). Based on the technology acceptance model (TAM), users' perceived usefulness and perceived ease of use jointly determine the acceptance and usage of a new IT system. Perceived ease of use is closely associated with the characteristics of system design and users. After IT investment, personal thought and ability should adapt the new IT system. Therefore, managers' ability to accept and use the new IT system have great influence on the role of IT plays. In other word, managers' attitude towards IT and their using habit of IT can form the basic tone of IT-use for the whole company. Users in subordinate positions will follow the example set by their superiors.

Unlike the matured capital market such as U.S., in China's enterprises, chairman of the board of directors, rather than CEO, is actually have the main responsibility for operating business. Chairman has absolute power and control rights in daily operating and decision making (Jiang & Kim, 2015). As an "absolute head" in a firm, chairman's habit in IT-use is very likely to affect his/her attitude towards acceptance and application of new technology. With the rising adoption of internet and Twitter, researchers such as Moez, Hirt, & Cheung (2007) and Barnes & Bohringer (2007) started to employ personal usage frequency of Internet or Twitter to measure personal's IT habit or attitude. Aline with this stream of literature, we construct a comprehensive variable equal to the mean value of chairman's usage frequency of Weibo, Wechat, Cloud disk and mobile office to proxy for his/her IT attitude or habit. Further, we collect the usage frequency of the above four IT applications for seven top managers, namely Chairman, CEO, Board secretary, CFO, IT director, Internal audit director and Internal control director. And we take the mean value of the seven executives' IT usage frequency to proxy for the IT usage tone of the whole company. We participate that if the tone is less use of IT, the effectiveness of IT investment is hard to be achieve the desired level. Hence, we put forward to the third hypothesis as below:

H3a: The positive effect of IT investment on internal control effectiveness is more pronounced when the Chairman's IT-use frequency is higher.

H3b: The positive effect of IT investment on internal control effectiveness is more pronounced when the executives' IT-use frequency is higher.

3. RESEARCH DESIGN

3.1 Sample selection

In order to investigate internal control situation of listed firms, CSRC organized China Association for Public Companies, Shanghai Stock Exchange, Shenzhen Stock Exchange, Internal Control Center for Enterprises and Non-profit Organization of Sun Yat-sen University and Shenzhen DIB Enterprise Risk Management Technology Ltd to be survey team in 2013. The official survey was launched on September 5th, 2014, and targeted all firms with A listed shares on China's two stock exchanges. Multiple individuals from 2,536 unique firms were invited to participate. Each firm received seven questionnaires to be completed by the Chairman, CEO, Board Secretary, CFO, Internal Auditor, IT Director and Internal Control Director. Targeted individuals were instructed to return their responses by September 15th, 2014, later extended to October 31st, 2014. By the end of October, there are 2,154 firms returned their questionnaire, and the response rate is 84.94% (Bernile, Cao, Lin, & Shu, 2017).

Due to the consideration that the impact of rapid expansion of IT on firm's operating environment, the survey team also designs some questions to know about IT situation in listed firms. The IT related data we used in this paper are from this survey, and the IT investment data covers 2011-2014 with all A share listed firms. Internal control data is from DIB database, and other financial data is from CSMAR database. We exclude firm-year observations that are from the financial and communication, software and information technology services industries because financial firms have unique data item, and communication, software and information technology services firms may invest more IT which would probably drives our results. We also exclude ST and *ST firms because these firms are under special treatment. Next, we exclude observations with missing data on the other variables used in the analyses. The final sample consists of 4315 firm-year observations. All continuous variables are winsorized at the 1% and 99% levels. To mitigate potential heteroscedasticity problem, we use the robust standard errors. Finally, we also add industry and year dummy variables to control fixed effect.

3.2 Regression model

Following Alexander, Bauguess, Bernile, Lee, & Marietta-Westberg (2013), Doyle, Ge, & McVay (2007) and Ashbaugh-Skaife, Collins, & Kinney (2007), we estimate the following pooled Logistic regression to test the relation between IT investment and internal control effectiveness:

$$ICD_{t+1}=\beta_0+\beta_1 IT\_Investment_t+\beta_2 Firm\_age_{t+1}+\beta_3 Size_{t+1}+\beta_4 Foreign\_sale_{t+1}+\beta_5 R\&D_{t+1}$$
$$+\beta_6 Lev_{t+1}+\beta_7 Growth_{t+1}+\beta_8 Loss_{t+1}+\beta_9 Top1_{t+1}+\beta_{10} Instown_{t+1}+\beta_{11} Multisegment_{t+1}$$
$$+\beta_{12} SOE_{t+1}+\beta_{13} Dual_{t+1}+\beta_{14} BH_{t+1}+\beta_{15} Big4_{t+1}+\sum Industry_{t+1} +\sum Year_{t+1} +\varepsilon \qquad (1)$$

Since IT implementations typically exhibit lags prior to producing the expected benefits (Barua & Mukhopadhyay, 2000), we consider whether the internal control weaknesses (*ICD*) occur in the year subsequent (*t+1*) to the IT investment (*t*) based on the research of Masli, Peters, Richardson, & Sanchez (2010).

We define *ICD* as an indicator variable that equals one if the firm discloses internal control weaknesses, and zero otherwise. In China, the internal control deficiency-disclosing ratio and information content are relatively low[1](Xie, Cao, Chen, & Li, 2016). Following Li, Lin, & Song (2011), we use the modified internal control deficiency under the provision of Public Company Accounting Oversight Board (hereafter PCAOB) Auditing Standard No. 5 to examine the relation between IT investment and internal control effectiveness. PCAOB Auditing Standard No. 5 and Internal Control Audit Guidance in China both indicate the indicators of material weaknesses in internal control over financial reporting, including: (i) identification of fraud, whether or not material, on the part of senior management; (ii) restatement of previously issued financial statements to reflect the correction of a material misstatement; (iii) Identification by the auditor of a material misstatement of financial statements in the current period in circumstances that indicate that the misstatement would not have been detected by the company's internal control over financial reporting; and (iv) ineffective oversight of the company's external financial reporting and internal control over financial reporting by the company's audit

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[1] The mean ratio of firms that disclose material weaknesses is 0.92% from 2011 to 2014 in China A-share market (the four years subsequent to the action of Enterprise Internal Control Standard in China), while the contemporaneous mean ratio of that in U. S. market is up to 19.45%.

committee. If the firm that does not disclose internal control deficiency has at least one of indicators, then we treat it as having internal control material weaknesses. Compared to the disclosing ratio of 12.91%, the proportion of existing internal control deficiency is 32.05% after the adjustment, with 10.73% of firms having control deficiency, 1.57% of firms having significant deficiency and 23.04% of firms having material weakness. Our primary test variable is IT investment (*IT_Investment*). We construct it as the percentiles of IT investment scaled by total assets by year. We also construct IT-Business strategy alignment (*Alignment*) and Executives' IT-use frequency (*Frequency*). The measurement of *Alignment* is derived from Anthony, Lewis, & Bryan (2006) and Chen (2010), and we design the following three questions to validate our construct: (i) the IT strategy and business strategy are in fit in my company; (ii) the IT plan is closely tied up with organizational strategic plan in my company; (iii) the business strategy and IT strategy are mapping closely in my company. CEO and IT director are required to respond to each question, and every question is with five scales. Scale 1 means strongly disagree, and scale 5 means strongly agree. Due to the fact that in company, CEO is in charge of strategy, and IT director is responsible to IT-related issues. So, we sum the responses of CEO and IT director to measure IT-business strategy alignment. Further, we measure *Frequency* from two aspects. Chairman's IT-use frequency (*Frequency1*), is the mean value of Chairman's four IT applications use frequency, including Weibo, Wechat, cloud disk and mobile office. Executives' IT-use frequency (*Frequency2*), is the mean value of executive team's (Chairman, CEO, Board secretary, CFO, IT director, Internal audit director and Internal control director) listed four IT applications use frequency. For each IT application, scale 1 means no use, and scale 5 means highly frequent.

We also control factors that prior literature (Alexander, Bauguess, Bernile, Lee, & Marietta-Westberg, 2013; Doyle, Ge, & McVay, 2007; Ashbaugh-Skaife, Collins, & Kinney, 2007) has demonstrated would influence internal control effectiveness. The first set is firm complexity factors, including the natural logarithm of total assets (*Size*), the natural logarithm of number of years the firm has been trading in a stock exchange (*Firm_age*), whether the firm has foreign sales (*Foreign_sale*), whether the firm has research and development expenditure (*R&D*), leverage (*Lev*), sales growth (*Growth*), natural logarithm of number of business segments (*Multisegment*), whether the firm has negative earnings (*Loss*). We also control corporate governance factors, which consist of the largest shareholder's ownership (*Top1*), institutional ownership (*Instown*), whether the chairman and CEO is the same person (*Dual*), whether the firm is a state-owned-enterprise (*SOE*), whether the firm has issued B share or H share (*BH*), whether the firm is audited by Big 4 audit firms (*Big4*). Table 1 represents detailed variable definitions.

Table 1. Variable definitions

Variables	Definition
ICD	An indicator variable coded 1 if the firm has internal control deficiency after the adjustment by PCAOB AS No. 5, and 0 otherwise.
IT_Investment	The percentiles of IT investment scaled by total assets by year.
Alignment	IT-Business strategy alignment. We take the sum of the responses of CEO and IT director to the survey instrument to validate the construct: (1) the IT strategy and business strategy are in fit in my company; (2) the IT plan is closely tied up with organizational strategic plan in my company; (3) the business strategy and IT strategy are mapping closely in my company. Each question is with five scales, scale 1 means strongly disagree, and scale 5 means strongly agree.
Frequency1	The mean value of Chairman's four IT applications (Weibo, Wechat, Cloud disk and mobile office) use frequency. For each IT application, scale 1 means no use, and scale 5 means highly frequent.
Frequency2	The mean value of executive team's (Chairman, CEO, Board secretary, CFO, IT director, Internal audit director and Internal control director) listed four IT applications use frequency. For each IT application, scale 1 means no use, and scale 5 means highly frequent.
Firm_age	The natural logarithm of number of years the firm has been trading in a stock exchange.
Size	The natural logarithm of total assets.
Foreign_sale	An indicator variable coded 1 if the firm reports foreign earnings, and 0 otherwise.
R&D	An indicator variable coded 1 if the firm reports research and development expenditure, and 0 otherwise.
Lev	The ratio of total debt to total assets.
Growth	The growth rate of earnings.
Multisegment	The natural logarithm of number of business segments
Loss	An indicator variable coded 1 if the firm reports a loss (negative earnings), and 0 otherwise.
Top1	The largest shareholder's ownership
Instown	Institutional ownership
Dual	An indicator variable coded 1 if the Chairman and CEO is the same person, and 0 otherwise.
SOE	An indicator variable coded 1 if the firm is a state-owned-enterprise, and 0 otherwise.
BH	An indicator variable coded 1 if the firm issues B share or H share, and 0 otherwise.
Big4	An indicator variable coded 1 if the firm is audited by Big 4 audit firms, and 0 otherwise.
Industry	Industry dummy variable, based on CSRC industry classification standard (2012).
Year	Year dummy variable.

4. EMPRICAL RESULTS

4.1 Descriptive statistics

Panel A of Table 2 presents the descriptive statistics on variables used in the analyses for the full sample. The results show that the ratio of disclosing internal control deficiency (*ICD*) is 32.10%, with the standard deviation 0.467, which reveals that the internal control quality of listed firms in China is relatively low and the variance across firms is large. The mean IT-business strategy alignment (*Alignment*) is 22.84, and the mean Executives' IT-use frequencies for Chairman (*Frequency1*) and the executive team (*Frequency2*) are 2.773 and 2.956 respectively. There are 55.40% of firms have foreign sales, 34.40% of firms are state-owned-enterprise, 5.00% of firms issue B share or H share, and 9.40% of firms have loss at the corresponding year.

Panel B of Table 2 presents the descriptive statistics on variables used in the analyses for firm-years with and without internal control deficiency. The mean IT investment (*IT_Investment*) is significantly lower for firm-years with internal control deficiency (48.719) than for those without internal control deficiency (51.875). This result provides preliminary evidence on the negative association between IT investment and internal control deficiency. Among the determinants of internal control deficiency, we find that firms with internal control deficiency are smaller, more easily have loss, have higher leverage, have lower largest shareholder's ownership and institutional ownership, and lower IT-business strategy alignment.

Table 2. Descriptive statistics

Panel A: Descriptive statistics for the full sample

Variable	N	Mean	Median	Min	Max	Sd
ICD	4315	0.321	0.000	0.000	1.000	0.467
IT_Investment	4315	50.863	51.000	1.000	100.000	28.870
Alignment	4315	22.841	24.000	7.000	30.000	3.872
Frequency1	4315	2.773	2.750	1.000	5.000	0.818
Frequency2	4315	2.956	2.964	1.292	4.792	0.556
Firm_age	4315	9.140	7.000	0.000	25.000	6.449
Size	4315	21.988	21.850	19.322	25.599	1.141
Foreign_sale	4315	0.554	1.000	0.000	1.000	0.497
R&D	4315	0.830	1.000	0.000	1.000	0.376
Lev	4315	0.432	0.423	0.045	0.964	0.211
Growth	4315	0.169	0.082	-0.592	4.464	0.528
Multisegment	4315	1.738	1.946	0.000	3.135	0.772
Loss	4315	0.094	0.000	0.000	1.000	0.292
Top1	4315	0.351	0.331	0.034	0.900	0.150
Instown	4315	0.387	0.400	0.000	0.870	0.232
Dual	4315	0.261	0.000	0.000	1.000	0.439
SOE	4315	0.344	0.000	0.000	1.000	0.475
BH	4315	0.050	0.000	0.000	1.000	0.218
Big4	4315	0.045	0.000	0.000	1.000	0.208

Panel B: IT investment and control variables by internal control effectiveness

	Firm-years with effective internal control			Firm-years with ineffective internal control			Difference test	
	N	Mean	Median	N	Mean	Median	*t*-test	Wilcoxon
IT_Investment	2932	51.875	53.000	1383	48.719	49.000	3.155***	3.359***
Alignment	2932	22.949	24.000	1383	22.612	23.000	0.337***	3.040*
Frequency1	2932	2.766	2.750	1383	2.788	2.750	-0.022	-0.682
Frequency2	2932	2.956	2.970	1383	2.957	2.964	-0.001	0.238
Firm_age	2932	9.033	7.000	1383	9.367	8.000	-0.334	-1.176
Size	2932	22.031	21.885	1383	21.898	21.783	0.133***	2.835**
Foreign_sale	2932	0.548	1.000	1383	0.568	1.000	-0.02	-1.204
R&D	2932	0.832	1.000	1383	0.827	1.000	0.004	0.353
Lev	2932	0.417	0.403	1383	0.463	0.466	-0.046***	-6.391***
Growth	2932	0.171	0.088	1383	0.165	0.068	0.006	2.894***
Multisegment	2932	1.713	1.946	1383	1.791	1.946	-0.078***	-3.307***
Loss	2932	0.070	0.000	1383	0.146	0.000	-0.076***	-8.030***
Top1	2932	0.357	0.338	1383	0.338	0.312	0.020***	3.898***
Instown	2932	0.401	0.410	1383	0.357	0.350	0.044***	5.826***
Dual	2932	0.266	0.000	1383	0.251	0.000	0.015	1.032
SOE	2932	0.341	0.000	1383	0.351	0.000	-0.01	-0.621
BH	2932	0.051	0.000	1383	0.048	0.000	0.003	0.436
Big4	2932	0.052	0.000	1383	0.033	0.000	0.019***	2.791***

Note: This table reports descriptive statistics. Panel A and B represent the descriptive statistics on variables for the full sample and separately for firm-years with and without internal control deficiency, and the difference between two groups using a t-test and Wilcoxon rank-sum test. All continuous variables are winsorized at the 1% and 99% levels.

4.2 Regression results

4.2.1 IT investment and internal control effectiveness: Tests of H1

Table 3 presents the regression results on the association between IT investment and internal control effectiveness. Column (1) and (2) show the pooled Logistic results of univariate and multivariate regression after controlling industry and year fixed effect respectively. In column (2), we find that the coefficient on *IT_Investment* is negative and significant (-0.003 with t-statistic of -2.59). This result indicates that internal control effectiveness is lower for firm-years with lower IT investment, consistent with H1. Column (3) presents the ordered Logistic regression results on the association between IT investment and internal control weakness severity. *IC_severity* is coded 3, 2, 1, and 0 separately if the firm exists material weakness, significant deficiency, control deficiency, and no deficiency. We find that the coefficient on *IT_Investment* is negative and significant (-0.003 with t-statistic of -2.53). this result further indicates that the internal control weakness is less severe for firm-years with more IT investment, which would induce a higher informatization level. Overall, consistent with H1, we document a negative association between IT investment and internal control effectiveness.

Table 3. IT investment and internal control effectiveness

	(1)	(2)	(3)
	ICD		*IC_severity*
IT_Investment	-0.005***	-0.003***	-0.003**
	(-4.45)	(-2.59)	(-2.53)
Firm_age		0.004	0.001
		(0.62)	(0.18)
Size		-0.156***	-0.163***
		(-3.73)	(-3.97)
Lev		1.545***	1.648***
		(7.04)	(7.57)
Foreign_sale		-0.012	-0.021
		(-0.16)	(-0.28)
R&D		-0.258**	-0.248*
		(-1.99)	(-1.95)
Multisegment		0.024	0.025
		(0.42)	(0.45)
Growth		0.043	0.052
		(0.67)	(0.77)
Loss		0.529***	0.517***
		(4.54)	(4.63)
Top1		-0.345	-0.431*
		(-1.38)	(-1.74)
Instown		-0.664***	-0.691***
		(-3.77)	(-3.92)
SOE		0.056	0.002
		(0.63)	(0.02)
Dual		-0.097	-0.072
		(-1.20)	(-0.89)
BH		0.080	0.030
		(0.47)	(0.19)
Big4		-0.192	-0.188
		(-0.97)	(-1.01)
Cons1	0.014	2.995***	-3.255***
	(0.05)	(3.36)	(-3.67)
Cons2			-2.830***
			(-3.19)
Cons3			-2.771***
			(-3.12)
Industry	YES	YES	YES
Year	YES	YES	YES
N	4315	4315	4315
Pseudo R²	0.019	0.048	0.038

Note: This table shows the results of the regression model (1). All of the variables are as defined in Table 1. *, ** and *** indicate significance at the 10%, 5% and 1% levels of two-tails, respectively. T-values are shown in the brackets.

4.2.2 IT investment and internal control effectiveness: Tests of H2, H3a and H3b

We next examine the hypothesis 2, 3a and 3b. Table 4 presents the results on the association between IT investment and internal control effectiveness based on IT-business strategy alignment and executives' IT-use frequency. Column (1) to (2) are the results based on IT-business strategy alignment, in which we treat the firms belong to high alignment group if it is higher or equal to the median of *Alignment*. Column (3) to (4) are the

results based on Chairman's IT-use frequency, in which we classify the firms to high frequency group if it is higher or equal to the median of *Frequency1*. Column (5) to (6) are the results based on executive team's IT-use frequency, in which we classify the firms to high frequency group if it is higher or equal to the median of *Frequency2*. From column (1) and (2), we find that the coefficient on *IT_Investment* is negative, but just significant in high IT-business strategy alignment groups, and it indicates that IT investment could improve internal control effectiveness only when the IT and business strategy are well aligned. Column (3) and (4) show that the coefficient on *IT_Investment* is negative, but just significant in high Chairman's IT-use frequency group. Column (5) and (6) show that the coefficient on *IT_Investment* is negative, but just significant in high executive team's IT-use frequency group. The results indicate that IT investment could improve internal control effectiveness only when the executives use IT frequently. Overall, the above results are consistent with H2, H3a and H3b, and we document a more pronounced negative association between IT investment and internal control effectiveness in high IT-business strategy alignment, high Chairman IT-use frequency and high executive team's IT-use frequency firms.

Table 4. IT investment and internal control effectiveness—Alignment and IT-use frequency

	(1)	(2)	(3)	(4)	(5)	(6)
			ICD			
	Alignment High	*Alignment Low*	*Frequency1 High*	*Frequency1 Low*	*Frequency2 High*	*Frequency2 Low*
IT_Investment	-0.004**	-0.002	-0.004**	-0.003	-0.005***	-0.001
	(-2.30)	(-1.12)	(-2.32)	(-1.43)	(-2.64)	(-0.65)
Firm_age	-0.014	0.023**	-0.007	0.018*	0.000	0.009
	(-1.37)	(2.12)	(-0.72)	(-1.70)	(-0.03)	(-0.81)
Size	-0.157**	-0.146**	-0.154**	-0.159***	-0.148**	-0.194***
	(-2.52)	(-2.44)	(-2.49)	(-2.71)	(-2.56)	(-3.09)
Lev	1.965***	1.122***	1.320***	1.678***	1.802***	1.197***
	(5.97)	(3.74)	(3.94)	(5.65)	(5.90)	(3.69)
Foreign_sale	-0.136	0.123	-0.1	0.091	-0.185*	0.225*
	(-1.29)	(1.06)	(-0.93)	(0.81)	(-1.81)	(1.86)
R&D	-0.368*	-0.215	-0.212	-0.302	-0.225	-0.284
	(-1.91)	(-1.17)	(-1.12)	(-1.64)	(-1.33)	(-1.40)
Multisegment	-0.007	0.061	-0.07	0.139*	0.018	0.037
	(-0.09)	(0.72)	(-0.86)	(1.66)	(0.23)	(0.41)
Growth	-0.134	0.164*	0.034	0.063	0.106	-0.084
	(-1.15)	(1.89)	(0.38)	(0.65)	(1.27)	(-0.76)
Loss	0.364**	0.638***	0.437**	0.591***	0.454***	0.611***
	(2.03)	(4.09)	(2.47)	(3.76)	(2.82)	(3.54)
Top1	-0.569*	-0.117	-0.255	-0.36	-0.302	-0.311
	(-1.67)	(-0.31)	(-0.76)	(-0.96)	(-0.91)	(-0.79)
Instown	-0.728***	-0.641**	-0.635***	-0.753***	-0.546**	-0.786***
	(-3.07)	(-2.33)	(-2.60)	(-2.89)	(-2.27)	(-2.95)
SOE	0.113	0.05	0.18	-0.038	0.065	0.025
	(0.90)	(0.38)	(1.37)	(-0.30)	(0.54)	(0.19)
Dual	-0.364***	0.13	0.013	-0.230**	0.01	-0.245*
	(-3.21)	(1.10)	(0.11)	(-1.97)	(0.09)	(-1.95)
BH	-0.272	0.418	-0.128	0.167	-0.076	0.33
	(-1.11)	(1.60	(-0.50)	(0.68	(-0.34)	(1.22)
Big4	-0.011	-0.629	-0.095	-0.298	-0.254	-0.149
	(-0.05)	(-1.59)	(-0.36)	(-0.95)	(-0.96)	(-0.48)
Cons	4.454***	2.233*	3.334**	2.741**	2.657**	4.096***
	(3.17)	(1.77)	(2.49)	(2.21)	(2.19)	(3.01)
Industry	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
N	2323	1992	2169	2138	2433	1882
Pseudo R²	0.057	0.064	0.043	0.063	0.051	0.06

Note: This table shows the results of the regression model (1) for the sample partitioned by IT-business strategy alignment (see column 1 and 2) and executives' IT-use frequency (see column 3-6). All of the variables are as defined in Table 1. *, ** and *** indicate significance at the 10%, 5% and 1% levels of two-tails, respectively. T-values are shown in the brackets.

5. FURTHER ANALYSIS

5.1 IT investment and five elements of internal control

According to C-SOX, corporate internal control contains five elements: internal environment (*ic_a*), risk assessment (*ic_b*), controlling activity (*ic_c*), information and communication (*ic_d*) and internal monitoring (*ic_e*). Based on these five elements of internal control, we further analyze the effects of IT investment on firms' internal control effectiveness. Table 5 shows the results. Column (1) shows the effect of IT investment on the internal control quality index (*IC_index*), and column (2) to (6) presents the effect of IT investment on the five

components of internal control quality separately. The data of internal control quality index and its five components are from DIB database[2].

Results in table 5 show that IT investment has positive effect on internal environment (*ic_a*), risk assessment (*ic_b*), controlling activity (*ic_c*), as well as information and communication (*ic_d*), but none of them are significant. While IT investment can positively and significantly affect internal monitoring (*ic_e*). Our findings suggest that IT improves the effectiveness of internal control mainly by increasing the efficiency of internal monitoring. The possible explanation is that managers may easily access information data after the upgrading level of informatization. They can make timely response to the potential existing problems and quickly identify and revise control deficiencies in order to improve internal control effectiveness. It is worth to note that result in column (1) shows that the association of IT investment (*IT_Investment*) and internal control quality index (*IC_index*) is significantly positive, indicating our previous main results are robustness.

Table 5. IT investment and five elements of internal control

	(1)	(2)	(3)	(4)	(5)	(6)
	IC_index	*IC_a*	*IC_b*	*IC_c*	*IC_d*	*IC_e*
IT_Investment	0.008**	0.002	0.001	0.001	0.000	0.005***
	(2.20)	(1.04)	(0.97)	(0.32)	(0.08)	(2.63)
Firm_age	-0.091***	-0.051***	-0.022***	-0.074***	-0.031***	0.088***
	(-4.34)	(-5.51)	(-5.19)	(-7.95)	(-9.16)	(8.42)
Size	1.109***	0.293***	0.193***	0.070	0.072***	0.481***
	(8.57)	(5.39)	(7.50)	(1.29)	(3.45)	(7.79)
Lev	-4.419***	-1.620***	-0.222	-1.112***	0.295***	-1.760***
	(-6.18)	(-5.71)	(-1.61)	(-3.67)	(2.73)	(-5.03)
Foreign_sale	-0.132	-0.063	0.054	-0.212*	-0.031	0.120
	(-0.54)	(-0.60)	(1.08)	(-1.94)	(-0.80)	(0.97)
R&D	0.594	0.230	0.219***	0.041	0.194***	-0.089
	(1.52)	(1.37)	(2.72)	(0.25)	(3.24)	(-0.48)
Multisegment	0.247	0.011	0.098***	0.075	0.052**	0.010
	(1.51)	(0.16)	(2.72)	(0.96)	(1.97)	(0.11)
Growth	-0.337*	-0.001	-0.020	-0.159*	0.098***	-0.255**
	(-1.72)	(-0.02)	(-0.50)	(-1.86)	(3.02)	(-2.20)
Loss	-0.711*	-0.138	-0.009	-0.240	-0.039	-0.285
	(-1.83)	(-0.85)	(-0.11)	(-1.36)	(-0.67)	(-1.42)
Top1	-0.651	-0.422	-0.463***	-0.010	0.023	0.221
	(-0.88)	(-1.28)	(-2.83)	(-0.03)	(0.20)	(0.62)
Instown	2.092***	1.196***	0.285***	0.414*	0.005	0.193
	(4.08)	(5.28)	(2.59)	(1.72)	(0.06)	(0.76)
SOE	0.878***	0.349***	0.053	-0.255**	-0.125***	0.855***
	(3.25)	(2.90)	(0.94)	(-2.08)	(-2.84)	(6.97)
Dual	-0.249	-0.528***	0.069	0.053	0.040	0.117
	(-1.05)	(-5.10)	(1.34)	(0.47)	(1.07)	(0.98)
BH	1.438***	0.683***	0.042	0.677***	0.160*	-0.124
	(2.69)	(2.99)	(0.37)	(3.02)	(1.81)	(-0.50)
Big4	-0.855	-0.232	0.043	-0.152	-0.151*	-0.363
	(-1.48)	(-0.92)	(0.35)	(-0.69)	(-1.66)	(-1.40)
Cons	3.984	6.593***	-3.152***	6.537***	0.658	-6.653***
	(1.44)	(5.57)	(-5.73)	(5.50)	(1.49)	(-4.99)
Industry	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
N	4315	4315	4315	4315	4315	4315
Adj. R²	0.233	0.552	0.672	0.086	0.168	0.510

Note: *, ** and *** indicate significance at the 10%, 5% and 1% levels of two-tails, respectively. T-values are shown in the brackets.

5.2 IT investment, property right and internal control effectiveness

We further test how the effects of IT investment on internal control effectiveness varied with state ownership by estimating regression (1) in the subsamples, which are partitioned based on state ownership status. Results are shown in table 6. Column (1) is the result for state-controlled listed firms (*SOEs*) and column (2) is the result for non-state-controlled listed firms (*non-SOEs*). We also add the interaction term of *SOE* and *IT_investment* in the regression model and the result is presented in column (3). We can see that the significant negative effect of IT

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[2] *IC_index* is an index developed by DIB Company to measure internal control quality. According to C-SOX, a corporate internal control system contains five elements: internal environment, risk assessment, controlling activity, information and communication and internal monitoring. These five elements can be further divided into multiple second-level indicators. Each indicator equals 1 if a firm disclosed that it has met the requirement specified by that indicator and 0 otherwise. *IC_index* is the sum of all the second-level indicators. The higher the *IC_index*, the higher the quality of the firm's internal control. Based on their *IC_index*, DIB issued a white paper on internal control of China's listed firms annually, which is be published in China Securities Daily every year from 2008. Now, this disclosure index is publicly available and widely used in China's academic, such as Li et al. (2010).

investment on internal control deficiencies can only be held in non-SOE firms. Column (3) shows a positive and significant coefficient of *SOE×IT_Investment* (coeff. = 0.007; t = 2.70), indicating the effects of IT investment on internal control effectiveness are significantly varied with state ownership.

There are two possible explanations of the above results. On the one hand, corporate governance differs a lot in *SOEs* and *non-SOEs* (Jiang & Kim, 2015). For example, CEOs in *SOEs* have to take their political future and evaluation pressure into their business decision. When making IT investment decision, they are more likely to simply respond to the national call or just to meet their performance requirements. These "formal over substance" requirements may cause the IT investment less likely to be linked to the actual business units. On the other hand, those SOEs are normally long-listed firms with relatively complete system construction. Based on our field research[3], we found that most of SOEs have established systems or procedures similar to internal control in order to meet the regulatory requirements of multiple regulators. And those systems can better satisfy the demand of internal control effectiveness (Bernile, Cao, Lin, & Shu, 2017). Thus, the incremental enhancing of internal control effectiveness by IT investment in SOEs may not be significant. On the contrary, those non-SOEs are generally short-listed firms. They haven't set up a complete internal control system as those SOEs. They need to make the IT investment from their inherent needs. The demand of thrusting internal control concepts into information system is larger. Therefore, the informatization level can significantly improve the internal control effectiveness for non-SOEs.

Table 6. IT investment, property right and internal control effectiveness

	(1)	(2)	(3)
		ICD	
	SOEs	*Non-SOEs*	*All Firms*
IT_Investment	0.002	-0.004***	-0.005***
	(0.80)	(-2.70)	(-2.87)
SOE			-0.267*
			(-1.79)
*SOE*IT_Investment*			0.007***
			(2.70)
Firm_age	-0.012	0.003	-0.003
	(-0.93)	(0.28)	(-0.39)
Size	-0.197***	-0.162***	-0.162***
	(-2.68)	(-2.93)	(-3.81)
Lev	1.651***	1.478***	1.545***
	(4.11)	(5.16)	(6.81)
Foreign_sale	-0.027	-0.030	-0.041
	(-0.19)	(-0.29)	(-0.50)
R&D	-0.068	-0.367*	-0.216*
	(-0.36)	(-1.86)	(-1.65)
Multisegment	0.120	-0.034	0.018
	(1.24)	(-0.43)	(0.31)
Growth	-0.101	0.101	0.046
	(-0.75)	(1.28)	(0.69)
Loss	0.532***	0.461***	0.489***
	(2.96)	(2.77)	(4.09)
Top1	-0.839*	-0.395	-0.388
	(-1.66)	(-1.24)	(-1.50)
Instown	0.005	-0.936***	-0.697***
	(0.01)	(-4.33)	(-3.83)
Dual	-0.196	-0.089	-0.114
	(-0.93)	(-0.97)	(-1.38)
BH	0.050	0.259	0.101
	(0.21)	(0.89)	(0.58)
Big4	-0.237	-0.216	-0.214
	(-0.78)	(-0.75)	(-1.09)
Cons	2.547	3.998***	3.296***
	(1.63)	(3.34)	(3.61)
Industry	YES	YES	YES
Year	YES	YES	YES
N	1485	2830	4315
Pseudo R²	0.097	0.061	0.061

Note: This table shows the results of the regression model (1) for the sample partitioned by SOE. All of the variables are as defined in Table 1. *, ** and *** indicate significance at the 10%, 5% and 1% levels of two-tails, respectively. T-values are shown in the brackets.

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[3] We investigated two state-controlled listed firms in China, one is China State Construction Engineering Corporation (stock code: 601668), and the other is Beijing Gehua Cable TV network Corporation (stock code: 600037). The two firms not only need to satisfy the internal control requirements of CSRC, but also accept the previously existing supervision from State-owned Assets Supervision and Administration Commission of the State Council. There are many similarities between the two different regulatory requirements.

5.3   Robustness test

We conduct the following two tests to check the robustness of the main results.

1. Considering the possible changes of chairman during the sample period, we delete samples with chairman's tenure less than four years. Thus, our total sample size is reduced to 3,320 and the results are still consistent with previous main results.

2. We changed measurements of main variables, for example, we use gross revenue to measure firm size, standardize IT investment variable etc. The results are still robust.

6.   CONCLUSIONS

With the rapid development of information technology as well as the widely and deeply use of it among enterprises, internal control has faced new challenges. However, existing research on internal control effectiveness from the perspective of information technology is relatively limited. Under this background, we investigate the association between IT investment and internal control effectiveness based on the survey on China's listed companies' internal control conducted by CSRC in 2014. The findings show that: (1) IT investment is significantly and positively associated with internal control effectiveness; (2) This positive association differs with different conditions. Specifically, when the IT-business strategy alignment is higher or executives' IT-use is more frequently, IT investment can significantly improve internal control effectiveness, and vice versa. In further analysis, we examined the effect of IT investment on five internal control components. We documented that IT improves the effectiveness of internal control mainly through increasing the efficiency of internal monitoring. We also investigated whether the effect of IT investment on internal control varies with state ownership. The empirical results showed the effect of IT investment on internal control effectiveness was more pronounced in non-SOEs.

In summary, our results indicated that IT investment could improve internal control effectiveness. Further, "well adaptation" between IT and business process as well as human resources can better enhance internal control and protect the interests of stakeholders. The findings in our study have two important implications. First, the result provides direct evidence on the effectiveness of IT investment from an internal angle. It builds up a new knowledge on how to play a positive role of IT investment. Second, it complements internal control literature from IT perspective by providing empirical evidence of improving internal control effectiveness in the context of informatization. The findings have important implications for the listed firms in strengthening the internal control function under informatization background and for regulators in making policy in future.

ACKNOWLEDGEMENTS

REFERENCES

Alexander, C. R., Bauguess, S. W., Bernile G., Lee, Y. A., & Marietta-Westberg, J. (2013). Economic effects of SOX Section 404 compliance: A corporate insider perspective. *Journal of Accounting and Economics*, 56, 267-290.

Alles, M. G., Kogan, A., & Vasarhelyi, M. A. (2002). Feasibility and economics of continuous assurance. *AUDITING: A Journal of Practice & Theory,* 21, 125-138.

American Institute of Certified Public Accountants (AICPA). (2006). Understanding the entity and its environment and assessing the risks of material misstatement. Statement on Auditing Standards No. 109. New York, NY: AICPA.

Anthony B. T., Lewis, B. R., & Bryan R. W. (2006). The leveraging influence of strategic alignment on IT investment: An empirical examination. *Information & Management.* 43, 308-321.

Ashbaugh-Skaife, H., Collins, D. W., & Kinney, W. R. (2007). The discovery and reporting of internal control deficiencies prior to SOX-mandated audits. *Journal of Accounting and Economics,* 44, 166-192.

Barnes, S. J., & Bohringer, M. (2011). Modeling use continuance behavior in microblogging services: The case of twitter. *Journal of Computer Information Systems*, 51, 1-10.

Barua, A., & Mukhopadhyay, T. (2000). Business value of information technologies: Past, present and future. In framing the domains of IT management: Projecting the future through the past, edited by Zmud, R. W., Cincinnati, OH Pinnaflex Educational Resources.

Bernile, G., Cao, J., Lin, B. & Shu, W. (2017). The economic effects of mandated ICFR disclosure in China: An insider perspective. *Working paper*.

Call, A. C., Campbell, J. L., Dhaliwal, D. S., & Moon, J. R. (2017). Employee quality and financial reporting outcomes. *Journal of Accounting and Economics,* 64 (1), 123-149.

Chen, L. (2010). Business–IT alignment maturity of companies in China. *Information & Management,* 47, 9-16.

Chen, Y., Smith, A. L., Cao, J., & Xia, W. (2014). Information technology capability, internal control effectiveness, and audit fees and delays. *Journal of Information Systems, 28*, 149-180.

Curtis, M. B., Jenkins, J. G., Bedard, J. C., & Deis. D. R. (2009). Auditors' training and proficiency in information systems: A research synthesis. *Journal of Information Systems*, 23(1), 79-96.

Delone, W. H., & Mclean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research*, 3 (1), 60-95.

Doyle, J., Ge, W., & McVay, S. (2007). Determinants of weaknesses in internal control over financial reporting. *Journal of Accounting and Economics*, 44 (1-2), 193-223.

Han, S., Rezaee, Z., Xue, L., & Zhang, J. H. (2016). The association between information technology investments and audit risk. *Journal of Information Systems, 30*, 93-116.

Henderson, B. C., Kobelsky, K., Richardson, V. J., & Smith, R. E. (2010). The relevance of information technology expenditures. *Journal of Information Systems*, 24 (2), 39-77.

Henderson, J. C., & Sifonis, J. G. (1988). The value of strategic IS planning: understanding consistency, validity, and IS markets. *MIS Quarterly*, 12, 187-200.

Hoitash, U., Hoitash, R., & Bedard, J. C. (2009). Corporate governance and internal control over financial reporting: A comparison of regulatory regimes. *The Accounting Review*, 84 (3), 839-867.

Jarvenpaa, S. L., & Ives, B. (1990). Information technology and corporate strategy: A view from the top. *Information Systems Research, 1*, 351-376.

Jiang, F., & Kim, K. A. (2015). Corporate governance in China: A modern perspective. *Journal of Corporate Finance, 32*, 190-216.

Krishnan, J. (2005). Audit committee quality and internal control: An empirical analysis. *The Accounting Review, 80* (2), 649-675.

Li, C., Sun, L., & Ettredge, M. (2010). Financial executive qualifications, financial executive turnover, and adverse SOX 404 opinions. *Journal of Accounting and Economics*, 50 (1), 93-110.

Li, W. F., Lin B., & Song, L. (2011). The role played by the internal control in companies' investment: Is it a promotion of efficiency or a repression there of? *Management World*, 2, 81-99+188. (in Chinese)

Li, W. F., Lin, B., Yang, D.M., & Sun, Y. (2010). Internal control disclosure, firm over-investment, and financial crisis: Evidence from Chinese listed companies. *China Accounting and Finance Review, 12*, 107-141.

Liang, H., & Xue, Y. (2009). Avoidance of information technology threats: A theoretical perspective. *MIS Quarterly, 33*, 71-90.

Masli, A., Peters, G. F., Richardson, V. J., & Sanchez, J. M. (2010). Examining the potential benefits of internal control monitoring technology. *The Accounting Review, 85*, 1001-1034.

Moez, L., Hirt, S. G., & Cheung, M. K. C. (2007). How habit limits the predictive power of intention: The case of information systems continuance. *MIS Quarterly, 31*, 705-737.

Powell, T. C., & Dent-Micllef, A. (1997). Information technology as competitive advantage: the role of human, business and technology resources. *Strategic Management Journal*, 18 (5), 375-405.

Reich, B. H., & Benbasat, I. (1990). An empirical investigation of factors influencing the success of customer-oriented strategic systems. *Information Systems Research, 1*, 325-347.

Sabherwal, R., & Chan, Y. E. (2001). Alignment between business and IS strategies: A study of prospectors, analyzers, and defenders. *Information Systems Research, 12*, 11-33.

Stratopoulos, T. C., Vance, T. W., & Zou, X. (2013). Incentive effects of enterprise systems on the magnitude and detectability of reporting manipulations. *International Journal of Accounting Information Systems*, 14 (1), 39–57.

Xie, F., Cao, J., Chen, Y, & Li, Y. (2016). Research on economic consequences of internal control deficiency: From the perceptive of mandatory compliance. *Accounting Research*, 9, 62-67. (in Chinese)

Yayla, A. A., & Hu, Q. (2012). The impact of IT-business strategic alignment on firm performance in a developing country setting: exploring moderating roles of environmental uncertainty and strategic orientation. *European Journal of Information Systems*, 21: 373-387.