The Influence of Enterprise Digitalization on Internal Control Quality

Yaqi Zhang*

*zhangyaqi0714@163.com

Beijing Jiaotong University, School of Economics and Management, China

Abstract. As an important way to promote the combination of real economy and digital economy, enterprise digitalization plays a vital role in promoting high-quality economic development. This paper investigates the impact of enterprise digitalization on the internal control quality based on a text mining approach, using 2009-2020 Shanghai and Shenzhen A-share listed companies for research. It can be seen that enterprise digitalization can enhance the internal control quality. And further heterogeneity analyses reveal that enterprise digitalization has a more pronounced effect on internal control quality improvement for private enterprises and for the samples after the implementation of the national industrial policy for digitalization of the real economy. The research in this paper provides a new perspective for driving enterprises to strengthen internal governance in the digital era, and provides empirical evidence for enterprises to promote the embedding of digital technology into internal governance.

Keywords: Digitalization; Internal control; Text mining

1. Introduction

With the deep evolution of the new round of technological revolution, at the macro level, the new generation of digital intelligence technology can promote the all-round reshaping of the entire economic form, which can not only create a new industrial industry, drive a new round of consumption and investment growth, but also realize the multiplier effect of industrial total factor productivity; while at the micro level, many traditional enterprises are seizing the strategic opportunity of digital technology embedding and digital technology empowerment to deeply embed digital technology into their production, R&D, management and sales systems. Digital intelligence technologies drive enterprise digitalization. Enterprise digitalization in a broad sense includes the use of digital technology, business model innovation and digital strategy change [1], and enterprise digitalization reflects a high degree of integration between the digital and real economy.

Enterprise digitalization has driven innovation in enterprise governance models. Internal control is an important part of modern enterprise governance mechanism, and perfect internal control is conducive to enterprise value creation and risk prevention. With wide application of new technologies in the digital era, the business management, value creation and risk prevention capabilities of enterprises have undergone great changes. A new governance model that integrates internal control with digital governance has become an inevitable choice for many companies in the digital economy. Through digitalization of internal control, enterprises can

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fully exploit the role of digitalization in corporate governance to promote the improvement of operational management efficiency and the realization of value creation. However, while new technologies have provided more effective ways for information collection and disclosure, they have also further exacerbated the current dilemma of internal control evaluation reports, which are important vehicles for conveying information on corporate internal control, in reflecting new changes and insufficient demand for new information. An important reason for this phenomenon is that in the context of new business models, new business formats and digitalization scenarios, innovation in theoretical research on internal control is significantly lagging behind the development of corporate practice.

In view of this, this paper selects 2009-2020 Shanghai and Shenzhen A-share listed companies for research, constructs an enterprise digitalization thesaurus based on text data mining methods, measures the degree of enterprise digitalization based on thesaurus word frequency as the basis of text mining, and explores the influence of enterprise digitalization on the internal control quality. The results represent that enterprise digitalization can improve the internal control quality, and through further research, it is found that the role of enterprise digitalization in improving internal control quality is more pronounced for private enterprises and for the samples after the implementation of the national industrial policy for digitalization of the real economy. The research implications lie in: at the theoretical level, the role of enterprise digitalization on internal control quality is studied based on a large sample of micro tests, which provides a theoretical reference to further promote the improvement of internal control in enterprises in the digital era and expands the research on the consequences of enterprise digitalization; at the practical level, industrial digitalization is still an important goal for the development of the real economy at present. Therefore, in the current new development pattern, digitalization is crucial to enterprises, and the influence of enterprise digitalization on the internal control quality explored in the study provides rich empirical evidence for enterprises to implement enterprise digital strategies, which is conducive to the path of high-quality development driven by digital technologies.

2. Theoretical analysis and hypothesis

Enterprise digitalization is a company-wide phenomenon [1], in which enterprises use digital intelligence technologies to make changes in business processes, culture and organization [2]. For example, enterprises can embed digital technologies into their production, R&D, management and sales systems, and finally realize digital technologies to deeply empower the innovation chain, supply chain, value chain and all-round management of enterprises.

The degree of enterprise digitalization has two effects on internal control. On the positive side, enterprise digitalization can be deeply involved in all aspects of internal control, strengthening the motivation of companies to improve their internal control mechanisms and ultimately enhancing internal control quality. Secondly, the application of information technology is one of the important means of digitalization, and successful implementation of information technology can also improve the internal control quality of enterprises [3]. Moreover, enterprise digitalization can curb internal opportunistic tendencies and contribute to the transparency of stakeholder information [4]. Especially when digitalization is deeply embedded in enterprise operation management and business system, the information disclosure system of enterprises

will be reshaped in all aspects [5], thus contributing to the improvement of internal control quality. In addition, enterprise digitalization can improve the efficiency and agility of all aspects of internal control. Enterprise digitalization enables dynamic capture and identification of risks in the interaction between the enterprise and the environment, dynamic feedback and evaluation of management decisions, and also improves the efficiency of communication with external stakeholders and the dynamics of decision-making interactions, thus helping to enhance the internal control quality [6].

However, on the negative side, enterprise digitalization requires organizational changes and strategic changes, as well as the formation of a digital growth strategy. However, transactions in fast-growing companies tend to be more complex and staff changes can be greater. At this time, the internal control may be more deficient because it does not adapt to the changes in the new environment, which will reduce the internal control quality [7]. Moreover, if the information technology adopted in the enterprise digitalization is not effectively implemented within the enterprise, it can also increase the control risk of the enterprise [8]. Accordingly, the following competing hypotheses are formulated in this paper:

H1a: Under the same conditions, enterprise digitalization can improve the internal control quality.

H1b: Under the same conditions, enterprise digitalization can reduce the internal control quality.

3. Research design

3.1 Sample and data selection

Due to the financial crisis that occurred in 2008, which had a large damage to China's economy, this paper takes 2009 as the initial year and this paper selects 2009-2020 Shanghai and Shenzhen A-share listed companies for research.

Drawing on the existing relevant literature, this paper also treats the samples as follows: I. Excluding the companies of insurance and finance industries; II. Excluding the companies that had been ST or PT; III. Excluding the companies with missing main variables; IV. Winsorizing all continuous variables at the top and bottom 1% levels. The final panel data is obtained for a total of 25,584 company-annual sample observations.

The internal control index data are obtained from DIB database, the annual report data of relevant enterprises are obtained from the official websites of Shanghai stock exchange and Shenzhen stock exchange, all other data are obtained from CSMAR.

3.2 Empirical model and variable definitions

$$IC_{it} = \alpha_0 + \alpha_1 Digital_{it} + \alpha_i \sum Control_i + \varepsilon_{it} \quad (1)$$

Among them, the explained variable is internal control (IC), referring to Ruijing Li et al., internal control quality is measured by the natural logarithm of internal control index from the DIB database after adding 1 [9] (see **Table 1**).

Table 1 Variable Definition

Variable	Variable definitions
IC	Ln (internal control index+1)
Digital	Measured based on text mining data
Size	Ln (annual total assets)
Lev	Total liabilities / Total assets
ROA	Net profit / Average balance of total assets
Cashflow	Net cash flow from operating activities/Total assets
Age	Ln (current year - year of listing +1)
Board	Ln (the number of directors)
Indep	Number of independent directors/Number of directors
Dual	The chairman and general manager are the same as 1, otherwise 0
SOE	State-owned enterprises take the value of 1, others are 0
Big4	The company is audited by the PWC, DTT, KPMG or EY as 1, otherwise it is 0

The explanatory variable is enterprise digitalization, referring to Fei Wu et al, this paper extracts the text of annual reports of listed companies based on Python to form a data pool, searches, matches and counts word frequencies based on 159 feature words, then classifies and collects the word frequencies of key technology directions and forms the final summed word frequencies, so as to build an index system of enterprise digitalization [10] (see **Table 1**).

Referring to the research of Pingping Huang et al. and Hongjun Xiao et al., the control variables in this paper include variables of company basic financial characteristics: Company size(Size), Asset-liability ratio (Lev), Return on assets (ROA), Cash flow ratio (cashflow) and Listing age (age); variables of corporate governance characteristics: Board size(Board), Proportion of independent directors (Indep), Whether the chairman and the general manager are the same person (Dual), Property right nature (SOE); variable of firm characteristics: Whether the company is audited by PWC, DTT, KPMG or EY(Big4) [5] [11] (see **Table 1**).

4. Empirical analyses

4.1 Descriptive statistics

It can be seen from the results of descriptive statistics, the explanatory variable (Digital) has a mean value of 2.7578, variance of 1.2577, minimum value of 0.6931 and maximum value of 5.8377, which means that the degree of digitalization varies widely across companies. The explained variable (IC) has a mean value of 6.3584, variance of 0.9169 and maximum value of 6.7698, which means that different listed companies have large differences in internal control quality. In terms of control variables such as company financial characteristics variables as well as governance characteristics variables, there are differences among the sample listed companies that may affect internal control quality.

Table 2 Enterprise digitalization and internal control quality

VARIABLES	(1) IC	(2) IC
Digital	0.048***	0.026***
	(7.58)	(4.33)
Controls	Yes	Yes
Constant	6.282***	5.146***
	(83.46)	(30.30)
Observations	25,584	25,583
R-squared	0.013	0.076
Industry FE	Control	Control
Year FE	Control	Control

*, ** and *** indicate 10%, 5% and 1% significance levels, respectively.

4.2 The enterprise digitalization and internal control quality

The method of multiple linear regression is used to test. Columns (1) and (2) in Table 2 present the regression results without and with the inclusion of all control variables, respectively. It can be seen from the results that when controlling only for year and industry, the coefficient of enterprise digitalization (Digital) is 0.048, showing a positive correlation. With the inclusion of all control variables, the coefficient of enterprise digitalization (Digital) is 0.026, which also shows a positive correlation at the 1% level of significance. These both suggest that enterprise digitalization can improve the internal control quality, and hypothesis H1a has been verified (see **Table 2**).

5. Heterogeneity test

5.1 Nature of property rights

Because of the unique nature of property rights in China, the effect of enterprise digitalization on the internal control quality may be asymmetric. Therefore, this paper is divided into state-owned enterprises and private enterprises sub-samples for testing. The correlation between enterprise digitalization and internal control quality for both state-owned enterprises and private enterprises is significantly positive, but the improvement is greater for private enterprises (see **Table 3**).

Table 3 Heterogeneity test

VARIABLES	(1) State-owned	(2) Private	(3) Before 2015	(4) After 2015
Digital	0.019*	0.026***	0.004	0.039***
	(1.74)	(3.54)	(0.58)	(4.74)
Controls	Yes	Yes	Yes	Yes
Constant	4.842***	5.374***	4.850***	4.911***
	(19.16)	(22.44)	(21.72)	(19.77)

Observations	9,508	16,075	9,200	16,383
R-squared	0.089	0.075	0.099	0.067
Industry FE	Control	Control	Control	Control
Year FE	Control	Control	Control	Control

*, ** and *** indicate 10%, 5% and 1% significance levels, respectively.

5.2 Policy implementation time

Industrial policies directly related to the digitalization of the real economy were introduced in China only after 2015, so the role of enterprise digitalization in improving internal control quality may be more pronounced after 2015. In this paper, the samples are divided into two groups using 2015 as the cut-off point. From the results, it can be seen that the correlation between enterprise digitalization and internal control quality is not significant before the implementation of industrial reform policy, but after the implementation of industrial reform policy, the coefficient between enterprise digitalization and internal control quality is significantly positive, indicating that enterprise digitalization has an improvement effect on internal control quality after the implementation of industrial reform policy (see **Table 3**).

6. Robustness test

6.1 Replacement of internal control proxy variable

Drawing on the research of Yuyuan Fu et al, the internal control quality is reclassified according to the annual industry mean with the sample group above the annual industry mean defines as 1, otherwise defines as 0 [12]. The results of the regression according to the reclassified samples can be seen from columns (1) in Table 4. It shows that the coefficient of enterprise digitalization is also significantly positive, indicating the robustness of the results (see **Table 4**).

Table 4 Robustness test

	(1)	(2)	(3)	(4)
VARIABLES	IC_n	IC	First Digital	Second IC
Digital	0.007***	0.022***		0.017**
	(3.60)	(3.13)		(2.37)
Digital_l			0.835***	
			(219.26)	
Controls	YES	YES	YES	YES
Constant	0.518***	5.003***	0.066	5.201***
	(9.49)	(25.68)	(0.63)	(32.29)
Observations	25,583	19,262	21,333	21,333
R-squared	0.137	0.078	0.815	0.078
Industry FE	Control	Control	Control	Control
Year FE	Control	Control	Control	Control

*, ** and *** indicate 10%, 5% and 1% significance levels, respectively.

6.2 Change the time window selection of the samples

In order to avoid the research samples being affected by the selection of the sample period, the time window in the above study is changed from 2009-2020 to 2009-2019, and it can be seen

from columns (2) in Table 4 that regression results are still consistent with the above study, indicating that the results are robust (see **Table 4**).

6.3 Endogenous problem

Considering that the results of the regression analyses may be biased if the enterprise digitalization is an endogenous variable. Accordingly, this paper adopts the instrumental variable method to test for endogeneity, and this paper selects the enterprise digitalization in the previous period as the instrumental variable. In this paper, a two-stage least squares method is used to test the hypothesis again. It can be seen from the results that there is a significant correlation between the digitalization level in the previous period and the digitalization of individual enterprises, but it is not directly related to the internal control quality; while the correlation between internal control quality and enterprise digitalization is still significantly positive (**Table 4**). The results further verify the hypothesis of this paper.

7. Conclusions

7.1 Research findings and discussion

Using A-share listed companies in China's 2009-2020 Shanghai and Shenzhen stock markets for research, this paper measures the enterprise digitalization based on large sample data mining and examines the influence of enterprise digitalization on internal control quality. It is found that the enterprise digitalization can enhance internal control quality. Meanwhile, the heterogeneity analyses find that enterprise digitalization can enhance internal control quality in both state-owned enterprises and private enterprises, but the enhancing effect in private enterprises is greater; moreover, the enhancing effect of enterprise digitalization on internal control quality is more pronounced after the national industrial policy of digitalization of real economy was implemented. After a series of robustness regressions, the regression results of this paper remain reliable. The research in this paper expands the research on the consequences of enterprise digitalization, provides empirical evidence to further deepen the research on corporate governance in digital scenarios, and facilitates enterprises to recognize the importance of digitalization in corporate governance and use it to enhance the internal control and improve the governance capacity of enterprises.

7.2 Management insights and policy recommendations

This paper has the following suggestions for the strategic decision of enterprises and governments:

I. Enterprises should build an internal control system suitable for themselves with the help of new technologies. On the basis of evaluating the existing internal control system, new information technologies should be used to transform the whole process of the internal control, complete the planning of operation management, information disclosure and risk control, and enhance the operational effect and efficiency of the internal control.

II. Enterprises need attach great importance to the quality of data statistics and enhance the use value of data. The collection and processing of data is the prerequisite for giving full play to the use value and application value of data. On the basis of ensuring the quality of data generation,

enterprises need attach great importance to the collection, processing of data. In the digital era, enterprises should fully exploit the advantages of big data and other technical means, use new technical means to continuously optimize the construction of internal control, and use more efficient data to serve economic development.

III. The government should provide institutional supply conducive to enterprise digitalization. The government needs to continuously promote the implementation of the macro policy for enterprise digitalization, and deeply promote enterprises to accelerate the construction of digitalization system by establishing a policy system that combines innovation policies and industrial policies oriented to digital strategy.

References

[1] Verhoef P. C., Broekhuizen T., Bart Y., et al.: Digital transformation: A multidisciplinary reflection and research agenda, Journal of business research. Vol. 122, pp. 889-901, 2021.

[2] Nasiri M., Ukko J., Saunila M., et al.: Managing the digital supply chain: The role of smart technologies, Technovation. Vol. 96-97, pp. 102121, 2020.

[3] Morris J. J.: The impact of enterprise resource planning (ERP) systems on the effectiveness of internal controls over financial reporting, Journal of information systems. Vol. 25, No. 1, pp. 129-157, 2011.

[4] Wu K., Fu Y., Kong D.: Does the digital transformation of enterprises affect stock price crash risk? Finance research letters. Vol. 48, 2022.

[5] Xiao Hongjun, Yang Zhen, Liu Meiyu: The social responsibility promotion effect of enterprise digitalization: A test of internal and external dual paths, Business management journal. Vol. 43, No. 11, pp. 52-69, 2021.

[6] Zhao Bei, Wu Fang, Zhang Yan: Corporate visibility, social responsibility and performance, Journal of Xiamen university (Arts & Social Sciences). No. 03, pp. 20-28, 2015.

[7] Zhai Huayun, Li Qianru: Has digital transformation of enterprises improved audit quality? —An empirical test based on a multitemporal double difference model, Journal of audit & economics. pp. 1-12, 2022.

[8] Wright S., M W. A.: Information system assurance for enterprise resource planning systems: Unique risk considerations, Journal of information systems. Vol. 16, pp. 99-113, 2002.

[9] Li Ruijing, Dang Suting, Li Baixing et al.: CEO's IT background and the quality of corporate internal control, Auditing research. No. 01, pp. 118-128, 2022.

[10] Wu Fei, Hu Huizhi, Lin Huiyan et al.: Corporate digital transformation and capital market performance—Empirical evidence from stock liquidity, Management world. Vol. 37, No. 07, pp. 130-144+10, 2021.

[11] Huang P., Jiao Y., Li S.: Impact of internal control quality on the information content of social responsibility reports: A study based on text similarity—Evidence from China, International journal of accounting information systems. pp. 100558, 2022.

[12] Fu Yuyuan, Yuan Zeming, Li Tian: Major shareholder equity pledges and corporate internal control, Collected essays on finance and economics. No. 01, pp. 71-80, 2019.