

Research on the Impact of Digital-Real Technology Integration on Accounting Conservatism

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Abstract

Digital-real technology integration has become an important component of the broader process of integrating the digital and real economies. By reshaping information processing and governance practices within firms, it may also influence the quality of accounting information. Using a sample of Shanghai and Shenzhen A-share listed companies from 2015 to 2024, this paper examines the relationship between digital-real technology integration and accounting conservatism. The results suggest that firms with a higher degree of digital-real technology integration tend to exhibit greater accounting conservatism. This finding remains robust after propensity score matching is applied. Further analysis indicates that the effect operates partly through increased innovation activity and reduced financing constraints. The relationship is also found to vary across different contexts, with stronger effects observed among firms located in eastern and western China, manufacturing enterprises, and high-tech firms. By linking digital-real technology integration to accounting conservatism, this study contributes to the literature on both digital transformation and accounting information quality. The findings also have implications for firms pursuing digital transformation strategies and for policymakers concerned with improving corporate information governance.

Keywords

digital-real technology integration, accounting conservatism, innovation level, financing constraint level, propensity score matching method

1. Introduction

In recent years, the rapid development of the digital economy has significantly reshaped industrial development patterns and the competitive environment faced by firms. In China, the integration of the digital economy with the real economy has become an important component of broader efforts to promote economic upgrading and high-quality development. As traditional growth models driven primarily by factor inputs face increasing constraints, digital technologies are increasingly regarded as a source of productivity improvement and industrial transformation. Owing to their ability to facilitate information sharing, resource coordination, and technological innovation, digital technologies have created new opportunities for firms to develop on the basis of existing industrial foundations.

Digital-real technology integration represents the implementation of digital-real economic integration at the enterprise level. Rather than simply adopting individual digital tools, it involves embedding digital technologies into business operations and production processes. Through this process, firms may improve the efficiency of information transmission, strengthen coordination across different functions, and respond more effectively to changes in market conditions and operational risks. Over time, these changes may also influence corporate governance practices and financial decision-making.

Accounting conservatism is widely regarded as an important characteristic of high-quality accounting information and is closely related to a firm's information environment and risk management capability. As digital-real technology integration continues to deepen, examining its relationship with accounting conservatism is relevant to understanding the governance implications of digital transformation and the factors shaping accounting information quality [1].

Despite the growing attention devoted to digital-real technology integration, a number of challenges remain during its implementation. For many Chinese firms, the integration process is still at a relatively early stage, and digital technologies have yet to be fully embedded in core business activities. As a result, the governance benefits associated with technological integration may not be fully realized. At the same time, substantial investment in digital infrastructure and technology does not always generate stable or immediate returns, which may increase uncertainty in financial decision-making. Rapid technological change can also pose challenges for traditional accounting practices, making it more difficult to identify and evaluate emerging risks and thereby affecting the prudence and reliability of accounting information. These issues suggest that the relationship between digital-real technology integration and accounting conservatism has not yet been sufficiently examined, while firms still lack direct empirical evidence that can inform practical decision-making. Against this background, investigating how digital-real technology integration influences accounting conservatism may provide useful insights into how technological transformation and financial governance can be coordinated more effectively [2, 3].

Existing studies have examined the economic consequences of digital transformation from a variety of perspectives, including industrial upgrading, economic growth, firm performance, and innovation capability. In the accounting field, attention has largely focused on the role of digital technologies in improving information transparency, reducing information asymmetry, and constraining earnings management. Nevertheless, several limitations remain. Most studies treat digital transformation as a broad concept and pay relatively limited attention to digital-real technology integration as a distinct dimension of digital change. Research on the governance effects generated by the interaction between digital technologies and real economic activities remains relatively limited. In addition, the mechanisms through which digital-real technology integration may influence accounting behavior have not been fully explored, and differences across regions and industries have received comparatively less attention. These gaps indicate the need for further investigation of the relationship between digital-real technology integration and accounting conservatism [4].

Using a sample of Shanghai and Shenzhen A-share listed companies from 2015 to 2024, this study examines the impact of digital-real technology integration on accounting conservatism. In addition to assessing the overall relationship, the analysis explores the roles of innovation capability and financing constraints as potential transmission channels and further investigates whether the effect varies across different regions and industries. This study contributes to the existing literature in several respects. First, it extends research on digital transformation by focusing specifically on digital-real technology integration and examining its implications for accounting information quality. Second, it provides evidence on the channels through which digital-real technology integration may affect accounting conservatism, contributing to a better understanding of the governance consequences of digital technologies. Third, by considering regional and industry heterogeneity, the study highlights the conditions under which the effects of digital-real technology integration are more pronounced. The findings may also offer useful insights for firms seeking to balance digital transformation with improvements in financial governance.

2. Theoretical Analysis and Research Hypotheses

2.1 Digital-Real Technology Integration and Accounting Conservatism

Digital-real technology integration reflects the deepening interaction between digital technologies and real economic activities at the firm level. Rather than representing the simple adoption of digital tools, it involves the incorporation of digital technologies into business operations, production processes, and managerial activities. As this process develops, firms may gradually adjust traditional operating practices and governance arrangements, which can in turn influence financial reporting behavior and accounting decisions.

Accounting conservatism is widely regarded as an important attribute of accounting information quality. It emphasizes the timely recognition of potential losses and risks while requiring greater caution in the recognition of revenues and assets. Prior research suggests that accounting conservatism can help mitigate agency conflicts and reduce information problems between firms and external stakeholders. In an environment characterized by increasing uncertainty and rapid technological change, conservative reporting may also contribute to financial stability and support long-term business development [5, 6].

From the perspective of information asymmetry theory, digital-real technology integration may improve the collection, transmission, and processing of information within firms. The application of digital technologies and real-time information systems can facilitate closer links between operational and financial data, making business activities more visible to both managers and external stakeholders. As information becomes more transparent, investors may gain a clearer understanding of a firm's operating conditions, reducing the scope for managerial opportunism arising from information advantages. Under such circumstances, firms may face stronger incentives to adopt prudent accounting practices, which could contribute to a higher degree of accounting conservatism [7, 8].

Corporate reputation theory offers another perspective for understanding this relationship. The integration of digital technologies into business operations may encourage greater standardization of management processes and strengthen internal monitoring procedures. Digital governance tools can improve the traceability of business activities and reduce the influence of subjective intervention in decision-making. At the same time, more transparent information disclosure may help firms build credibility with investors, creditors, and other stakeholders. Since reputation is an important intangible asset, managers may become more cautious about actions that could undermine external trust. This may reduce incentives for aggressive financial reporting and increase the likelihood of adopting more conservative accounting policies [9].

Risk management theory also provides a useful explanation. Digital-real technology integration may strengthen firms' ability to identify, monitor, and respond to operational and financial risks. Enhanced data-processing capabilities can help firms detect potential asset impairment, monitor changes in cash flows, and evaluate emerging sources of uncertainty in a more timely manner. Better access to risk-related information may facilitate the recognition of potential losses and support more prudent accounting judgments. As a result, accounting information may more accurately reflect the risk conditions faced by the firm [10, 11].

Based on the above analysis, this paper proposes the following hypothesis:

Hypothesis 1: Digital-real technology integration is positively associated with accounting conservatism.

2.2 Digital-Real Technology Integration, Innovation Level, and Accounting Conservatism

In addition to its direct influence on accounting conservatism, digital-real technology integration may also affect accounting practices indirectly through its impact on firm innovation. Innovation plays an important role in sustaining competitiveness and supporting long-term growth. By facilitating the application of digital technologies in business operations, digital-real integration may create conditions that are conducive to innovation activities, which in turn could influence firms' financial reporting behavior.

From the perspective of resource-based theory, digital-real technology integration may enhance firms' access to information resources and technological capabilities. The application of digital technologies can improve the collection, processing, and utilization of information during research and development activities, helping firms reduce information-related constraints in the innovation process. At the same time, digital-real integration may contribute to more efficient resource allocation and lower coordination costs associated with innovation activities. As firms accumulate innovative capabilities, they may strengthen their competitive position and develop more sustainable sources of growth. Improved operating performance and stronger

resilience to external shocks may reduce pressure on managers to prioritize short-term results, increasing the likelihood of adopting more prudent accounting policies. Under such circumstances, a higher level of accounting conservatism may be observed [12].

Sustainable development theory provides a complementary explanation. Continuous innovation enables firms to adapt to changing market conditions through the development and improvement of products, services, and production processes. As firms strengthen their ability to respond to evolving consumer demand and industry competition, their market position may become more stable over time. Greater operational stability can help reduce the adverse effects of market volatility and cyclical fluctuations on business performance, supporting relatively stable revenue streams and cash flows. When firms face less pressure to demonstrate short-term performance improvements, managers may have fewer incentives to engage in aggressive financial reporting. Instead, they may be more willing to recognize potential risks and losses in a timely manner, contributing to a higher degree of accounting conservatism [13].

Based on the above analysis, this paper proposes the following hypothesis:

Hypothesis 2: Digital-real technology integration promotes accounting conservatism by improving innovation levels.

2.3 Digital-Real Technology Integration, Financing Constraint Level, and Accounting Conservatism

Financing constraints represent an important factor shaping firms' financial decisions and accounting choices. Digital-real technology integration may influence accounting conservatism indirectly by easing firms' financing pressures and improving access to external funding.

From the perspective of signaling theory, digital-real technology integration may serve as a way for firms to convey information about their operational structure and governance quality to external capital providers. As firms advance in digital-real integration, internal management processes and financial control systems tend to become more structured and traceable. Such changes may be observed by external investors and interpreted as an improvement in operational transparency and organizational discipline. When firms are perceived as having more reliable internal systems, they may face fewer frictions in accessing external financing or may obtain funding under relatively more favorable conditions. With reduced financing pressure, firms may have less incentive to rely on aggressive financial reporting to attract or maintain external capital. Instead, accounting judgments are more likely to reflect underlying operating conditions, with greater attention to potential risks and uncertainties. This may contribute to an increase in accounting conservatism [14].

Agency theory offers a complementary explanation. When financing constraints are relaxed, firms may experience a reduction in short-term liquidity pressure, which can shift managerial attention toward longer-term operational considerations. In such situations, the emphasis on short-term financial performance may weaken to some extent, reducing incentives for earnings management aimed at immediate performance improvement. Managers may be more likely to adhere to accounting standards in a cautious manner and recognize potential losses in a timely way, which is consistent with more conservative accounting practices [15].

Based on the above analysis, this paper proposes the following hypothesis:

Hypothesis 3: Digital-real technology integration promotes accounting conservatism by alleviating financing constraints.

3. Research Design

3.1 Research Sample and Data Sources

This study uses data from Shanghai and Shenzhen A-share listed companies from 2015 to 2024 to examine the relationship between digital-real technology integration and accounting conservatism. The sample is processed as follows: financial firms are excluded, as are ST, ST*, and PT firms. Observations with missing key variables are also removed. All continuous variables are winsorized at the 1% and 99% levels to mitigate

the influence of extreme values. Data on digital-real technology integration are constructed from patent information, while financial and accounting data are obtained from the CSMAR database.

3.2 Variable Selection and Description

3.2.1 Dependent Variable

Accounting conservatism (CScore). Following Khan and Watts (2009), this study measures accounting conservatism at the firm-year level based on the Basu (1997) model. The C-Score model extends the Basu framework by incorporating firm-specific characteristics such as leverage, market-to-book ratio, and firm size. The specific measurement models are as follows [16, 17]:

$$\frac{EPS_{i,t}}{P_{i,t}} = \mu_0 + \mu_2 R_{i,t} + \mu_3 DR_{i,t} + \mu_3 DR_{i,t} \times R_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$GScore_{i,t} = \mu_1 = \alpha_1 + \alpha_2 SIZE_{i,t} + \alpha_3 MB_{i,t} + \alpha_4 LEV_{i,t} \quad (2)$$

$$CScore_{i,t} = \mu_3 = \beta_1 + \beta_2 SIZE_{i,t} + \beta_3 MB_{i,t} + \beta_4 LEV_{i,t} \quad (3)$$

$$\frac{EPS_{i,t}}{P_{i,t}} = \mu_1 + \mu_2 DR_{i,t} + RET_{i,t}(\alpha_1 + \alpha_2 SIZE_{i,t} + \alpha_3 MB_{i,t} + \alpha_4 LEV_{i,t}) + DR_{i,t} \times R_{i,t}(\beta_1 + \beta_2 SIZE_{i,t} + \beta_3 MB_{i,t} + \beta_4 LEV_{i,t}) + \varepsilon_{i,t} \quad (4)$$

where GScore represents the response of accounting earnings to good news; CScore represents the level of accounting conservatism; $EPS_{i,t}$ is the earnings per share of firm i in year t ; $P_{i,t}$ is the stock price per share of firm i at the beginning of year t ; $R_{i,t}$ is the annual stock return of firm i in year t . If $R_{i,t} < 0$, then $DR_{i,t} = 1$; otherwise, $DR_{i,t} = 0$. $SIZE_{i,t}$ is the natural logarithm of firm i 's size in year t ; $MB_{i,t}$ is the market-to-book ratio of firm i in year t ; $LEV_{i,t}$ is the leverage ratio of firm i in year t .

To incorporate investment opportunity information into accounting conservatism, this paper first substitutes equations (2) and (3) into equation (1). Following the standard treatment of interaction terms in the accounting conservatism model, each individual term is substituted into equation (1) to obtain equation (4). The regression coefficients obtained from equation (4) are then substituted into equation (3) to calculate the firm-year CScore value. A larger CScore value indicates stronger accounting conservatism for the firm, and vice versa [18].

3.2.2 Independent Variable

Digital-real technology integration (cedrt). Following Huang Xianhai and Gao Yaxing (2023), patent data are classified based on the Patent Classification Reference Table (2023). Patents are matched and coded to distinguish digital industry technology, real industry technology, and digital-real technology integration. A patent is identified as reflecting digital-real integration when it belongs primarily to real industry technology and its citation network includes patents related to digital technologies [19].

3.2.3 Mechanism Variables

Innovation level (patent) and financing constraints (SA). Following Bereskin et al. (2016) and Li Wenjing and Zheng Manni (2016), innovation is measured as the natural logarithm of (1 + total number of patents, including invention, utility model, and design patents). Financing constraints are measured using the SA index proposed by Hadlock and Pierce (2009), which is constructed based on firm size and firm age. The index relies on variables that are relatively stable over time and considered to have strong exogeneity. The formula is as follows [20, 21]:

$$SA = -0.737 * Size + 0.043 * Size^2 - 0.04 * Age \quad (5)$$

3.2.4 Control Variables

The regression model controls for firm size (Size), leverage (Lev), growth (Growth), fixed asset ratio (FIXED), board size (Board), independence of the board (Indep), CEO duality (Dual), listing age (ListAge), and institutional ownership (INST), along with year and industry fixed effects.

Variable definitions are summarized in Table 1.

Table 1: Variable Definitions

Variable Type	Variable Name	Variable Symbo	Description
Dependent Variable	Accounting Conservatism	CScore	Measured using the Khan & Watts (2009) C-Score model; higher values indicate stronger accounting conservatism
Independent Variable	Digital-Real Technology Integration	cedrt	Degree of integration between digital technology and the real economy in the firm; higher values indicate higher integration levels
Mechanism Variables	Innovation Level	patent	Natural logarithm of (enterprise patent applications + 1)
	Financing Constraint Level	SA	SA index; larger absolute value indicates higher financing constraints faced by the firm
Control Variables	Firm Size	Size	Natural logarithm of (total assets at period-end + 1)
	Financial Leverage	Lev	Total liabilities at period-end / Total assets at period-end
	Growth Ability	Growth	Growth rate of total operating revenue
	Fixed Assets Ratio	FIXED	Net fixed assets / Total assets at period-end
	Board Size	Board	Natural logarithm of (number of board members + 1)
	Independent Director Ratio	Indep	Number of independent directors / Total number of board members
	Duality	Dual	1 if the chairman and general manager are the same person; otherwise 0
	Listing Age	ListAge	Natural logarithm of (years since listing + 1)
	Institutional Investor Shareholding	INST	Institutional investor shareholding / Total shares
	Industry	IND	CSRC 2012 industry classification
	Year	YEAR	Year of the listed company

3.3 Construction of Regression Models

To test Hypotheses 1–3, the following regression models are specified:

$$CScore_{i,t} = \alpha_0 + \alpha_1 cedrt_{i,t} + \alpha_2 Controls_{i,t} + YEAR + IND + \varepsilon_{i,t} \quad (6)$$

where i denotes the firm, t denotes time, $CScore_{i,t}$ is accounting conservatism, $cedrt_{i,t}$ is digital-real technology integration, $Controls_{i,t}$ is the set of control variables, $YEAR$ is the year dummy variable, IND is the industry dummy variable, and ε is the random disturbance term (the same below). Model (1) is used to test the baseline relationship in Hypothesis 1. It controls for factors such as firm size (Size), financial leverage (Lev), and growth ability (Growth), with primary focus on the independent variable digital-real technology integration ($cedrt$). A significantly positive coefficient on $cedrt$ would support Hypothesis 1.

$$patent_{i,t} = \alpha_0 + \alpha_1 cedrt_{i,t} + \alpha_2 Controls_{i,t} + YEAR + IND + \varepsilon_{i,t} \quad (7)$$

$$CScore_{i,t} = \alpha_0 + \alpha_1 cedrt_{i,t} + \alpha_2 patent_{i,t} + \alpha_3 Controls_{i,t} + YEAR + IND + \varepsilon_{i,t} \quad (8)$$

To test the mediating role of innovation level ($patent$), Models (1)–(3) are used for the mechanism analysis. A significantly positive coefficient on $cedrt$ in Model (2) and significantly positive coefficients on both $cedrt$ and $patent$ in Model (3) would support Hypothesis 2.

$$SA_{i,t} = \alpha_0 + \alpha_1 cedrt_{i,t} + \alpha_2 Controls_{i,t} + YEAR + IND + \varepsilon_{i,t} \quad (9)$$

$$CScore_{i,t} = \alpha_0 + \alpha_1 cedrt_{i,t} + \alpha_2 SA_{i,t} + \alpha_3 Controls_{i,t} + YEAR + IND + \varepsilon_{i,t} \quad (10)$$

To test the mediating effect of financing constraint level (SA), Models (1), (4), and (5) are used for the mechanism analysis. A significantly positive coefficient on $cedrt$ in Model (4), a significantly positive coefficient on $cedrt$ and a significantly negative coefficient on SA in Model (5) would support Hypothesis 3.

4. Empirical Analysis

4.1 Descriptive Statistics

Table 2: Descriptive Statistics

Variable	N	Min	Max	Mean	p50	SD
cedrt	27950	0	1.3860	0.0713	0	0.2520
CScore	27950	-4.2030	73.9200	2.2580	0.0544	9.9750
Size	27950	20.1500	26.5000	22.4400	22.2300	1.3090
Lev	27950	0.0621	0.9000	0.4210	0.4130	0.1980
Growth	27950	-0.5360	1.7300	0.1250	0.0823	0.3240
FIXED	27950	0.0033	0.6560	0.2050	0.1750	0.1470
Board	27950	1.6090	2.6390	2.1000	2.1970	0.1970
Indep	27950	33.3300	57.1400	37.9700	36.3600	5.4250
Dual	27950	0	1	0.3140	0	0.4640
ListAge	27950	0.6930	3.4340	2.2310	2.3030	0.7780
INST	27950	0.0036	0.9150	0.4160	0.4230	0.2500

Table 2 reports the descriptive statistics of the main variables. The mean value of accounting conservatism (CScore) is 2.2580, while the median is 0.0544, with a standard deviation of 9.9750. The difference between the mean and median indicates considerable variation in accounting conservatism across firms, suggesting a skewed distribution. The mean value of digital-real technology integration (cedrt) is 0.0713, indicating that the overall level of digital-real integration among Chinese listed companies is relatively low during the sample period. Most firms remain at an early stage of digital-real integration. For the control variables, including firm size (Size), financial leverage (Lev), and growth ability (Growth), both the mean and median values fall within expected ranges. The dispersion of these variables does not show unusual patterns.

4.2 Benchmark Regression Test

Table 3: Benchmark Regression Results

	(1)	(2)
VARIABLES	CScore	CScore
cedrt	1.2696***	1.2144***
	(4.9264)	(4.7271)
Size		2.2560***
		(10.9316)
Lev		-3.7198***
		(-5.1684)
Growth		-1.0520***
		(-5.5506)
FIXED		3.0983***
		(2.9181)
Board		0.8520
		(1.1196)
Indep		-0.0030
		(-0.1339)
Dual		-0.3630*
		(-1.7324)
ListAge		-2.2349***
		(-6.5869)
INST		-2.2586***
		(-2.6577)
Observations	27,950	27,950
FIRM FE	YES	YES
YEAR FE	YES	YES
R ²	0.3270	0.3320
Adj. R ²	0.2020	0.2080

Note: *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. The same applies below.

The regression results on the relationship between digital-real technology integration and accounting conservatism are reported in Table 3. In Model (1), which does not include control variables, the coefficient of digital-real technology integration (*cedrt*) is 1.2696 and is significantly positive at the 1% level. In Model (2), after adding control variables such as firm size (*Size*) and financial leverage (*Lev*), the coefficient of *cedrt* remains positive at 1.2144 and is significant at the 1% level. Overall, the results show a stable positive association between digital-real technology integration and accounting conservatism. Firms with a higher level of digital-real technology integration tend to exhibit stronger accounting conservatism. This result may be related to the role of digital technologies in improving internal information processing and enhancing the timeliness of risk identification. It may also help reduce information asymmetry between internal management and external stakeholders and strengthen firms' monitoring and risk management capacity. These factors are consistent with a higher degree of accounting prudence. The baseline regression results therefore provide support for the main hypothesis of this study.

4.3 Mechanism Tests

Table 4: Mechanism Tests

	(1)	(2)	(3)
VARIABLES	CScore	patent	SA
<i>cedrt</i>	1.2144***	5.7779***	-0.0033***
	(4.7271)	(6.8062)	(-2.9784)
<i>Size</i>	2.2560***	5.8254***	0.0206***
	(10.9316)	(8.5420)	(23.4463)
<i>Lev</i>	-3.7198***	-2.2071	-0.0150***
	(-5.1684)	(-0.9280)	(-4.8975)
<i>Growth</i>	-1.0520***	-1.3575**	-0.0070***
	(-5.5506)	(-2.1675)	(-8.6889)
FIXED	3.0983***	-4.8148	0.0332***
	(2.9181)	(-1.3723)	(7.3542)
<i>Board</i>	0.8520	1.1922	-0.0095***
	(1.1196)	(0.4740)	(-2.9393)
<i>Indep</i>	-0.0030	0.1224	0.0000
	(-0.1339)	(1.6391)	(0.1898)
<i>Dual</i>	-0.3630*	-0.4014	-0.0019**
	(-1.7324)	(-0.5799)	(-2.1197)
<i>ListAge</i>	-2.2349***	-4.7012***	-0.0719***
	(-6.5869)	(-4.1930)	(-49.8565)
INST	-2.2586***	4.0519	0.0081**
	(-2.6577)	(1.4429)	(2.2523)
Observations	27,950	27,950	27,950
FIRM FE	YES	YES	YES
YEAR FE	YES	YES	YES
R ²	0.3320	0.8390	0.9820
Adj. R ²	0.2080	0.8090	0.9780

To examine the transmission mechanisms through which digital-real technology integration affects accounting conservatism, this study conducts mediation analyses from the perspectives of innovation and financing constraints. The results are reported in Table 4. The coefficient of digital-real technology integration (*cedrt*) on innovation level (*patent*) is 5.7779 and is significantly positive at the 1% level, indicating that firms with higher levels of digital-real technology integration tend to exhibit higher innovation output. This suggests a positive association between digital-real technology integration and corporate innovation activity. The coefficient of *cedrt* on financing constraint (*SA*) is -0.0033 and is significantly negative at the 1% level. Given the construction of the *SA* index, this result suggests that digital-real technology integration is associated with lower financing constraints, reflecting relatively improved financing conditions for firms. Overall, these results indicate that both innovation improvement and the easing of financing constraints may serve as channels linking digital-real technology integration and accounting conservatism. Through these channels, digital-real technology integration may be associated with changes in firms' operational conditions and financing environment, which are in turn related to more conservative accounting practices.

4.4 Robustness Tests

To ensure the reliability of the benchmark regression results, this paper conducts robustness tests from five aspects: adding control variables, changing the time window, excluding municipality samples, changing the winsorization method, and using propensity score matching (PSM). The regression results are detailed in Table 5.

Table 5: Robustness Tests

	(1)	(2)	(3)	(4)	(5)
	Add Controls	Exclude Special Years	Exclude Municipalities	Change Winsorization	PSM
VARIABLES	CScore	CScore	CScore	CScore	CScore
cedrt	1.2041*** (4.7001)	1.9549*** (5.4061)	1.2144*** (4.7271)	0.6169*** (5.1386)	0.3787*** (4.2136)
Size	1.6686*** (7.6831)	3.0922*** (11.4843)	2.2560*** (10.9316)	0.7205*** (9.2120)	0.4988*** (4.7262)
Lev	-3.9679*** (-5.5006)	-7.0288*** (-7.1503)	-3.7198*** (-5.1684)	-0.5984** (-2.1663)	0.2799 (0.7936)
Growth	-0.3397* (-1.6516)	-1.0112*** (-3.5115)	-1.0520*** (-5.5506)	-0.4437*** (-4.6325)	-0.3295*** (-3.2393)
FIXED	2.8704*** (2.7075)	2.8369* (1.9068)	3.0983*** (2.9181)	1.0321** (2.5001)	0.6906 (1.2195)
Board	0.7411 (0.9765)	1.7264 (1.6225)	0.8520 (1.1196)	0.0092 (0.0316)	0.1255 (0.3636)
Indep	-0.0021 (-0.0936)	-0.0047 (-0.1488)	-0.0030 (-0.1339)	-0.0046 (-0.5148)	-0.0045 (-0.4361)
Dual	-0.3991* (-1.9103)	-0.3538 (-1.1642)	-0.3630* (-1.7324)	-0.1517** (-2.0009)	-0.1909** (-2.1272)
ListAge	-1.9178*** (-5.6024)	-2.3048*** (-5.0601)	-2.2349*** (-6.5869)	-0.1756 (-1.4644)	-0.3215** (-2.0834)
INST	-0.8958 (-1.0359)	-3.9582*** (-3.3146)	-2.2586*** (-2.6577)	-0.8523*** (-2.7248)	-0.9381*** (-2.6534)
Observations	27,949	17,374	27,950	27,950	27,950
FIRM FE	YES	YES	YES	YES	YES
YEAR FE	YES	YES	YES	YES	YES
R ²	0.3360	0.4410	0.3320	0.4050	0.4220
Adj. R ²	0.2130	0.2700	0.2080	0.2950	0.3140

4.4.1 Adding Control Variables

The baseline model already includes controls such as firm size, leverage, and growth. To reduce concerns about omitted variables, additional controls including asset turnover ratio (ATO), cash flow ratio (Cashflow), and Tobin's Q (TobinQ) are further included. The results in Column (1) of Table 5 show that the coefficient of cedrt is 1.2041 and remains significantly positive at the 1% level, consistent with the baseline results. This suggests that the baseline findings are not sensitive to the inclusion of additional control variables.

4.4.2 Excluding Special Years

To account for the potential impact of the COVID-19 pandemic on firm operations and macroeconomic conditions, observations from 2020 to 2022 are excluded and the regressions are re-estimated. As shown in Column (2), the coefficient of cedrt is 1.9549 and remains significantly positive at the 1% level. The result is broadly consistent with the baseline estimation [22].

4.4.3 Excluding Municipalities

Given that municipalities may benefit from policy and resource advantages, firms registered in Beijing, Tianjin, Shanghai, and Chongqing are excluded from the sample. The results in Column (3) show that the coefficient of cedrt remains 1.2144 and is significant at the 1% level. The estimated effect is similar to the baseline result [23].

4.4.4 Changing Winsorization

The regressions are re-estimated using 5% and 95% winsorization. As shown in Column (4), the coefficient of cedrt is 0.6169 and remains significantly positive at the 1% level. The result remains consistent under an alternative treatment of extreme values.

4.4.5 PSM

To address potential self-selection bias, kernel propensity score matching (PSM) is applied to match firms with similar characteristics. The ATT estimate in Column (5) shows that the coefficient of cedrt is 0.3787 and remains significantly positive at the 1% level, consistent with the baseline findings [24].

4.5 Heterogeneity Analysis

Table 6: Heterogeneity Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	east	middle	west	manu	non-manu	highfirm	lowfirm
VARIABLES	cedrt	cedrt	cedrt	cedrt	cedrt	cedrt	cedrt
CScore	0.0009*** (6.1561)	0.0002 (0.9045)	0.0006** (2.2903)	0.0012*** (9.5926)	0.0003 (1.0080)	0.0016*** (9.8690)	0.0002 (0.8878)
Size	-0.0006 (-0.0771)	0.0219 (1.1769)	-0.0007 (-0.0332)	-0.0027 (-0.3120)	0.0056 (0.5298)	-0.0103 (-1.0643)	0.0140 (1.5190)
Lev	0.0149 (0.6251)	-0.0623 (-1.3712)	-0.0702 (-1.4299)	-0.0135 (-0.5592)	0.0271 (0.8091)	-0.0051 (-0.1772)	-0.0054 (-0.2065)
Growth	0.0034 (0.5467)	-0.0038 (-0.3080)	-0.0118 (-1.1033)	0.0010 (0.1492)	-0.0018 (-0.2486)	-0.0018 (-0.2455)	-0.0019 (-0.3021)
FIXED	-0.0302 (-0.6948)	-0.0425 (-0.5225)	0.0220 (0.2563)	-0.0233 (-0.5333)	-0.0588 (-1.0986)	0.0058 (0.1054)	-0.0669* (-1.6832)
Board	0.0399 (1.2758)	-0.0228 (-0.3763)	0.0234 (0.4571)	0.0580* (1.7732)	-0.0504 (-1.5011)	0.0569 (1.5538)	0.0034 (0.1096)
Indep	0.0001 (0.1621)	-0.0011 (-0.6106)	0.0009 (0.6329)	0.0009 (0.9418)	-0.0013 (-1.2570)	-0.0007 (-0.7168)	0.0014 (1.6437)
Dual	-0.0037 (-0.5077)	0.0182 (1.1586)	0.0086 (0.5848)	0.0033 (0.4579)	-0.0046 (-0.4087)	0.0098 (1.1542)	-0.0107 (-1.2846)
ListAge	-0.0374*** (-2.9284)	-0.0225 (-0.7831)	0.0034 (0.1118)	-0.0147 (-1.1039)	-0.0658*** (-3.4215)	-0.0388** (-2.3416)	0.0047 (0.3579)
INST	0.0034 (0.1103)	-0.0785 (-1.2076)	0.0334 (0.4357)	0.0028 (0.0892)	-0.0415 (-0.9171)	-0.0049 (-0.1285)	-0.0306 (-0.9015)
Constant	0.1358 (0.7860)	-0.1368 (-0.3192)	0.0850 (0.1815)	0.1076 (0.5336)	0.2809 (1.1560)	0.3816* (1.6856)	-0.2313 (-1.1016)
Observations	19,937	3,983	3,309	20,159	8,095	15,462	12,792
FIRM FE	YES	YES	YES	YES	YES	YES	YES
YEAR FE	YES	YES	YES	YES	YES	YES	YES
R ²	0.0500	0.0530	0.0410	0.0530	0.0430	0.0630	0.0330
Adj.R ²	0.0494	0.0484	0.0356	0.0517	0.0410	0.0620	0.0320

4.5.1 Regional Heterogeneity Analysis

Differences in digital infrastructure and digital economy development across China's eastern, central, and western regions may lead to heterogeneous effects of digital-real technology integration on accounting conservatism. To examine this issue, the sample is divided into eastern, central, and western regions according to firm registration location, and subsample regressions are conducted. The results are reported in Columns (1)–(3) of Table 6. The results show that the coefficient of digital-real technology integration in the eastern region is 0.0009 and is significantly positive at the 1% level. In the western region, the coefficient is 0.0006 and is significant at the 5% level. In the central region, the coefficient is 0.0002 and is not statistically significant. Overall, the positive association between digital-real technology integration and accounting conservatism is mainly observed in the eastern and western regions.

These differences may be related to variations in regional development conditions. The eastern region has relatively more developed digital infrastructure and industrial systems, which may facilitate the application of

digital technologies in firm operations. The western region has benefited in recent years from policy initiatives related to digital infrastructure development, which may have supported the diffusion of digital technologies in local firms. By contrast, the central region appears to be in a more transitional stage in terms of digital economy development, and the related effects of digital-real integration may not yet be fully reflected at the firm level. These findings suggest that the impact of digital-real technology integration is not uniform across regions and may depend on local development conditions [25].

4.5.2 Industry Heterogeneity Analysis (Manufacturing)

Differences in the integration of real-economy operations and digital technologies across industries may lead to heterogeneous effects of digital-real technology integration on accounting conservatism. To examine this issue, the sample is divided into manufacturing and non-manufacturing groups based on the CSRC industry classification, and subsample regressions are conducted. The results are reported in Columns (4) and (5) of Table 6. The results show that the relationship between digital-real technology integration and accounting conservatism is not statistically significant in non-manufacturing firms. In contrast, for manufacturing firms, digital-real technology integration is significantly and positively associated with accounting conservatism at the 1% level. Overall, the effect of digital-real technology integration is mainly concentrated in the manufacturing sector.

These differences may be related to the extent to which digital technologies are embedded in production and operational processes. In manufacturing industries, digital technologies can be more closely integrated with production activities and operational management, which may be associated with improvements in information processing and risk identification. By contrast, in non-manufacturing industries, business processes are relatively standardized and less dependent on production-based integration, which may limit the observable effect of digital-real technology integration on accounting conservatism. These results indicate that the impact of digital-real technology integration varies across industries and appears to be more pronounced in manufacturing firms.

4.5.3 Heterogeneity Analysis by High-Tech Enterprises

Whether a firm is classified as a high-tech enterprise reflects differences in technological capabilities and innovation conditions, which may influence the effectiveness of digital-real technology integration. To examine this issue, the sample is divided into high-tech and non-high-tech groups, and subsample regressions are conducted. The results are reported in Columns (6) and (7) of Table 6. The results show that the relationship between digital-real technology integration and accounting conservatism is not statistically significant among non-high-tech enterprises. In contrast, for high-tech enterprises, digital-real technology integration is significantly and positively associated with accounting conservatism at the 1% level. Overall, the effect is mainly observed in high-tech firms.

These differences may be related to variations in firms' technological capabilities and digital foundations. High-tech enterprises generally have relatively stronger R&D capacity and a higher level of technological accumulation, which may facilitate the adoption and application of digital technologies in business processes. By contrast, non-high-tech enterprises tend to have weaker technological bases, which may limit the extent to which digital-real technology integration is reflected in accounting outcomes. These findings suggest that the impact of digital-real technology integration depends on firms' technological conditions and is more pronounced among high-tech enterprises [26].

5. Conclusions and Implications

This study uses data from Shanghai and Shenzhen A-share listed companies from 2015 to 2024 to examine the impact, mechanisms, and heterogeneity of digital-real technology integration on accounting conservatism. The results show a positive association between digital-real technology integration and accounting conservatism. Firms with higher levels of digital-real technology integration tend to exhibit stronger accounting conservatism. The findings also indicate that digital-real technology integration may influence accounting conservatism through two channels: improving innovation levels and alleviating financing constraints. In addition, the effect is more evident in the eastern and western regions, manufacturing firms, and high-tech enterprises.

Based on these results, several implications can be drawn.

First, firms may consider further integrating digital technologies into business operations and financial management processes. Such integration may help improve information processing efficiency and support more timely identification of operational and financial risks. At the same time, increasing investment in innovation activities and improving financing arrangements may help firms better realize the potential benefits of digital-real technology integration in accounting practice. Under such conditions, accounting conservatism may play a more consistent role in supporting long-term firm stability.

Second, policy support for digital transformation may take into account regional and structural differences. Greater attention may be given to regions with relatively weaker digital infrastructure, such as the central region, as well as to firms outside manufacturing and high-tech sectors. Reducing the cost of digital transformation and improving access to digital resources may help expand the diffusion of digital-real technology integration across different types of firms.

Third, regulatory attention may further consider the role of digital development in accounting information quality. The application of digital tools in internal control and risk monitoring may help improve the transparency and reliability of financial reporting. This may reduce information asymmetry between firms and external stakeholders and support the protection of investors and creditors.

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Conflicts of Interest

The authors declare no conflict of interest.

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