Pnternal Audit Independence in the Context of Big Data A Study on the Impact of Dynamic Competitiveness on State-Owned Enterprises

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KEYWORDS	ABSTRACT
Internal Audit Independence	This study employs panel data of A-share listed companies on the Shanghai and Shenzhen Stock Exchanges from 2018 to 2022 as the baseline sample to empirically examine the impact of internal audit independence on corporate competitiveness in the current year (2018–2022), one-year lag (2019–2023), and two-year lag (2020–2024). Furthermore, it investigates whether this impact exhibits significant heterogeneity across firms with different ownership structures. The results indicate that internal audit independence exerts a significantly positive effect on corporate competitiveness in the current year: specifically, a one-unit increase in internal audit independence is associated with an approximate 8.869-unit rise in competitiveness. This positive impact persists in the one-year lag period but weakens substantially (as reflected by reduced coefficient magnitude and statistical significance). By the third year, however, the effect of internal audit independence on corporate competitiveness becomes statistically insignificant. Further analysis reveals significant ownership-based heterogeneity in the aforementioned relationship: the enhancement of internal audit independence only significantly boosts the current competitiveness of state-owned enterprises (SOEs), while exerting no notable influence on that of non-SOEs. This suggests that strengthening the independent status of internal audit in SOEs constitutes an effective governance mechanism to improve their short-term competitive capacity and responsiveness. Additionally, the moderating role test of data element utilization efficiency shows that this efficiency significantly amplifies the positive impact of internal audit independence on the one-year lagged competitiveness of SOEs. In other words, a higher level of data element utilization efficiency enables internal audit independence to promote corporate competitiveness more effectively in the second year. Nevertheless, this moderating effect becomes ineffective for SOEs in the third year, implying that SOEs can gain substantial short-term audit synergy benefits from improved data element utilization efficiency, but the sustainability of such effects is limited.

INTRODUCTION

(1) Research Background

As a critical management activity, internal audit serves as a robust pillar for improving the supervision system of state-owned assets and an organizational guarantee for state-owned enterprises (SOEs) to achieve benchmarking management against world-class enterprises and fulfill high-quality development goals. In October 2013, at the Executive Meeting of the State Council, Premier Li Keqiang put forward the important requirement of implementing full-coverage auditing. In December 2013, Liu Jiayi, then Auditor-General, emphasized at the National Audit Work Conference that to meet the overall objectives and requirements of audit work, efforts should be made to realize full-coverage of audit supervision, continuously enhance the

deterrence and effectiveness of auditing, and ensure in accordance with the law that all public funds, state-owned assets, and state-owned resources are within the scope of audit supervision without leaving any supervision blind spots or gaps.

In 2014, the Fourth Plenary Session of the 18th Central Committee of the Communist Party of China further incorporated the economic responsibility audit of leading cadres into the scope, explicitly proposing to improve the audit system and implement full-coverage auditing for four key areas: public funds, state-owned assets, state-owned resources, and the performance of economic responsibilities by leading cadres. On December 8, 2015, the General Office of the State Council issued the Implementation Opinions on Carrying out Full-Coverage Auditing, which put forward specific requirements and implementation suggestions for the practice of full-coverage auditing.

Since the concept of full-coverage auditing was proposed and put into practice, it has become a core strategic requirement for China's audit work, while the economic responsibility audit targeting leading cadres has emerged as a new focus of this full-coverage initiative. In 2017, the General Office of the Communist Party of China Central Committee and the General Office of the State Council issued the Several Opinions on Deepening the Audit Supervision of State-owned Enterprises and State-owned Capital, explicitly proposing the establishment of a regular audit system for enterprise state-owned capital and the implementation of full-coverage audit supervision over state-owned assets.

In May 2018, General Secretary Xi Jinping delivered an important speech at the First Meeting of the Central Audit Commission, putting forward the requirement to "strengthen the coordination of national audit work, optimize the allocation of audit resources, ensure that all entities subject to audit are audited, all audits are conducted strictly, and accountability is enforced rigorously, striving to build a centralized, unified, fully covered, authoritative, and efficient audit supervision system." In 2020, the State-owned Assets Supervision and Administration Commission of the State Council (SASAC) issued the Notice on Carrying Out the Action to Improve Management by Benchmarking World-Class Standards and the Implementation Opinions on Deepening the Internal Audit Supervision of Central Enterprises, emphasizing that central enterprises should establish a centralized, unified, fully covered, authoritative,

and efficient audit supervision system adapting to the new era, new situation, and new requirements, and build a long-term closed-loop mechanism for risk prevention and control. Table 1 lists the major documents issued by state authorities regarding the governance reform of state-owned enterprises, the development of internal audit, and the utilization of data elements since the deepening of state-owned enterprise reform in 2015.

Strengthening internal audit is not only an inevitable requirement for advancing the modernization of the national governance system and governance capacity, but also an objective necessity for propelling high-quality economic development. Existing literature has demonstrated that internal audit can enhance the quality of financial reports (Abbott et al., 2016; Tao, 2016; Lü & Wang, 2021; Christensen, 2022; Wang & Chen, 2024), identify audit risks (Zhang et al., 2024; Huang, 2024), reduce improper managerial behaviors (Ege, 2015), lower audit fees and improve audit efficiency by assisting external auditors in annual report audits (Abbott et al., 2012; Pizini et al., 2015; Li, 2025), mitigate internal control deficiencies (Lin et al., 2011; Guo, 2017; Wu et al., 2021), reduce risks and enhance organizational value (Carcello et al., 2020), drive value creation (Emett et al., 2024; Xiang & Zhou, 2025; Zhang et al., 2025; Xie et al., 2025), improve economic performance (Jiang et al., 2020; He et al., 2025), and facilitate the development of new-quality productive forces (He, 2025).

As a production factor, data has restructured the business models, management paradigms, and organizational governance structures of modern enterprises. Due to the "disintermediation" effect triggered by digitalization, networking, and intelligentization in the economic field, enterprises face increased environmental uncertainty, complexity, and risks, with their competitive and profit margins correspondingly compressed (Chen et al., 2020; Jia et al., 2020). Traditional production organizations, transaction models, and corporate governance structures—such as internal audit—must undergo adaptive adjustments to respond to these new changes (Luo et al., 2017). Morakanyane et al. (2017) reviewed existing literature and summarized the research progress on the digital transformation of business organizations from dimensions including definitions, characteristics, driving factors, key areas, and economic impacts. They emphasized that corporate digital transformation should be regarded as a dynamic and continuous evolutionary process, which

requires integrating digital resources of enterprises and reshaping the corporate ecosystem in terms of business models, operational processes, and organizational structures. Therefore, breaking organizational inertia, integrating digital technologies, and restructuring organizational structures have become strategic choices for enterprises to achieve successful digital transformation (Matt et al., 2015; Hess et al., 2016; Vial, 2019). As the "third line of defense" for corporate organizations, the internal audit management system faces the demand for digital organizational restructuring. However, there remain numerous gaps to be filled in the digital transformation of internal audit (Qin, 2014, 2018; Liu et al., 2019; Li & He, 2019; Wang, 2020; Zhang et al., 2020). Big data auditing focuses more on the reapplication of audit techniques and operational models, while the digital transformation of internal audit is not only the implementation of information technologies such as online auditing, big data analytics, blockchain-based independent auditing, and AI-assisted auditing, but also a top-down systematic project with a broader scope. It involves comprehensive digital structural reforms, including the positioning of internal audit objectives, management systems and monitoring methods, the construction of information platforms, evidence-gathering models and technical methods, the application of audit results, the allocation of interdisciplinary talents, and institutional guarantees. Based on this, this study will, against the backdrop of II. Research Significance

(2.1) Theoretical Significance

Against the backdrop of big data, this study explores the impact of internal audit independence on SOEs' dynamic competitiveness, enriching the theoretical system of corporate governance and auditing. Traditional audit independence focuses on organizational and personnel dimensions, while this study extends it to data independence (e.g., objectivity of data acquisition, neutrality of algorithms) and combines it with technological empowerment (blockchain-based evidence preservation, automated analysis), providing a new perspective for audit theory (Zhang et al., 2024). Meanwhile, internal audit has shifted from "post-event supervision" to "in-process early warning" and "pre-event prevention" (Yang, 2025), and independent audit institutions can actively participate in strategic decisions, promoting the transformation of audit functions from compliance supervision to value creation (Zhi et al., 2021).

This study constructs a theoretical framework of dynamic competitiveness, revealing the transmission mechanism between auditing and competitiveness. Independent internal audit can monitor operational risks in real time through big data, improve risk response speed, and enhance dynamic competitiveness (Duan, 2023). Additionally, it promotes interdisciplinary integration: at the intersection of auditing and information economics, big data reduces information asymmetry, and data authenticity relies on independence, expanding the application scenario of "signaling theory" (Yang, 2025); at the intersection of organizational studies and strategic management, independent audit breaks departmental barriers, enhances organizational agility, and supports dynamic competitiveness (Zhang et al., 2024).

(2.2) Practical Significance

First, it optimizes SOEs' governance structure, strengthens audit authority, advances the reform of separating management from auditing, and improves audit credibility. Second, it enhances risk prevention and control capabilities and decision-making effectiveness. Independent audit institutions integrate multi-source data, identify anomalies such as fund misappropriation through big data models, and realize the transformation from "post-event rectification" to "pre-event prevention" (Zou, 2022). Third, it promotes SOEs' sustainable development. Through full-process supervision (e.g., asset handover, merger and acquisition restructuring), independent internal audit reduces corruption and inefficient investment (Zhang et al., 2017), preventing the loss of state-owned assets. In complex market environments, it evaluates the risks and returns of innovative projects, ensuring enterprises' compliance and dynamic competitiveness.

1. Literature Review at Home and Abroad

1.1. Research on Internal Audit

1.1.1. Evolution of Internal Audit

Research on internal audit has evolved from traditional financial supervision to modern governance empowerment. Early studies focused on internal control and compliance: Mautz and Sharaf (1961) emphasized the reliability of financial information, and Chambers (1995) positioned internal audit as a "management tool." With the rise of corporate governance theory, Cohen et al. (2004) confirmed that internal audit enhances organizational value through risk

identification; Sarens and Abdolmohammadi (2011) found that audit committee independence affects internal audit effectiveness. In the technology-driven era, Vasarhelyi et al. (2020) proposed a continuous auditing framework, and AI and blockchain enabled real-time risk monitoring (Brown-Liburd et al., 2021). In China, the "triple-audit synergy mechanism" (Liu, 2021) and the Provisions on Internal Audit Work (2018) have strengthened supervisory synergy (Wang, 2022). Current research focuses on technological empowerment (Zhang, 2023), governance synergy (Li, 2023), and emerging fields (Kolk & Perego, 2014).

1.1.2. Supervisory Functions of Internal Audit

Research on internal audit's supervisory functions focuses on effectiveness and influencing factors. Influencing factors include functional positioning (Mei, 2018), leadership style (Dal Mas & Barac, 2018), and personnel allocation (Wang et al., 2014). Internal audit departments subordinate to audit committees and concurrent leadership of audit heads can improve independence (Wang, 2018). In terms of effectiveness, collaboration between internal and external auditors reduces audit costs (Wang & Yang, 2009; Al-Dhamari, 2018), and internal audit improves financial report quality (Prawitt et al., 2009; Gros et al., 2017). Mei (2018) pointed out that internal auditors' communication skills moderate the relationship between independence and supervision quality.

1.1.3. Economic Consequences of Internal Audit

Internal audit's economic consequences mainly involve corporate value and governance effects. It achieves value addition through reasonable assurance and consulting services (Zhao, 2008), and positive interaction with other governance mechanisms enhances this effect (Chen et al., 2016). In terms of governance, it supports internal control (Vijayakumar & Nagaraja, 2012), improves financial report quality (Wang et al., 2010), and inhibits irregularities (Chen et al., 2016). However, existing research has limitations: poor adaptability of Western theories to China's context (Yang, 2022), over-reliance on questionnaire surveys (Sarens, 2021), and lag in emerging field standards (Mock et al., 2023). Future research should construct a "national governance—organizational governance—technological governance" framework (Liu, 2024) and innovate evaluation indicators (Cao et al., 2023).

1.2. Literature Review on Corporate Competitiveness

1.2.1. Evolution of Corporate Competitiveness Research

Corporate competitiveness research has evolved from single financial performance to a comprehensive framework including knowledge accumulation, dynamic capabilities, and niche breadth. Xu (2020) proposed a three-tier knowledge structure model; Li (2024) found that digital transformation enhances competitiveness through improving production efficiency. In evaluation methods, Qian (2022) used text mining to construct a competitiveness identification model; Zhang (2019) combined grey relational analysis and dynamic efficacy coefficient method to develop a shipbuilding enterprise competitiveness index. This evolution continues Barney's (1991) Resource-Based View and integrates Teece's (1997) Dynamic Capability Theory in China.

1.2.2. Influencing Factors of Competitiveness

Policy and institutional factors: Yang and Gong (2025) verified that the "leader recruitment system" improves corporate innovation and competitiveness; Lu (2025) found that fintech pilot policies promote digital transformation and competitiveness. Digital economy and technological innovation: Sun et al. (2025) confirmed that data element marketization enhances core competitiveness; Cao et al. (2025) pointed out that digital technology innovation reduces supply chain concentration and increases product differentiation. AI and big data: Chen and Liao (2025) found that AI promotes profitability and operational capabilities; Zheng et al. (2025) revealed an inverted U-shaped relationship between big data applications and manufacturing competitiveness. Industrial and enterprise characteristics: Ma (2025) found that basic research investment promotes high-tech industry competitiveness; Zhang et al. (2025) verified a U-shaped correlation between carbon information disclosure and green competitiveness. Corporate governance and social responsibility: Shi et al. (2025) found that ESG performance promotes competitiveness through charitable donations and TFP; Yu (2025) pointed out that CSR reduces customer concentration.

2. Path Mechanisms of Corporate Competitiveness

Three core driving mechanisms are identified: Technological dimension—AI enhances competitiveness by improving TFP (Du et al., 2024), but there is an inverted U-shaped

relationship due to "financial distress" risk (Pan, 2023); Institutional dimension—digital finance alleviates financing constraints (Zhang, 2023), while resource allocation distortion inhibits competitiveness (Jiang, 2025); ESG dimension—green innovation promotes competitiveness (Wang, 2023), but social responsibility investment has a "resource crowding-out effect" (Yang, 2022), and industry technological intensity plays a moderating role (Li, 2025). These findings deepen the understanding of the "technology-institution-environment" interaction in Porter's (1990) Diamond Model.

3. Measurement of Corporate Competitiveness

Scholars have proposed various evaluation methods. Tang & Liu (2010) used financial indicators; Gao et al. (2023) constructed a comprehensive index from seven dimensions; Zeng (2023) included scale, growth, profitability, and innovation capacity. Literature on agricultural listed companies' competitiveness evaluation is scarce, and variable selection varies. This study measures micro-level dynamic competitiveness using financial indicators.

III. Theoretical Analysis and Research Hypotheses

1. Internal Audit Improves Financial Quality

Internal audit oversees financial reports and monitors operational management, identifying aggressive accounting practices, reducing managerial interference, and safeguarding financial report quality (Wang et al., 2010; Kaawaase et al., 2021), contributing to SOEs' high-quality development.

2.nternal Audit Alleviates Principal-Agent Problems

As a professional and independent internal supervision department, internal audit supervises agents on behalf of principals, curtails managers' myopic behaviors, prevents shareholder expropriation, improves governance efficiency and quality, and supports SOEs' long-term development.

3. Internal Audit Improves Internal Controls

First, it fosters a corporate culture of excellence, providing institutional guarantees for competitive advantage. Second, it ensures timely and accurate communication of internal control information, improving operational efficiency (Yan & Xu, 2023). Third, it optimizes the balance between centralization and decentralization, cultivating a results-oriented attitude. Fourth, it supervises and evaluates internal controls, identifying deficiencies and proposing optimization solutions.

Research Hypothesis (H): Internal auditing positively promotes enterprises' dynamic competitiveness, and this promotional effect is more pronounced in state-owned enterprises.

IV. Research Design

(1) Data Source and Sample Selection

The initial sample includes A-share listed companies on the Shanghai and Shenzhen Stock Exchanges from 2018 to 2024. Samples are screened as follows: excluding those with asset-liability ratio outside 0-1, ST/*ST/PT companies, and those with missing data. Finally, 20,117 observation samples are obtained, with all variables winsorized at the 1% level. Data are sourced from the CSMAR Database, processed using Stata 18.0. Base period data (2018-2022) are used to calculate competitiveness in Ti+1 and Ti+2.

Control variables: (1) Actual controller type (1=SOE, 0=non-SOE); (2) Controlling shareholder ownership ratio; (3) Managerial ownership; (4) Board size; (5) Supervisor board size; (6) Independent director ratio; (7) Independent director network centrality.

(2) Variable Selection

1.Enterprise Dynamic Competitiveness: Referring to Jin & Zhang's method, factor analysis is used to evaluate static competitiveness in the current and lagged two years, and a dynamic evaluation model is constructed.

1.Explanatory Variable — Internal Audit Independence (Indep_Audit): Referring to Specific Standards for Internal Auditing No. 22 and existing literature, it is measured by organizational structure: 1 if the number of audit committee members $\geqslant$ industry average, otherwise 0.

1.Moderating Variable—Data Element Utilization Efficiency: A lexicon is constructed from policy documents and literature, Word2Vec is used to expand it, and machine learning extracts word frequencies from annual reports. The natural logarithm of total word frequency (after adding 1) is used as the indicator.

1.Control Variables: Firm size (natural logarithm of employees), ownership type, controlling shareholder ownership ratio, managerial ownership, board size, supervisory board size.

Independent Director Ratio: The ratio of independent directors to the total number of directors, which reflects the degree of board independence and is positively correlated with the effectiveness of the board's oversight and advisory functions.

Independent Director Network Centrality: A comprehensive

indicator measuring the importance of independent directors' positions within the overall director network. A higher network centrality indicates that the company possesses greater discourse power and stronger resource integration capabilities in the independent director network.

Detailed variable descriptions are provided in Table 2.

Currently, there is no consensus in the academic community on how to measure static corporate competitiveness. Using a single indicator is highly one-sided, while adopting a multi-indicator evaluation also presents numerous challenges. Through in-depth analysis and drawing on the evaluation and analysis methods for corporate competitiveness developed by the Service Industry Survey Center of the National Bureau of Statistics of China, this study selects the following indicators:

Profitability indicators: Return on Assets (ROA), Return on Equity (ROE), Return on Invested Capital (ROIC);

Solvency indicators: Leverage Ratio (LEV, i.e., asset-liability ratio), Current Ratio (CR), Quick Ratio (QR), Cash Asset Ratio (CAR);

Operational efficiency indicators: Current Asset Turnover (CAT), Total Fixed Asset Turnover (TRFA);

Growth capacity indicators: Sustainable Growth Rate (SGR).

A comprehensive evaluation index system for dynamic corporate competitiveness is constructed, consisting of 4 first-level indicators and 10 second-level indicators.

In conducting the comprehensive evaluation of corporate competitiveness, the primary step is to normalize moderate indicators to ensure they are positively oriented (i.e., direction alignment). Failure to implement such positive orientation will affect the analysis process and its results. There are various methods for normalizing moderate indicators (e.g., taking the opposite number, taking the reciprocal), and this study adopts the method of taking the opposite number for positive orientation.

The specific positive orientation method for moderate indicators in this study is as follows:

(1)Public factors, along with their corresponding factor eigenvalues, variance contribution rates, and cumulative variance contribution rates, were calculated using SPSS 20.0. The results indicate that within the corporate competitiveness measurement index system, the asset-liability ratio (LEV) falls into the category of moderate indicators. For enterprises, a higher asset-liability ratio increases their debt-servicing pressure, while an excessively

low ratio hinders the effective use of financial leverage. This prevents minimizing the weighted average cost of capital (WACC) and adversely impacts the firm's market value. Therefore, for manufacturing enterprises, the optimal value of the asset-liability ratio is typically 0.5.

(2)In measuring corporate competitiveness, this study adopts the widely used and objective factor analysis method to construct a comprehensive score function. Prior to conducting factor analysis, the Kaiser-Meyer-Olkin (KMO) test and Bartlett's Test of Sphericity were performed to verify the suitability of the sample variables for factor analysis, using SPSS 20.0.

As shown in Table 3, the KMO statistics are 0.628, 0.641, and 0.634, respectively, all exceeding 0.6—indicating that the data are suitable for factor analysis. The Bartlett's Test of Sphericity yields large chi-square values with 45 degrees of freedom, and all results are statistically significant. This confirms the appropriateness of factor analysis for the data. Across the three sample periods, the approximate chi-square values of the test are 157,750.457, 172,778.095, and 174,074.784, respectively, with corresponding significance levels of 0.000 (far below the 0.01 significance threshold). These results strongly reject the null hypothesis that the correlation matrix among variables is an identity matrix, demonstrating significant correlations between the variables in this study—providing a fundamental prerequisite for factor analysis.

Statistic Year		Year T	Year T+1	Year T+2
KMO Measure of Sampling Adequacy		.628	.641	.634
Bartlett's Test of Sphericity	Approximate Chi-Square	157750.457	172778.095	174074.784
	Degrees of Freedom	45	45	45
	Significance	.000	.000	.000

Table.3. KMO and Bartlett's Test

Table 4 presents the total variance explained by each component factor in the factor analysis of corporate competitiveness indicators for the base period (Year T). Through dimensionality reduction via factor analysis, three public factors were extracted based on the criterion of eigenvalue > 1, with a cumulative variance contribution rate of 59.274%. This indicates that the extracted factors retain

most of the information from the original data. The weight

of each public factor is defined as the ratio of the variance contribution rate of the respective factor to the cumulative variance contribution rate. Calculations show that the weights of the three public factors are 0.4627, 0.3611, and 0.1761, respectively.

Table 5 presents the total variance explained by each component factor in the factor analysis of corporate competitiveness indicators for the one-year lagged period (Year T+1). Through dimensionality reduction via factor analysis, three public factors were extracted based on the criterion of eigenvalue > 1, with a cumulative variance contribution rate of 61.510%. This indicates that the extracted factors retain most of the information from the original data. Calculations show that the weights of the three public factors are 0.4543, 0.3770, and 0.1688, respectively.

Table 5 presents the total variance explained by each component factor in the factor analysis of corporate competitiveness indicators for the two-year lagged period (Year T+2). Through dimensionality reduction via factor analysis, three public factors were extracted based on the criterion of eigenvalue > 1, with a cumulative variance contribution rate of 61.214%. This indicates that the extracted factors retain most of the information from the original data. Calculations show that the weights of the three public factors are 0.4582, 0.3702, and 0.1715, respectively.

Figure 1 presents the scree plot of the common factors, where the horizontal axis represents the factor serial numbers and the vertical axis denotes the factor eigenvalues. The plot indicates that the eigenvalues of the first three factors are generally high, forming a relatively steep line segment. In contrast, the eigenvalues of factors beyond the third are generally low, connecting to form a flat line segment. Thus, extracting three common factors is deemed appropriate. Based on the extraction of principal component factors, Table 7 presents the component score coefficient matrix obtained through SPSS analysis.

Factor		Component in Year T			Components of Year T+1			Components of Year T+2		
		1	2	3	1	2	3	1	2	3
LEV	X1	-.264	.057	-.022	-.261	.044	-.026	-.263	.051	-.038
CAR	X2	.210	.050	.023	.212	.039	.011	.208	.047	-.016
QR	X3	.342	-.004	.022	.336	.001	.035	.337	-.002	.045
ROA	X4	.013	.430	.001	.012	.393	-.009	.015	.399	.004
ROE	X5	-.021	.279	-.043	-.018	.317	-.034	-.023	.306	-.066
ROIC	X6	-.014	.440	-.009	-.013	.410	-.015	-.014	.417	-.019
CAT	X7	-.113	.059	.405	-.126	.061	.375	-.120	.054	.397
TRFA	X8	.083	-.016	.891	.069	-.001	.907	.078	-.006	.888
SGR	X9	.003	.054	.062	.001	.043	.046	.003	.085	.072
CR	X10	.342	-.001	.021	.336	.003	.034	.337	.000	.043

Table.7. Component Score Coefficient Matrix

The comprehensive score function for Year T is as follows：

$$F_1 = -0.264 X_1 + 0.210 X_2 + 0.342 X_3 + 0.013 X_4 - 0.21 X_5 \quad (1)$$
$$-0.014 X_6 - 0.113 X_7 + 0.083 X_8 + 0.003 X_9 + 0.342 X_{10}$$

$$F_2 = 0.057 X_1 + 0.050 X_2 - 0.04 X_3$$
$$+ 0.430 X_4 + 0.279 X_5 + 0.440 X_6 + 0.059 X_7 \quad (2)$$
$$-0.016 X_8 + 0.054 X_9 - 0.001 X_{10}$$

$$F_3 = -0.022 X_1 + 0.023 X_2 + 0.022 X_3$$
$$+ 0.001 X_4 - 0.043 X_5 - 0.009 X_6 + 0.405 X_7 \quad (3)$$
$$+ 0.891 X_8 + 0.062 X_9 + 0.021 X_{10}$$

The comprehensive score function for Year T+1 is as follows:

$$FF_1 = -0.261 X_1 + 0.212 X_2 + 0.336 X_3$$
$$+ 0.012 X_4 - 0.018 X_5 - 0.013 X_6$$
$$- 0.126 X_7 + 0.069 X_8 + 0.001 X_9 + 0.336 X_{10}$$

$$FF_2 = 0.044 X_1 + 0.039 X_2 + 0.001 X_3$$
$$(4) \quad + 0.393 X_4 + 0.317 X_5 + 0.410 X_6$$
$$+ 0.061 X_7 - 0.001 X_8 + 0.043 X_9 + 0.003 X_{10}$$

(5)

$$FF_3 = -0.026 X_1 + 0.011 X_2 + 0.035 X_3$$
$$- 0.009 X_4 - 0.034 X_5 - 0.015 X_6 \quad (6)$$
$$+ 0.375 X_7 + 0.907 X_8 + 0.046 X_9 + 0.034 X_{10}$$

The comprehensive score function for Year T+2 is as follows

$$FFF_1 = -0.263 X_1 + 0.208 X_2 + 0.337 X_3$$
$$+ 0.015 X_4 - 0.023 X_5 - 0.014 X_6 \quad (7)$$
$$- 0.120 X_7 + 0.078 X_8 + 0.003 X_9 + 0.337 X_{10}$$

$$FFF_2 = 0.051 X_1 + 0.047 X_2 - 0.002 X_3$$
$$+ 0.399 X_4 + 0.306 X_5 + 0.417 X_6 + 0.054 X_7 \quad (8)$$
$$- 0.006 X_8 + 0.085 X_9$$

$$FFF_3 = -0.038 X_1 - 0.016 X_2 + 0.045 X_3$$
$$+ 0.004 X_4 - 0.066 X_5 - 0.019 X_6 + 0.397 X_7 \quad (10)$$
$$+ 0.888 X_8 + 0.072 X_9 + 0.043 X_{10}$$

Using the above nine formulas, the common factor scores of the samples can be calculated via Stata 18.0. Subsequently, the composite scores of corporate competitiveness for the base period, one-year lagged period, and two-year lagged period of the samples can be computed respectively using Formulas (3)–(5), (6)–(8), and (9)–(11).

$$CC_T = 0.4627 * F_1 + 0.3611 * F_2 + 0.1761 * F_3 \quad (12)$$

$$CC_{T+1}=0.4543*FF_1+0.3770*FF_2+0.1688*FF_3 \qquad (13)$$

$$CC_{T+2}=0.4582*FFF_1+0.3702*FFF_2+0.1715*FFF_3 \qquad (14)$$

(III) Regression Model Design

To test the research hypothesis regarding the impact of internal audit independence on corporate dynamic competitiveness, the following regression model is constructed:：

$$CC_T / CC_{T+1} / CC_{T+2}$$
$$= \alpha_0 + \alpha_1 \text{indep\_audit} + \alpha_{2-n} \sum \text{Controls} + \varepsilon$$

(15)

In the model, α_0 denotes the constant term; α_1、 α_2、 ……、 α_n is the regression coefficient；CC_T、 CC_{T+1}、 CC_{T+2} denote corporate competitiveness in the base period, one-year lagged corporate competitiveness, and two-year lagged corporate competitiveness, respectively.; indep_auditindep_audit represents a firm's internal audit independence; Controlsdenotes a set of control variables; and is the random error term.

V. Empirical Results and Discussion

(1) Internal Audit Independence and Enterprises' Dynamic Competitiveness

The empirical results in Table 8 indicate that the impact of internal audit independence on corporate competitiveness exhibits a distinct characteristic of "short-term promotion and long-term attenuation."

Column (1) shows that after controlling for other factors, the improvement of internal audit independence significantly enhances enterprises' current-year competitiveness. The coefficient is 8.869 and statistically significant at the 1% level, indicating that higher internal audit independence is associated with stronger current-year competitiveness. Specifically, a one-unit increase in internal audit independence leads to an approximate 8.869-unit increase in current-year competitiveness.

Column (2) reports a coefficient of 4.589 for internal audit independence, which is statistically significant at the 10% level (t = 1.93). The positive impact of internal audit independence on competitiveness persists in the one-year lagged period but weakens substantially (the coefficient decreases from 8.869 to 4.589), with the significance level dropping from 5% to 10%. This suggests that the driving effect of internal audit independence has short-term momentum but cannot alone sustain strong medium-term growth.

Column (3) presents a coefficient of -0.054, which is completely insignificant (t = -0.15). By the third year, internal audit independence no longer has any statistically identifiable impact on corporate competitiveness. These findings demonstrate that the effect of internal audit independence on competitiveness is temporary rather than permanent; the long-term performance of corporate competitiveness depends more on other structural or strategic factors.

In summary, internal audit independence acts as a "short-term catalyst" rather than a "long-term engine" for corporate competitiveness. It can bring immediate improvements in corporate governance and operational efficiency, but sustaining long-term competitiveness requires integration with other long-acting mechanisms.

Heterogeneous Impacts of Control Variables

Firm Size: Exhibits a complex dynamic impact on competitiveness. Column (1) shows a significantly negative coefficient of -5.410 at the 1% level, which may reflect the "large enterprise syndrome"—expansion leading to bureaucracy and delayed decision-making, thereby inhibiting short-term competitiveness. Column (2) reports a significantly positive coefficient of 1.509 at the 1% level, indicating that the positive effects of scale begin to dominate. Column (3) shows that the significant positive impact of firm size disappears, suggesting that the scale effect itself is a dynamic adjustment process, and its long-term impact is overshadowed by other more complex factors.

Ownership Type: Demonstrates a robust long-term positive impact on corporate competitiveness. Results in Columns (2) and (3) indicate that the coefficient of ownership type is significantly positive in both the second and third years with relatively large values. This suggests that state-owned enterprises (SOEs) play a decisive role in enhancing medium- and long-term competitiveness through their advantages in resource acquisition, policy support, and stability maintenance.

Board Size: Shows dynamic changes in its impact on competitiveness. Column (1) reports a significantly negative coefficient of -1.448 at the 5% level, reflecting the inefficiency in decision-making caused by overly large boards. Column (3) presents a significantly positive coefficient of 0.311 at the 1% level, supporting the "resource dependence theory"—in the long run, larger boards can bring more external resources and information, facilitating corporate stability and development.

Supervisory Board Size: Displays a short-term positive and long-term negative impact on competitiveness. Column (1) shows a significantly positive coefficient of 2.015 at the 5% level, indicating that the supervisory function of the supervisory board plays an active role in the current year. Column (3) reports a significantly negative coefficient of -0.202 at the 10% level; similar to board size, it may generate certain governance costs in the long run.

Managerial Ownership: Exhibits a short-term negative impact on competitiveness. Column (1) presents a significantly negative coefficient of -0.123 at the 1% level, which may imply an "entrenchment effect" rather than an "interest alignment effect"—managers may make decisions that are not conducive to short-term competitiveness to protect personal interests (e.g., risk avoidance).

Practical Implications

For Enterprises: They should strengthen short-term governance, attach great importance to and safeguard the independence of internal auditing, and regard it as a key tool to improve short-term operational efficiency and risk control capabilities. Meanwhile, enterprises should layout long-term strategies, integrating optimized corporate governance structures with long-term technological innovation and market strategies to build sustainable competitive advantages. Enterprises should view scale rationally, guard against the "large enterprise syndrome" during expansion, and stimulate organizational vitality through internal management reforms to convert scale advantages into sustained competitiveness.

For Regulators: They should continue to introduce policies to encourage and regulate the construction of enterprise internal audit systems, especially setting clear requirements for independence. This is of positive significance for improving the quality and short-term performance of microeconomic entities in the entire market.

In conclusion, these more comprehensive regression results clearly depict a picture: internal auditing is an effective "governance emergency injection," while the long-term "healthy physique" of enterprises relies on a comprehensive and dynamically adjusted governance system and strategic layout.

Variable	(1)	(2)	(3)
	Audit Independence		
	(3.36)	(1.93)	(-0.15)
Firm Size	-5.410***	1.509***	-0.033
	(-8.58)	(2.66)	(-0.40)
Ownership Nature	2.202	14.492***	5.308***
	(1.06)	(7.76)	(19.39)
Controlling Shareholder Ownership Ratio	-4.786	-8.479*	0.521
	(-0.95)	(-1.88)	(0.79)
Controlling Shareholder Ownership Ratio	-0.123***	0.029	-0.000
	(-2.75)	(0.72)	(-0.05)
Board Size	-1.448**	-0.388	0.311***
	(-2.34)	(-0.70)	(3.81)
Supervisory Board Size	2.015**	-0.041	-0.202*
	(2.19)	(-0.05)	(-1.66)
Independent Director Ratio	-24.589	6.278	3.289
	(-1.51)	(0.43)	(1.53)
Independent Director Network Centrality	-1.387	-1.036	0.160
	(-0.63)	(-0.52)	(0.55)
Intercept	64.372***	-7.268	-2.056
	(6.17)	(-0.77)	(-1.49)
Observations	20,117	20,117	20,117
R-squared	0.005	0.006	0.030

Table.

(2) Internal Audit Independence and State-Owned Enterprises' Competitiveness

Table 9 presents the results of subgroup regression analysis based on enterprise ownership type, aiming to examine the heterogeneous impacts of internal audit independence on the dynamic competitiveness of state-owned enterprises (SOEs) in the current period (Year T), short term (Year T+1), and

Variable	(1) Competitiveness in Year T	(2) Competitiveness in Year T+1	(3) Competitiveness in Year T+2
Internal	8.869***	4.589*	-0.054

medium term (Year T+2).

SOE Subgroup

Within the SOE subgroup, internal audit independence exhibits a significant short-term promotional effect on corporate competitiveness. Specifically, in the current period (Year T), the coefficient of internal audit independence is 17.212, which is statistically significant at the 1% level (t = 2.87). This indicates that enhancing internal audit independence in SOEs can immediately strengthen their current-period competitiveness. However, this positive impact is time-bound: in Years T+1 and T+2, the coefficients are 8.492 and -0.340, respectively, neither of which is statistically significant. This suggests that the impact of internal audit independence is primarily concentrated in the short term and fails to persist into the medium and long terms.

Non-SOE Subgroup

In contrast, the impact of internal audit independence in non-SOEs presents a distinctly different pattern. In Years T, T+1, and T+2, the coefficients are -1.113, -0.121, and -0.008, respectively—all negative but statistically insignificant.

Key Findings and Implications

These results confirm significant ownership-based heterogeneity in the impact of internal audit independence on corporate competitiveness. Specifically, enhancing internal audit independence significantly boosts the current-period competitiveness of SOEs but exerts no significant effect on that of non-SOEs.

For SOEs, strengthening the independent status of internal auditing constitutes an effective governance mechanism to improve short-term competitiveness and responsiveness. Regulators and SOE managers should strive to ensure the independence of internal audit departments through institutional design, organizational structure optimization, and resource allocation, thereby unlocking their potential in corporate governance and value creation. However, given the short-term nature of this impact, SOEs need to complement internal audit independence with other long-acting governance mechanisms to sustain competitive advantages.

For non-SOEs, the drivers of competitiveness may stem more from market mechanisms, entrepreneurial spirit, or alternative governance arrangements. The standalone enhancement of internal audit independence is not a critical lever for improving their competitiveness.

	Non-State-Owned Competitiveness in	State-Owned Corporate Competitiveness in Year T+1	Non-State-Owned Competitiveness in Year T+1	State-Owned Corporate Co... Year T+2
	-1.113	8.492	-0.121	-0.340
	(-0.55)	(1.42)	(-0.77)	(-0.39)
	-3.321***	4.491**	0.043	-0.095
	(-8.53)	(2.43)	(1.42)	(-0.35)
	-0.512	-32.002**	-0.031	1.440
	(-0.17)	(-2.05)	(-0.13)	(0.63)
	-0.134***	-0.167	0.000	-0.030
	(-5.79)	(-0.29)	(0.01)	(-0.35)
	-1.390***	-1.410	0.019	0.814***
	(-3.44)	(-0.85)	(0.61)	(3.34)
	-0.450	-0.101	-0.021	-0.434
	(-0.58)	(-0.05)	(-0.35)	(-1.50)
	-10.928	9.556	-0.0263	5.303
	(-1.02)	(0.22)	(-0.31)	(0.82)
	-2.582*	-2.403	-0.157	0.496
	(-1.93)	(-0.35)	(-1.50)	(0.50)
...*	49.2386	-2.192	1.332	-1.065
	(6.87)	(-0.08)	(2.37)	(-0.26)
	14361	5,756	14361	5,756
	0.0096	0.002	0.0008	0.003

Table.

(3) Moderating Role of Data Element Utilization Efficiency

Table 9 indicates that the positive impact of internal audit independence on state-owned enterprises (SOEs)' competitiveness tends to weaken over time. To further explore the influence of data element utilization efficiency, we introduce it as a moderating variable and examine its moderating effect on the relationship between internal audit independence and SOEs' competitiveness in the one-year lagged (T+1) and two-year lagged (T+2) periods. The results are presented in Table 10.

Column (1): SOE Subgroup (T+1 Period)

The coefficient of the interaction term "Internal Audit Independence × Data Element Utilization Efficiency" is

3.853, which is statistically significant at the 5% level (t = 2.14). This suggests that in SOEs, data element utilization efficiency significantly strengthens the positive impact of internal audit independence on corporate competitiveness. In other words, a higher level of data element utilization efficiency amplifies the promotional effect of internal audit independence on enterprises' short-term competitiveness (Year T+1). A plausible explanation is that SOEs place greater emphasis on optimizing audit systems when enhancing data element utilization, thereby magnifying the value of internal audit independence.

Column (2): Non-SOE Subgroup (T+1 Period)

The coefficient of the interaction term "Internal Audit Independence × Data Element Utilization Efficiency" is 0.005, which is statistically insignificant (t = 0.28). This indicates that in non-SOEs, data element utilization efficiency does not significantly moderate the relationship between internal audit independence and corporate competitiveness. Possible reasons include: (1) the internal audit mechanisms of non-SOEs are inherently more flexible, leading to a smaller marginal effect of data element utilization efficiency; or (2) non-SOEs' competitiveness is more strongly driven by market factors.

Column (3): SOE Subgroup (T+2 Period)

The coefficient of the interaction term "Internal Audit Independence × Data Element Utilization Efficiency" is 0.326, which is statistically insignificant (t = 1.23). This demonstrates that the moderating effect of data element utilization efficiency on internal audit independence disappears in the medium term (Year T+2), indicating that such an effect is likely short-lived. Potential explanations are: (1) the effect of data element utilization efficiency in SOEs attenuates over time; or (2) the role of internal audit independence is offset by other factors.

Column (4): Non-SOE Subgroup (T+2 Period)

The coefficient of the interaction term "Internal Audit Independence × Data Element Utilization Efficiency" is 0.001, which is statistically insignificant (t = 0.43). This reconfirms that data element utilization efficiency exerts no significant moderating effect in non-SOEs, either in the short or medium term.

Summary of Moderating Effect Results

Table 10 reveals that data element utilization efficiency exerts a significant positive moderating effect on the relationship between internal audit independence and SOEs' short-term competitiveness (Year T+1), but this effect dissipates in the medium term. In non-SOEs, data element utilization efficiency shows no significant moderating effect whatsoever. These findings indicate that ownership type serves as a key boundary condition: SOEs may derive greater audit synergy benefits from data element utilization, but the sustainability of such benefits is limited.

Table.10. abc	(1) State-Owned	(2) Non-State-Owned	(3) State-Owned	(4) Non-State-Owned
	Competitiveness in the One-Year Lagged Period (Year T+1)		Competitiveness in the Two-Year Lagged Period	
Internal Audit Independence × Data Element Utilization Efficiency	3.853**	0.005	0.326	0.001
	(2.14)	(0.28)	(1.23)	(0.43)
Data Element Utilization Efficiency	-0.156	-0.001	-0.013	0.001
	(-0.27)	(-0.51)	(-0.16)	(0.64)
Internal Audit Independence	0.198	-0.137	-1.043	-0.011
	(0.03)	(-0.81)	(-1.00)	(-0.58)
Firm Size	4.439**	0.043	-0.100	-0.002
	(2.40)	(1.41)	(-0.37)	(-0.58)
Controlling Shareholder Ownership Ratio	-31.537**	-0.033	1.480	0.010
	(-2.02)	(-0.14)	(0.64)	(0.37)
Managerial Ownership	-0.162	0.001	-0.029	-0.001

	(-0.28)	(0.01)	(-0.34)	(-0.31)
Board Size	-1.554	0.019	0.801***	-0.003
	(-0.93)	(0.60)	(3.28)	(-0.95)
Supervisory Board Size	-0.183	-0.021	-0.441	-0.002
	(-0.09)	(-0.35)	(-1.52)	(-0.36)
Proportion of Independent Directors	7.949	-0.267	5.166	0.006
	(0.18)	(-0.32)	(0.80)	(0.06)
Proportion of Independent Directors	-1.854	-0.159	0.543	0.011
	(-0.27)	(-1.51)	(0.55)	(0.94)
Intercept	0.200	1.346**	-0.861	1.125***
	(0.01)	(2.39)	(-0.21)	(17.33)
Observations	5,756	14361	5,756	14361
R-squared	0.003	0.001	0.003	0.001

Table.

4.Research Conclusions and Implications

4.1.Research Conclusions

Based on empirical data of Chinese listed firms, this study explores how internal audit independence affects enterprises' dynamic competitiveness and the moderating role of ownership type. Full-sample regression and subgroup tests yield core findings:

Internal audit independence exerts a significant short-term boost on current dynamic competitiveness, but this positive effect fades and becomes statistically insignificant by Year T+3, constrained by long-term strategic factors. Subgroup analysis shows heterogeneous impacts: in state-owned enterprises (SOEs), internal audit independence strongly drives competitiveness (coefficient=17.212), far exceeding the full-sample average, as it mitigates principal-agent problems and ensures state-owned asset efficiency. In non-SOEs, however, its effect is insignificant due to flexible governance structures and competitiveness relying more on entrepreneurship, market opportunities and innovation.

Control variables like firm size also show heterogeneous effects across models, reflecting the systematic nature of competitiveness formation.

(2) Research Implications

This study offers targeted implications: For SOEs, strengthen internal audit independence via top-level design, shift its function from financial compliance to value creation, and integrate it with digital transformation. For non-SOEs, avoid copying SOE governance models; instead, embed internal audit into core business risk management. For policymakers, adopt classified regulatory guidance—impose mandatory independence requirements on SOEs and provide principle-based guidelines for non-SOEs.

REFERENCES

1. Yang, X. Q., & Gong, H. X. (2025). Can the "Problem Bidding and Leader Appointment" System Improve Corporate Innovation Performance? An Analysis Based on the Multi-period DID Method[J/OL]. Foreign Economics & Management, 1-18 [2025-11-14].

2. Lu, X. Q. (2025). The Impact of Sci-Tech Finance Development on Corporate Digital Transformation: A DID Analysis Based on Sci-Tech Finance Pilot Policies. Modernization of Management, 45(4), 41-49.

3. Zuo, G. Y. (2024). The Impact of Sci-Tech Finance Policies on Urban Circulation Competitiveness: An Empirical Analysis Based on DID and Mediation Effects. Journal of Commercial Economics, (22), 47-50.

4. Sun, L. J., Zhu, X., & Wan, X. W. (2025). Market-Oriented Construction of Data Factors and Corporate Core Competitiveness: A Quasi-Natural Experiment Based on the Establishment of Data Trading Platforms. Finance and Accounting Monthly, 46(16), 59-65.

5. Wang, Y. H. (2025). Analysis of the Impact Mechanism of Digital Business Environment on Regional Circulation Industry Competitiveness. Journal of Commercial Economics, (16), 128-131.

6. Cao, X. Y., Chen, W. S., & Zou, Z. H. (2025). Can Digital Technology Innovation Improve Corporate Competitiveness?

Evidence from A-Share Listed Companies. International Business (Journal of University of International Business and Economics), (5), 1-18.

7. Ren, J., & Yao, Q. (2025). Digital Transformation and the Enhancement of Competitiveness in Commercial Retail Enterprises: From the Perspective of Digital Innovation and Total Factor Productivity Improvement. Journal of Commercial Economics, (12), 141-145.

8. Du, C. Z., Liu, S. T., & Zhang, Q. L. (2025). Research on the Impact Mechanism and Effects of Digital Industrialization on the Competitiveness of China's High-Tech Manufacturing Industry. Inquiry into Economic Issues, (6), 119-139.

9. Lü, T. F. (2024). An Analysis of the Relationship Between Digital Economy, Technological Innovation, and the Enhancement of Service Trade Competitiveness. Journal of Commercial Economics, (12), 134-137.

10. Liu, K. (2025). The Impact of Data Factor Market Development on Regional Circulation Industry Competitiveness: The Mediating Role of Digital-Real Integration. Journal of Commercial Economics, (15), 26-30.

11. Chen, X., & Liao, Z. J. (2025). Artificial Intelligence, Innovation Efficiency, and Corporate Competitiveness. Social Sciences in Beijing, (9), 73-86.

12. Jiang, Y. H., & Zhao, K. (2025). Artificial Intelligence Technology and the Product Market Competitiveness of Manufacturing Enterprises. Commercial Research, (4), 1-10.

13. Zheng, B. H., Ni, P. S., & Xue, A. Q. (2025). The Impact of Big Data Application on the Market Competitiveness of Manufacturing Enterprises. Chinese Journal of Management, 22(1), 44-53.

14. Wang, S., Huang, X., Xia, M., et al. (2024). Does Artificial Intelligence Promote Firms' Innovation Efficiency: Evidence from Robot Application. Journal of the Knowledge Economy, 15(4).

15. Carayannis, E. G., Dumitrescu, R., Falkowski, T., et al. (2025). Empowering SMEs: Harnessing the Potential of Gen AI for Resilience and Competitiveness. IEEE Transactions on Engineering Management, 71. [2025-11-15].

16. Ma, J. (2025). The Impact of Basic Research Investment on the Competitiveness of High-Tech Industries. Communication of Finance and Accounting, (16), 86-90.

17. Yu, M. Y. (2025). The Impact of Incentive Environmental Regulation on the Competitiveness of Chinese Manufacturing Enterprises: An Analysis from the Perspective of Local Government Competition[J/OL]. Contemporary Economic Science, 1-14 [2025-11-15].

18. Zhang, W., Li, D. N., & Xu, K. X. (2025). The Impact of Carbon Information Disclosure on Corporate Green Competitiveness: An Empirical Analysis Based on A-Share Listed Companies in High-Pollution Manufacturing Industries. Ecological Economy, 41(4), 177-185.

19. Liu, Q. L., Guo, T. Z., & Zhang, P. J. (2025). The Impact of New Quality Productivity on the International Competitiveness of China's Manufacturing Industry: A Test Based on a Moderated Mediation Model of Human Capital Advancement. Dongyue Tribune, 46(2), 72-81+191-192.

20. Yang, S. (2025). An Empirical Test of the Impact of New Quality Productivity on the International Competitiveness of Digital Service Trade. Statistics & Decision, 41(14), 23-28.

21. Zhu, F. X., Xu, X. L., & Tan, Q. Y. (2024). New Quality Productivity, Dynamic Adaptability, and the Competitiveness of Manufacturing Enterprises. Southwest Finance, (12), 41-56.

22. Shi, N., Zhao, T. P., & Wanyan, R. Y. (2025). ESG Performance and Corporate Competitiveness: Governance Effect vs. Window-Dressing Effect. Journal of Statistics and Information, 40(8), 88-100.

23. Yu, X. J. (2025). Corporate Social Responsibility and Customer Concentration: The Mediating Role of Marketing Competitiveness. Communication of Finance and Accounting, (21), 70-74.

24. Zhang, J., Wu, Q. S., & Yang, R. P. (2025). The Impact of Marketing Investment on the Competitiveness of Retail Enterprises: The Mediating Role of Information Integration Capability. Journal of Commercial Economics, (11), 176-179.

25. Hai, X., Ke, X. X., & Li, M. Z. (2025). The Impact of Supply Chain Traceability on the Green Competitiveness of Retail Enterprises: The Moderating Role of Green Social Awareness and Green Human Capital. Journal of Commercial Economics, (3), 169-172.

26. Shen, Q., Sheng, F. Q., & Shen, X. M. (2024). The Path of Platform Economy Driving the Enhancement of the International Competitiveness of China's Digital Industry. Journal of Technology Economics & Management Research, (10), 40-45.

27. Du, Y., & Du, S. (2025). External Pay Competitiveness and Corporate Financial Asset Allocation: Incentive or Profit-Driven[J/OL]. Journal of Guizhou University of Finance and Economics, 1-12 [2025-11-15].

28. Cui, X., Sun, K., & Zhang, T. (2025). Optimization of Human Capital in Management and Integration with Digital Finance: Strategies for Enhancing Corporate Competitiveness. Finance

Research Letters, 83.

29. Feng, J., & Tan, C. (2021). State-Owned Enterprise Investors, Internal Audit, and Corruption Governance Under Full-Audit Coverage: An Analysis Based on Game Theory Journal of Audit & Economics, 36(6), 48-55.

30. Yan, L. J., Tang, S. Q., & Yan, H. Y. (2024). The Impact of Internal Audit Level on the High-Quality Development of State-Owned Enterprises: Empirical Evidence from Listed Companies Controlled by Beijing State-Owned Enterprises. China Soft Science, (S1), 414-420.

31. Zhang, L. L., Ma, X. H., & Xu, Y. L. (2024). Digital Transformation of Internal Audit in State-Owned Enterprise Groups: An Exploratory Case Study. Contemporary Accounting Review, 1(2), 97-120.

32. Luo, Y. (2025). Research on the Digital Transformation of Internal Audit in M Enterprise Under the Background of Big Data. Chongqing University of Technology.

33. State Council of the People's Republic of China. (2025). Measures for the Administration of Development Planning of Central Enterprises. Gazette of the State Council of the People's Republic of China, (18), 38-41.

34. Li, L. J. (2025, June 13). Constructing a Full-Process Monitorable and Evaluable Central Enterprise Planning Management System. Legal Daily, (006).

35. Li, S. H., Yang, L., & Zeng, H. X. (2019). The Supervisory Capability of Internal Audit Managers and Corporate Violations: Empirical Evidence from Small and Medium-Sized Board Listed Enterprises in China. Accounting Research, (8), 79-87.

36. Xiao, W. (2018). Reflections on Better Performing Internal Audit Duties in the New Era. China Internal Audit, (10), 27.

37. Liu, J. X., & Zhang, X. X. (2024). An Analysis of the Competitiveness of Agricultural Enterprises Under the Background of "Internet + Agriculture": A Case Study of Hefeng Animal Husbandry's Flexible Integration with the Internet. Rural Economy and Science-Technology, 35(7), 264-267.

38. Guo, Q. H., & Wang, H. (2023). Does the COVID-19 Pandemic Affect the Risk Sensitivity of Audit Fees. Friends of Accounting, (1), 81-88.

39. Yan, L. J., & Xu, M. H. (2023). The Mechanism of Internal Audit Innovation Promoting the High-Quality Development of State-Owned Enterprises Under the Background of Digital Transformation. Finance and Accounting, (17), 81-83.

40. Du, J., Huang, J. J., & Yang, Y. (2024). Institutional Co-ownership and Labor Income Share: From the Perspective of Resource Acquisition. Friends of Accounting, (4), 69-78.

41. Yao, H. X., & Zhang, X. X. (2019). Research on the Enhancement of Competitiveness of Agricultural Enterprises Under the Background of "Internet + Agriculture": An Empirical Analysis Based on Agricultural Listed Companies. Economic Review, (11), 70-81.

42. Sun, Z. Y., Wang, W., & Dong, Y. T. (2024). Can Internal Audit Improve Corporate Social Responsibility Performance? A Dual Perspective of Quality and Efficiency. Audit Research, (1), 126-139.

43. Zhu, K., & Tang, Y. (2025). Data Factor Utilization and Corporate Financial Asset Allocation: Evidence from Machine Learning and Text Analysis Accounting Research, (6), 121-133.

44. Yao, H. X., Sun, M. N., & Zhao, L. J. (2016). Can Corporate Dynamic Competitiveness Enhance M&A Performance. Journal of Liaoning University (Philosophy and Social Sciences Edition), 44(5), 98-108.

Release Date	Issuing Authority	Document Title	Core Tenets of the Document
August 2015	Central Committee of the Communist Party of China (CPC) and the State Council	Guidelines on Deepening the Reform of State-owned Enterprises	We will improve the supervision system and mechanisms for state-owned capital auditing, implement full-coverage auditing supervision over enterprise state-owned assets, and establish a regular auditing system for enterprise state-owned capital.
January 2018	National Audit Office, PRC	Provisions of the National Audit Office on Internal Audit Work	This constitutes a major initiative to implement the guiding principles of the CPC Central Committee and the State Council on strengthening internal audit work and giving full play to its role. It is of great significance for promoting audited entities to standardize internal management, improve internal control, mitigate risks, and enhance quality and efficiency.
November 2018	SASAC	Guidelines for Compliance	To promote central state-owned enterprises (CSOs) to comprehensively strengthen compliance management,

		Management of Central State-owned Enterprises (Trial Implementation	accelerate the improvement of law-based and compliant operation and management capabilities, strive to build law-based central enterprises, and ensure the sustainable and healthy development of enterprises.
December 2019	State-owned Assets Supervision and Administration Commission of the State Council	《Official Notice on Matters Concerning the Improvement and Oversight of the Internal Control Systems of Central Enterprises in 2020	All Central Enterprises shall take "strengthening internal control, preventing risks, and promoting compliance" as the goal, and establish a comprehensive, full-staff, whole-process, and whole-system risk prevention and control mechanism.
January 2020	State-owned Assets Supervision and Administration Commission of the State Council	Official Notice on Matters Concerning the Conduct of Internal Audit Work in Central Enterprises in 2020	Promote Central Enterprises to give full play to the supervisory and inspection role of internal audit in "facilitating management, controlling risks, and strengthening supervision", and continuously enhance enterprises' internal "immunity".
January 2020	State-owned Assets Supervision and Administration Commission of the State Council (SASAC)	Official Notice on Accelerating the Digital Transformation of State-owned Enterprises	Promote organizational and management reforms of enterprises oriented toward digital transformation, coordinate the development of new digital capabilities, and earnestly advance digital transformation efforts with a "nail-sticking spirit" to ensure consistent implementation of the overall blueprint.
September 2020	State-owned Assets Supervision and Administration Commission of the State Council	Implementation Opinions on Deepening the Internal Audit Oversight of Central Enterprises	Focusing on the formation of a state-owned asset supervision system centered on capital management, promote Central Enterprises to establish an internal audit leadership and management system that meets the requirements of the modern enterprise system with Chinese characteristics.
September 2020	State-owned Assets Supervision and Administration Commission of the State Council	Opinions on Further Deepening the Construction of Law-Based Central Enterprises	Deepen the informatization and digitalization of key areas such as contract management, case management, and compliance management; embed legal review into the processes of major decision-making and important business management; and realize the online identification, analysis, evaluation, and prevention and control of legal and compliance risks through big data and other means.
June 2025	State-owned Assets Supervision and Administration Commission of the State Council	Measures for the Administration of Development Planning of Central Enterprises	The State-owned Assets Supervision and Administration Commission of the State Council (SASAC) supervises and inspects the implementation of development plans, the progress of major engineering projects, and the completion of key tasks of Central Enterprises. For issues such as significant deviations in development direction, serious delays in implementation progress, and low development quality, it shall issue reminders, conduct interviews, or circulate notices in accordance with relevant provisions; for cases of blind investment deviating from the development plan direction, it shall impose assessment score deductions based on the severity of the circumstances.

Table.1. Relevant Documents on Internal Audit and Data Element Utilization Since 2015

Type	Variable	Definition
Dependent Variable	Corporate Dynamic Competitiveness	Comprehensive Index
Independent Variable	Internal Audit Independence	It is assigned a value of 1 if the number of audit committee members is greater than or equal to the industry average, and 0 otherwise.
Moderating Variable	Data Factor Utilization Rate	Ln (Number of Data Factor Utilization-related Words + 1)
Control Variable	Firm Size	Ln (Number of Employees + 1)
	Ownership Nature	Dummy variable: assigned a value of 1 for state-owned enterprises (SOEs), and 0 otherwise.

	Shareholding Ratio of Controlling Shareholders	(Number of Shares Held by Controlling Shareholders) / (Total Share Capital)
	Managerial Ownership Ratio	(Number of Shares Held by Managers) / (Total Share Capital)
	Board Size	Ln (Number of Board Members + 1)
	Proportion of Independent Directors	(Number of Independent Directors) / (Total Number of Board Members)
	Independent Director Network Centrality	The network centrality of independent directors' positions in the overall director network

Table.2. Variable Description

Component	Initial Eigenvalues			Sum of Squared Loadings			Rotated Sum of Squared Loadings		
	Total	Percentage of Variance	Cumulative %	Total	Percentage of Variance	Cumulative %	Total	Percentage of Variance	Cumulative %
1	2.780	27.799	27.799	2.780	27.799	27.799	2.743	27.431	27.431
2	2.118	21.181	48.980	2.118	21.181	48.980	2.141	21.405	48.837
3	1.029	10.294	59.274	1.029	10.294	59.274	1.044	10.437	59.274
4	.995	9.953	69.227						
5	.879	8.791	78.018						
6	.780	7.798	85.817						
7	.734	7.342	93.159						
8	.560	5.601	98.760						
9	.110	1.098	99.857						
10	.014	.143	100.000						

Table.4. Total Variance Explained in Base Year T

Component	Initial Eigenvalues			Sum of Squared Loadings			Rotated Sum of Squared Loadings		
	Total	Percentage of Variance	Cumulative %	Total	Percentage of Variance	Cumulative %	Total	Percentage of Variance	Cumulative %
1	2.827	28.273	28.273	2.827	28.273	28.273	2.794	27.942	27.942
2	2.296	22.965	51.238	2.296	22.965	51.238	2.318	23.184	51.126
3	1.027	10.272	61.510	1.027	10.272	61.510	1.038	10.384	61.510
4	.996	9.964	71.474						
5	.858	8.585	80.059						
6	.731	7.311	87.369						
7	.631	6.306	93.675						
8	.524	5.239	98.914						
9	.096	.955	99.870						
10	.013	.130	100.000						

Table.5. Total Variance Explained for T+2 Year

	Component			Component			Component		
Component	Total	Percentage of Variance	Cumulative %	Total	Percentage of Variance	Cumulative %	Total	Percentage of Variance	Cumulative %
1	2.843	28.432	28.432	2.843	28.432	28.432	2.805	28.050	28.050

2	2.246	22.457	50.889	2.246	22.457	50.889	2.266	22.664	50.715
3	1.032	10.325	61.214	1.032	10.325	61.214	1.050	10.499	61.214
4	.982	9.815	71.029						
5	.849	8.487	79.515						
6	.732	7.321	86.837						
7	.674	6.743	93.580						
8	.528	5.277	98.857						
9	.103	1.027	99.884						
10	.012	.116	100.000						

Table .6. Total Variance Explained for T+2 Year
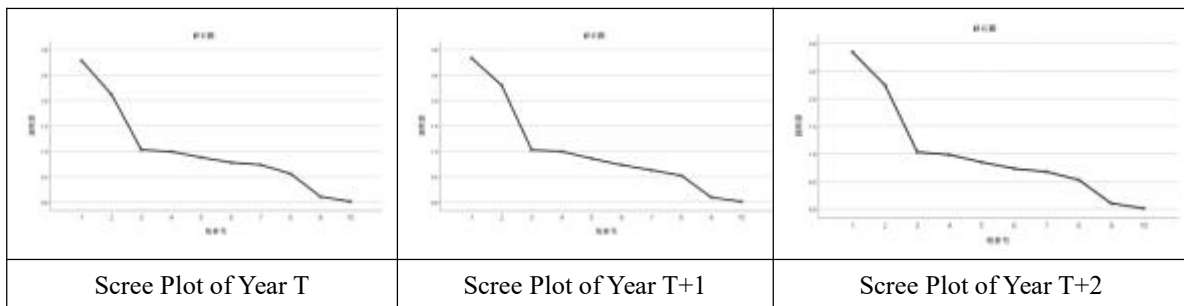

| Scree Plot of Year T | Scree Plot of Year T+1 | Scree Plot of Year T+2 |

Figure. 1. Scree Plot of Common Factors