

A Study on the Changes and Driving Factors of Corporate Performance Management in the Digital Economy Era: Take A-share listed companies in China as an example

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Abstract. In the era of digital economy, enterprise performance management is experiencing significant changes. This paper adopts principal component analysis to measure the development of local digital economy and empirically analyzes it with the financial data of China's A-share listed companies from 2011 to 2019, and the results show that the digital economy has a positive impact on enterprise performance, especially in high-tech enterprises and enterprises in the southern region. Net sales margin plays a key role in the development of digital economy to improve enterprise performance. High-tech enterprises can quickly adapt to new technologies and improve their performance by virtue of their technological advantages, while enterprises in the southern region can adopt new technologies and models more quickly and enhance their competitiveness due to the mature digital economy environment. It is suggested that enterprises should actively integrate into the digital economy and use big data and artificial intelligence technology to optimize performance management, while the government needs to strengthen policy support, promote the deep integration of the digital economy and the real economy, and promote the balanced development of the digital economy among regions.

Keywords: digital economy; enterprise performance management; high-tech enterprises; geographic differences; net sales rate.

1. Introduction

According to the Digital Economy Report 2019 released by the United Nations Conference on Trade and Development, China and the United States have become leaders in the field (see Figure 1). The digital economy driven by technological innovation has become a core driver of economic growth, and its widespread application has profoundly changed the business operating environment and performance measurement. However, China's weak innovation foundation and insufficient investment constrain high-quality development [1]. Existing studies have mostly focused on the internal digitalization of enterprises or "Internet+" technology, and have paid insufficient attention to the development of local digital economy and the effects of its policies [2]. The purpose of this paper is to measure the development of local digital economy through principal component analysis, empirically analyze its impact on enterprise performance using listed company data, explore the heterogeneity effect under the differences between high-tech enterprises and north-south regions, and reveal the impact mechanism from the perspective of net sales rate, so as to provide theoretical basis and practical guidance for the government and enterprises to make decisions.

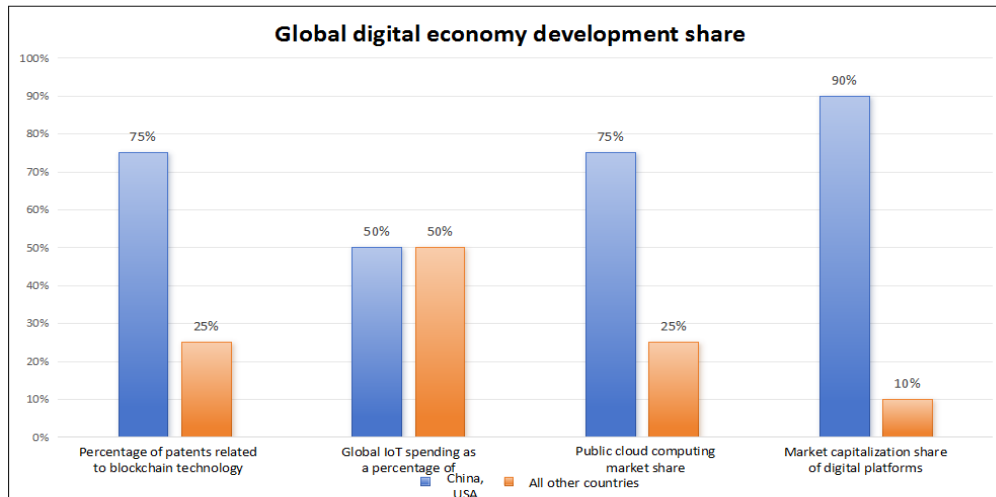


Figure 1. Global digital economy development share

2. Research Status and Theoretical Basis

2.1. Definition, Characteristics and Impact of Digital Economy

Digital economy, as a new type of economic form that takes digitized information and knowledge as the core production factors and reconstructs the economic development mode with the help of modern information network, shows the characteristics of high innovation, strong permeability and wide coverage. Through the extensive application of big data, cloud computing, artificial intelligence and other technologies, it has been deeply integrated into all aspects of economic activities such as production, distribution, exchange and consumption, and has become a key driving force for economic growth. At the level of enterprise performance management, the digital economy not only improves information transparency, reduces information asymmetry, and helps enterprises accurately formulate strategic objectives and optimize resource allocation, but also realizes the automation and intelligence of the operation process through the application of digital technologies such as ERP, which improves management efficiency and reduces human errors [3]. The digital economy has given rise to emerging business models such as the platform economy and the sharing economy, which have opened up new profit growth points for enterprises, such as Alibaba's e-commerce platform, which provides precise marketing services through big data analysis and significantly enhances corporate performance. The application of supply chain finance, blockchain and other technical means has promoted inter-enterprise cooperation, reduced transaction costs, and enhanced supply chain stability and flexibility. The digital economy plays an irreplaceable role in improving enterprise performance management and promoting enterprise transformation and upgrading.

2.2. Theoretical Foundations of Business Performance Management

The theoretical foundations of corporate performance management have undergone a significant shift between the traditional framework and the digital economy. The traditional framework of corporate performance management mainly relies on financial performance indicators, such as profit, revenue growth rate and return on assets (ROA), and comprehensively evaluates corporate performance through tools such as the balanced scorecard (BSC), which covers the four dimensions of finance, customers, internal processes, and learning and growth. With the rapid changes in the market environment, this framework has gradually revealed its limitations such as lagging response and neglecting non-financial indicators. In contrast, corporate performance management in the digital economy has introduced a new perspective that emphasizes data-driven and dynamic adjustments. The wide application of big data and artificial intelligence technology enables enterprises to collect and analyze massive amounts of data in real time, thus realizing accurate performance management. For example, through machine learning algorithms to predict sales data, enterprises can more flexibly

adjust market strategies and optimize resource allocation. Digital transformation has also prompted companies to focus on non-financial indicators, such as customer satisfaction and employee innovation, which are of critical importance to the long-term sustainable development of enterprises. The introduction of blockchain technology further enhances the transparency and credibility of performance data, providing a more solid basis for corporate decision-making. The development of emerging business models, such as platform economy and sharing economy, requires enterprises to re-examine performance from an ecosystem perspective, emphasizing the value creation of cooperation and synergy. Enterprise performance management in the era of digital economy pays more attention to real-time, comprehensiveness and dynamics, so as to better adapt to the complex and changing market environment and realize the sustainable development of enterprises.

3. Research Design

3.1. Data Source and Sample Selection

The data in this paper comes from financial databases such as Guotai Junan, WIND, Flush and the China Urban Statistical Yearbook, and the samples are the financial data of China's A-share listed companies from 2011 to 2019, financial companies are excluded to ensure consistency, and continuous variables are shrunken at 1% and 99% levels to exclude outliers. Corporate performance, as the core dependent variable, is measured by return on assets (ROA), which is the ratio of net profit to average total assets, which can intuitively reflect the efficiency of corporate asset utilization and operating results, such as Hikvision ROA has been leading for five consecutive years, which highlights the excellent asset management and profitability, and helps to analyze in depth the substantial impact of the development of the digital economy on the economic performance of enterprises.

3.2. Variable Definition and Measurement

The core measure of enterprise performance management effectiveness is return on assets (ROA), i.e., the ratio of net profit to average total assets, which effectively reveals the efficiency of enterprise asset utilization and operating results. In order to deeply explore the impact mechanism of digital economy development on enterprise performance, the study adopts principal component analysis to comprehensively measure digital economy-related indicators, which covers the number of people in the software industry and information transmission computer services, telecommunication business revenue, the number of cell phone subscribers, the number of Internet broadband access subscribers and the financial inclusion index, etc., and conducts a natural logarithmic processing of the principal component indices of the digital economy in order to comprehensively reflect the multi-dimensional characteristics of digital economy development.

In terms of control variables, we consider enterprise size (Size, expressed as the logarithm of the total value of enterprise assets), the nature of ownership (State, which is assigned a value of 1 for state-owned enterprises and 0 for non-state-owned enterprises), whether it is loss-making (Deficit, which is assigned a value of 1 for loss-making enterprises and 0 for non-loss-making enterprises), the degree of separation of powers (SOP, which measures the degree of separation of ownership and control of a company), the degree of separation of GDPPC (Gross Domestic Product), GDPPC (Gross Domestic Product), and the degree of separation of ownership and control of a company. Gross Domestic Product (GDPPC), Average Annual Population (AAP), and Expenditure on Local Finances (EBLF), among other multiple factors, in order to exclude other potentially influential factors and ensure the robustness of the study results.

In order to further explore the specific path of digital economy development to enhance enterprise performance, the study introduces net sales margin (SM, i.e., net profit as a share of sales revenue) as a mechanism variable. Based on the above variable definitions, the study constructs two models to test hypotheses H1 and H2, respectively. model (1) aims to verify the positive impact of digital economic development on enterprise performance, while model (2) adds mechanism variables to the

baseline regression model to observe whether digital economic development indirectly affects enterprise performance by increasing the net sales margin. Industry, year and city fixed effects, as well as random error terms, are incorporated into the model to comprehensively control for potential exogenous factors interfering with the research results. The results of descriptive statistics show that there are small differences in return on assets among firms, while there are significant differences in the degree of digital economy development, providing a solid data base for subsequent in-depth analysis.

4. Empirical Results and Analysis

4.1. Descriptive Statistics and Correlation Analysis

The descriptive statistics of variables show that the standard deviation of return on assets (ROA) is 0.065, the minimum value is -0.260, the maximum value is 0.217, which indicates that the difference in return on assets between enterprises is small but there is a loss. The standard deviation of digital economy development (DED) is 1.293, with a minimum value of 7.393 and a maximum value of 12.810, showing significant imbalances in the development of the digital economy between regions (see Table 1).

Table 1. Results of descriptive statistical analysis of variables

Variable	Average value	Standard deviation	Minimum value	Maximum value	Upper quartile
ROA	0.038	0.065	-0.26	0.217	0.037
DED	10.26	1.293	7.393	12.8	10.11
SM	0.061	0.204	-1.242	0.528	0.065
Size	22.14	1.313	19.47	26.15	21.97
State	0.353	0.478	0	1	0
Deficit	0.103	0.305	0	1	0
SOP	4.537	7.353	0	28.14	0
GDPPC	0.985	0.446	0.213	2.034	0.962
AAP	0.075	0.051	0.011	0.337	0.066
EBLF	1.965	2.228	0.105	8.352	0.892

Correlation analysis shows that digital economic development (DED) is positively related to return on assets (ROA), i.e., DED has a positive effect on firm performance. Net sales margin (SM) is also positively correlated with ROA, revealing the positive effect of net sales margin on firm performance improvement. Among the control variables, firm size (Size) is positively correlated with ROA, and the nature of ownership (State) is negatively correlated with ROA, suggesting that scale expansion contributes to the enhancement of firm performance, whereas the state ownership nature may have a negative impact on firm performance. Whether or not to lose money (Deficit) is negatively related to ROA, indicating that loss-making status reduces firm performance. The degree of separation of powers (SOP) has no significant effect on ROA, while gross domestic product per capita (GDPPC), average annual population (AAP), and local fiscal expenditure (EBLF) are all positively correlated with ROA, reflecting the positive impact of a favorable regional economic environment and financial support on firm performance (see Table 2).

Table 2. Results of variable correlation analysis

	ROA	DED	SM	Size	State	Deficit	SOP	GDPPC	AAP	EBLF
ROA	1									
DED	0.041***	1								
SM	0.796***	0.058***	1							
Size	0.024***	0.078***	0.065***	1						
State	-0.075***	0.003	-0.013*	0.328***	1					
Deficit	-0.651***	-0.044***	-0.631***	-0.089***	0.012*	1				
SOP	0.007	-0.100***	-0.015**	0.079***	-0.032***	-0.006	1			
GDPPC	0.022***	0.638***	0.023***	0.042***	-0.138***	-0.031***	-0.048***	1		
AAP	0.023***	0.583***	0.038***	0.083***	0.095***	-0.023***	-0.071***	0.060***	1	
EBLF	0.017***	0.816***	0.035***	0.110***	0.021***	-0.029***	-0.082***	0.525***	0.632***	1

Note: * denotes significant at 10% level of significance, ** denotes significant at 5% level of significance, *** denotes significant at 1% level of significance, values in parentheses are standard errors.

4.2. Regression Analysis of Digital Economy on Enterprise Performance Management

On the basis of comprehensively considering the impact of the basic nature of enterprises and business conditions on enterprise performance, this paper conducts a benchmark regression analysis of the relationship between the development of the digital economy and enterprise performance during the period of 2011-2019. During the analysis, variables such as enterprise size (Size), nature of ownership (State), whether it is loss-making (Deficit), and the degree of separation of powers (SOP) are introduced to control individual differences in enterprises. Meanwhile, given that the development of the digital economy is characterized by geography, this paper also incorporates variables such as Gross Domestic Product per Capita (GDPPC), Average Annual Population (AAP), and Expenditure on Local Finances (EBLF) to reflect the economic environment of the region in which the enterprise is located (see Table 3). The regression results show that with the gradual addition of control variables and the control of fixed effects, the regression coefficients of digital economic development (DED) are consistently and significantly positive, which strongly supports Hypothesis H1, which states that digital economic development has a positive impact on enhancing business performance. This result may be attributed to the fact that the digital economy effectively reduces the information asymmetry between enterprises and supply chain partners, improves operational efficiency and reduces costs.

Table 3. Summary of regression analysis of the impact of digital economy development on business performance

Variable	-1	-2	-3
	ROA	ROA	ROA
DED	0.002*** 0	0.002*** -0.001	0.004** -0.002
Size		-0.000* 0	0.001*** 0
State		-0.011*** -0.001	-0.011*** -0.001
Deficit		-0.135*** -0.001	-0.130*** -0.001
SOP		0 0	0 0
GDPPC		-0.002 -0.001	0.006** -0.003
AAP		0.013 -0.01	0.031 -0.134
EBLF		-0.001*** 0	-0.003*** -0.001
Constant	0.015*** -0.004	0.051*** -0.008	-0.004 -0.02
Industry fixed effects	Uncontrolled	Uncontrolled	Containment
Year fixed effects	Uncontrolled	Uncontrolled	Containment
Urban fixed effects	Uncontrolled	Uncontrolled	Containment
Observed value	22 172	20 345	20 343
Adjustment R2	0.002	0.419	0.466

Note: * denotes significant at 10% level of significance, ** denotes significant at 5% level of significance, *** denotes significant at 1% level of significance, values in parentheses are standard errors.

To further verify the robustness of the benchmark regression results, this paper implements the strategy of replacing variables and adding control variables. Specifically, earnings per share (EPS) is used to replace return on assets (ROA) as a measure of corporate performance, and the digital financial inclusion index (DFI) is introduced as a proxy variable for digital economic development (see Table 4). The regression results show that the positive impact of digital economic development on corporate performance remains significant.

Table 4. Robustness test results: variable substitution analysis

Variable	-1	-2	-3	-4
	EPS	EPS	EPS	ROA
DED	0.012*** -0.004	-0.001 -0.007	0.066*** -0.021	
DFI				0.011* (0.006)
Constant	0.203*** -0.04	-1.495*** -0.098	-2.485*** -0.249	-0.054*** -0.014
Control variable	Uncontrolled	Containment	Containment	Containment
Industry fixed effects	Uncontrolled	Uncontrolled	Containment	Containment
Year fixed effects	Uncontrolled	Uncontrolled	Containment	Containment
Urban fixed effects	Uncontrolled	Uncontrolled	Containment	Containment
Observed value	22 172	20 336	20 334	18 839
Adjustment R2	0.001	0.198	0.302	0.471

Note: * denotes significant at 10% level of significance, ** denotes significant at 5% level of significance, *** denotes significant at 1% level of significance, values in parentheses are standard errors.

By adding asset-liability ratio (AAL) and Tobin's Q (TQ) as control variables and effectively dealing with endogeneity, the positive impact of digital economy development on firm performance remains robust, thus fully proving the reliability of the benchmark regression results (see Table 5).

Table 5. Robustness regression analysis: the impact of digital economy development on firm performance

Variable	-1	-2	-3
	ROA	ROA	ROA
DED	0.002** -0.001	0.003*** -0.001	0.004** -0.002
AAL		-0.048*** -0.001	-0.044*** -0.001
TQ		0.001*** 0	0.001*** 0
Constant	-0.033** -0.016	-0.037*** -0.008	-0.072*** -0.018
Control variable	Containment	Containment	Containment
Industry fixed effects	Uncontrolled	Uncontrolled	Containment
Year fixed effects	Containment	Uncontrolled	Containment
Urban fixed effects	Uncontrolled	Uncontrolled	Containment
Enterprise fixed effects	Containment	Uncontrolled	Uncontrolled
Observed value	20 231	20 319	20 306
Adjustment R2	0.616	0.461	0.519

Note: * denotes significant at 10% level of significance, ** denotes significant at 5% level of significance, *** denotes significant at 1% level of significance, values in parentheses are standard errors.

4.3. Driver Analysis

4.3.1 Identification of Key Drivers

When exploring the impact of digital economy development on enterprise performance, the identification of key driving factors is particularly important [4]. In this paper, two key drivers are identified when exploring the impact of the development of digital economy on enterprise performance: whether the enterprise is a high-tech enterprise and the geographic region (south or north) to which the enterprise belongs.

First, high-tech firms are special in terms of financing constraints and cost performance. Since high-tech firms usually have higher R&D investment and stronger technological innovation capability, they are able to adapt and utilize new technologies faster in the development of the digital

economy, thus improving firm performance. For high-tech firms, the effect of digital economic development (DED) on firm performance (ROA) is significantly positive at the 1% level (see Table 6), which suggests that DED promotes the performance of high-tech firms in particular.

Table 6. Results of the analysis of the drivers of the impact of the development of the digital economy on business performance

Variable	-1	-2	-3	-4
	High-tech enterprises	Not a high-tech enterprise	The South	North
	ROA	ROA	ROA	ROA
DED	0.012***	0.002	0.006**	0.003
	-0.004	-0.002	-0.002	-0.003
Constant	-0.056	-0.009	-0.03	0.001
	-0.044	-0.023	-0.026	-0.037
Control variable	Containment	Containment	Containment	Containment
Industry fixed effects	Containment	Containment	Containment	Containment
Year fixed effects	Containment	Containment	Containment	Containment
Urban fixed effects	Containment	Containment	Containment	Containment
Observed value	4 432	15 908	13 655	6 677
Adjustment R2	0.423	0.487	0.45	0.484

Note: * denotes significant at 10% level of significance, ** denotes significant at 5% level of significance, *** denotes significant at 1% level of significance, values in parentheses are standard errors.

Second, geographical differences are also a key factor affecting enterprise performance. With the differentiation of China's regional economic development, the gap between the South and the North has gradually emerged in the fields of economy, society, ecology and people's livelihood. Benefiting from its more perfect infrastructure, superior business environment and higher level of human capital, the southern region has performed more prominently in the development of the digital economy. For southern enterprises, the promotion effect of digital economy development on enterprise performance is significantly positive at the 5% level, while it is not obvious for northern enterprises (see Table 6). This suggests that there is significant geographical heterogeneity in the impact of digital economy development on firm performance.

4.3.2 Specific Impact of Drivers on Business Performance Management

High-tech enterprises and geographical differences significantly affect enterprise performance management. High-tech enterprises rely on the advantages of digital technology to achieve product innovation, process optimization, improve production efficiency and market competitiveness, while expanding market space and business scale, reducing operating costs and improving profitability. Enterprises in the southern region are at the forefront of digital economy development, and can rapidly apply new technologies and models to optimize supply chain management, enhance customer experience and brand building, and thus improve corporate performance. In contrast, enterprises in the North are lagging behind in the development of digital economy and need to increase investment to narrow the gap. Mechanism analysis shows that the regression coefficient of the interaction term (DED \times SM) between digital economy development and net sales margin is significantly positive, indicating that the increase in net sales margin can enhance the promotion effect of digital economy development on enterprise performance (see Table 7). This may be due to the fact that the development of the digital economy enables enterprises to more accurately locate high net worth customer groups and obtain higher pricing power through differentiated competition; the application of the Internet also reduces the selling expenses and operating costs of enterprises, thus increasing the net sales margin and enterprise performance.

Table 7. Mechanistic analysis regression results: the impact of digital economy development on business performance

	-1	-2
	ROA	ROA
DED×SM		0.003*** (0.001)
SM		0.173*** (0.010)
DED	0.004** (0.002)	0.003** (0.001)
Constant	-0.004 (0.020)	0.005 (0.015)
Control variable	Containment	Containment
Industry fixed effects	Containment	Containment
Year fixed effects	Containment	Containment
Urban fixed effects	Containment	Containment
Observed value	20 343	20 343
Adjustment R2	0.465	0.677

5. Conclusions and Recommendations

In the context of the booming digital economy, enterprise performance management is facing a profound transformation. This study reveals that the digital economy significantly improves enterprise management effectiveness and facilitates the birth of emerging business models by enhancing information transparency, mitigating information asymmetry, and utilizing automation and intelligent technologies, opening up new avenues of profitability for enterprises. Key drivers include the technological advantages of high-tech firms, which enable them to rapidly implement product innovation and process optimization, and faster adoption of new technologies and models in the South due to the maturity of the digital economy. The study suggests that companies should proactively integrate into the digital economy, use big data and artificial intelligence to instantly monitor and analyze performance data, and emphasize the evaluation of non-financial indicators. The government should strengthen its support, promote the integration of the digital economy with the real economy, strengthen the digital infrastructure, and promote the balanced development of the regional digital economy [5]. This study suffers from sample limitations and insufficient time span, so future research should expand the sample scope, extend the research period, and explore the profound impact of organizational change and cultural reshaping on enterprise performance in digital transformation, with a view to providing more accurate policy recommendations and practical guidelines for enterprises and governments.

References

- [1] Li Pretty. Comprehensive evaluation of China's high-quality development and its path choice [J]. *Financial Economy*, 2021(10):47-55.
- [2] Jing Wenjun, Sun Baowen. Digital economy for high-quality economic development: a theoretical analysis framework [J]. *Economist*, 2019(02):66-73.
- [3] Du Chuanzhong, Zhang Yuan. Research on the impact mechanism of digital economy development on enterprise productivity growth[J]. *Securities Market Herald*, 2021(02):41-51.
- [4] Jiang Hongli, Hou Yan, Jiang Pengcheng. Does the development of digital economy promote or inhibit corporate real investment: empirical evidence from Chinese listed companies[J]. *Modern Finance and Economics (Journal of Tianjin University of Finance and Economics)*, 2022,42(05).
- [5] JIANG Dianchun, PAN Xiaowang. The impact of digital economy development on corporate innovation performance: empirical evidence based on listed companies in China[J]. *Journal of Shanxi University (Philosophy and Social Science Edition)*, 2022,45(01):149-160.