

Linear Regression Model Construction and Path Optimization of Digital Transformation of Enterprise Financial Management in Digital Economy

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ABSTRACT

In the era of digital economy, the digital transformation of enterprise financial management has become an important topic that needs to be studied and solved at present. In this paper, based on analyzing the internal and external drivers on the digital transformation of enterprise financial management, the financial data of 3,498 Shanghai and Shenzhen A-share listed enterprises were obtained using Python technology. Then a fixed effect model was constructed by combining the multiple linear regression model to analyze the degree of influence of internal and external drivers on the level of digital transformation of enterprise financial management. Policy support, digital technology environment, leadership support, team awareness, and digital technology investment all have a significant effect at the 1% level on the level of digital transformation of enterprise financial management. Among them, the influence of digital technology investment is the largest, that is, every 1 percentage point increase in the enterprise's digital technology investment in financial management, the level of digital transformation of enterprise financial management will increase by 0.204 percentage points. And there is significant regional and equity heterogeneity in the level of digital transformation of enterprise financial management, and the effect of digital transformation of financial management is stronger in the eastern region and state-owned enterprises. Therefore, in the era of digital economy, enterprises need to build a digital financial management system, strengthen cross-departmental collaboration and communication, and combine composite talents to realize the digital transformation of financial management.

Keywords: Python technology; linear regression model; financial management; digital transformation

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1. Introduction

Along with the development of the times, advanced technology has been widely used in the industry, including cloud computing, big data, artificial intelligence and so on. In this environment, enterprises should actively comply with the development trend of the digital economy era, change the previous financial management concepts and models, in-depth understanding of the importance of promoting the digital transformation of financial management [1-4].

With the development of informationization and digitalization, the digital transformation of enterprise finance has become a trend. Financial digital transformation, aimed at the company's financial statements, financial analysis, budgeting and cost control and other traditional financial management work through information technology means of digitalization, to achieve efficient coordination of information flow, capital flow, logistics, reduce labor costs, improve the operational efficiency of enterprises and financial risk management capabilities [5-8]. The theoretical logic of the digital transformation of enterprise finance lies in the fact that digitalization can realize the upgrading of enterprise financial management refinement, flexibility and intelligence, and then improve the effect of enterprise financial management [9-11]. The important role of digitization is to facilitate data management, analysis and utilization, which is conducive to the control of income and expenditure, optimize operations, improve efficiency and reduce costs [12-14]. Financial digital transformation can not only promote profit growth and enterprise competitiveness, but also improve the accuracy and timeliness of financial reporting, strengthen risk management and the ability to comply with internal and external regulatory requirements [15-17]. Digital transformation also increases the demands on finance staff and management, requiring finance staff to adapt to and master digital technology, as well as accounting, finance and financial knowledge [18-19].

Literature [20] reveals the importance of enterprise digital transformation. Literature research and other methods are utilized in order to expand the content of digital transformation of enterprise financial management and promote the implementation of digital strategy, so as to solve the various problems exposed by enterprise financial management. Literature [21] discusses the significance of financial transformation based on the basic concept of the digital economy, and develops an analysis of traditional financial management problems, and proposes practical strategies for enterprise financial transformation. Literature [22] examined the necessity, challenges and path of digital transformation of financial management based on literature review. And the conversion path was designed to address the risks of digital platforms. The importance of paths such as changing the mindset and strengthening the training of financial staff for digital transformation of financial management is emphasized. Literature [23] aims to understand the impact of digital transformation of financial management on efficiency, risk management and other aspects. A qualitative study was conducted using the library research method. Based on the analysis of previous research results, it is emphasized that digital transformation of financial management brings significant benefits such as improved operational efficiency and accurate decision-making, but there are also risks such as financial data security. Literature [24], based on the development of financial big data in an enterprise, points out the impact of the application of big data technology on financial accounting, workflow, and finance personnel, as well as the reaction and change of the enterprise, and analyzes the reasons and response options. Literature [25] utilizes the comparative method of literature to explore the difficulties faced by the financial management of enterprises in the context of the digital economy era, and puts forward suggestions for the transformation of the financial management mode of enterprises. Literature [26] outlines the concepts related to the digital transformation of traditional enterprise financial management in the context of big data. The opportunities and challenges that enterprises have to face in the process of digital transformation are analyzed. And discussed the transformation and upgrading of enterprises. It emphasizes that enterprises should actively transform their financial management in order to improve market competitiveness. Literature [27] highlights the important

impact of digital transformation on SMEs in terms of financial management, financial planning and budgeting, as well as the challenges and effective strategies encountered in the process of digital transformation. It is stated that by adopting cost-effective solutions, seeking external expertise, etc., SMEs can navigate this transformation and thus increase the level of competitiveness of their businesses. Literature [28] describes the necessity of financial management innovation in enterprises under digital transformation and makes relevant recommendations. It is pointed out that financial management innovation has a positive impact on improving financial risk management and reducing enterprise risks. Literature [29] aims to examine the impact of financial digital transformation of listed companies on financial performance, in order to put forward suggestions for enterprises in financial digital transformation. A panel data regression model is utilized to carry out the study. The conclusion is “financial digital transformation is conducive to improving the financial performance of enterprises”. Based on the concept of digital transformation of financial management, literature [30] explored the necessity of digital transformation of financial management. Through the digitalization of financial management of small and medium-sized enterprises in the problems, and put forward solutions. Literature [31] emphasizes the market environment that enterprises should be exposed to in their development based on examining the application of big data in enterprise management, showing that, by taking advantage of big data, it is possible to improve the economic efficiency of enterprises.

Digital transformation of financial management has become an important issue for modern enterprises in the digital economy, which not only concerns technological progress, but also completely changes the operation mode of enterprises. In this paper, we choose Anaconda and PyCharm to build a Python development environment, and based on Python technology, we obtained the financial related data of A-share listed enterprises in Shanghai and Shenzhen from 2010 to 2023. A multiple linear regression model was established by choosing internal drivers such as leadership support, team awareness, digital technology investment, and external drivers such as policy support and digital technology environment as the core explanatory variables. In this way, we explore the degree of influence of internal and external drivers on the level of digital transformation of financial management, and propose a specific path for the digital transformation of financial management of enterprises based on the analysis results.

2. Theoretical analysis and research hypothesis

Digital transformation has brought opportunities and challenges to all industries, and enterprises must cope with the problems brought about by digital transformation if they want to sustain development in the new era. Constrained by factors related to the development of enterprises themselves, most enterprises have problems such as insufficient financial information management and lack of internal supervision, which are not conducive to the realization of long-term strategic goals of enterprises. Enterprise financial management should comply with the characteristics of the digital economy, pay attention to risk control, improve the management level, so as to achieve high-quality development. Therefore, it is necessary to effectively recognize and fully introduce digital technology to comprehensively improve the level of financial management and governance, and then promote the digital transformation of enterprise financial management in the digital economy.

2.1. *Digitalization of enterprise financial management*

2.1.1. Digital transformation of enterprises. At present, regarding the concept of digital transformation, scholars define the different subjects and levels involved in digital transformation from different perspectives. From the perspective of traditional enterprises, some scholars point out that digital transformation is a process of enterprise change, i.e., after an enterprise applies new digital technologies, its core business is improved, its operational processes are simplified or new business models are created. Some scholars, from the perspective of innovation, believe that digital

transformation is a process in which enterprises will achieve the effect of innovation through the use of digital technology, mainly through the reshaping of the enterprise's vision, strategy, organizational structure, processes, etc., so that the enterprise can adapt to the ever-changing external environment [32].

According to the White Paper on Digital Transformation Indices and Methodological Paths for State-Owned Enterprises, the process of digitization is divided into three stages: digital conversion, digitization and digital transformation. Digital conversion and digitization are also uniformly called traditional enterprise informatization, i.e., the process of applying information technology, accelerating the sharing of internal and external information of the enterprise, and effectively utilizing such information to optimize and reconstruct business processes to achieve the purpose of improving quality, lowering costs and increasing efficiency, and constructing the competitiveness of the enterprise in the market. The digital transformation of enterprises includes intelligence and networking, i.e., the in-depth application of new-generation information technology has stimulated the innovation-driven potential of data elements, and constructed and enhanced the new capabilities of enterprises in the digital era, i.e., the new capabilities of survival and development have pressed the accelerator button for enterprise optimization, innovation and restructuring, and have generated, transmitted and acquired new values, which is a process of enterprise transformation, upgrading and innovative development.

2.1.2. Digitalization of financial management. Financial management digitization is the direction of the development of enterprise financial digitization in the era of digital economy, financial management as an important part of enterprise management, is an important breakthrough for enterprises to achieve management digitization. Enterprise financial management digitalization is shown in Figure 1. The digital transformation of financial management starts with the integration of industry and finance, and collects enterprise operating data in detail, which facilitates cost management and at the same time can provide data support for financial sharing [33]. Secondly, centralized accounting is carried out through financial sharing, and the communication and feedback efficiency between departments is improved. Finally, to realize the digitalization of enterprise management, the use of digital technology to fully explore the data assets to provide decision-making support to ensure that the planning of the overall situation. That is, through digital technology to promote the integration of industry and finance can initially realize the digitization of enterprise operation and management, and the construction of the sharing center is to realize the digitalization of enterprise finance is a powerful hand, on the basis of which the establishment of the financial cockpit can further realize the real-time management of the enterprise, to meet the needs of the enterprise strategic planning and management.



Fig. 1. Digital transformation of financial management

2.2. Formulation of research hypotheses

2.2.1. External motivations:

1) Policy support. In recent years, the government has attached great importance to the digital transformation of enterprise financial management and issued a series of policies to strongly support it. At the policy level, government departments have issued a series of guiding opinions and action plans, aiming to promote the deep integration of enterprise financial management with new-generation information technology and accelerate the process of industrial digitization. In terms of specific measures, the government encourages enterprises to increase investment in digital technology research and development, and gives them practical support in the form of tax incentives, financial subsidies and special funds. In addition, the government also advocates enterprises to participate in digital transformation demonstration projects, promotes successful cases, and strengthens domestic and international exchanges and cooperation through forums and seminars to enhance the overall digitization level of the industry. In addition, the state also places special emphasis on information security protection during the digital transformation of corporate finance, and has introduced corresponding regulations and standards to ensure that enterprises can effectively prevent information security risks while enjoying the dividends brought by digitization. Through the above policy measures, the government has created a favorable policy environment for the digital transformation of enterprise financial management, which has strongly promoted the innovative development and transformation and upgrading of enterprises. Based on this, the following hypotheses are proposed:

H1: There is a positive impact of policy support on the digital transformation of enterprise financial management.

2) Digital technology environment. At present, the world is witnessing a new generation of information technology clusters led by the Internet, the Internet of Things, cloud computing, big data and artificial intelligence and other cutting-edge technologies are closely integrated with traditional industries at an unprecedented speed, and this has triggered the climax of the technology revolution on a global scale as well as the process of in-depth reshaping of the industrial landscape. In this process, the disruptive power brought by high technology is stimulating a new production mode, organizational form and business model, and these changes are like a new force emerging from the cocoon, greatly broadening the boundaries of industrial development and improving the innovation ability and efficiency of the whole industry. With the help of big data technology, enterprises can extract valuable information from massive production data, which can be used to optimize resource allocation, reduce costs, improve product quality, and predict changes in market demand. By keeping up with the pace of the times and taking advantage of the new generation of information technology, enterprises continue to break down old production barriers, improve overall competitiveness, and move toward higher levels of intelligent manufacturing and intelligent services. Based on this, the following hypotheses are proposed:

H2: There is a positive impact of digital technology environment on the digital transformation of enterprise financial management.

2.2.2. Internal motivations. The demand for financial management within enterprises is an indispensable force driving the digital transformation of financial management. With the expansion of enterprise scale and business scope, financial management is facing unprecedented challenges, and the processing of massive financial data, the management of complex financial processes, and the support of efficient financial decision-making have all become difficult problems that must be overcome by enterprise financial management. The digital transformation of financial management is an effective means to cope with these challenges. Through the introduction of advanced financial

management systems and automation tools, the automated processing and analysis of financial data is realized, thus significantly improving the efficiency and accuracy of financial management. It not only reduces the workload of financial staff, but also improves the overall level of financial management.

More importantly, the digital transformation of financial management can also integrate various types of financial information within the enterprise, providing comprehensive and timely financial data support for enterprise decision-making, so that enterprises can make scientific decisions based on accurate and timely financial information, which in turn promotes the sustainable development and competitiveness of enterprises. Therefore, the demand for financial management within the enterprise has become an important factor in promoting the digital transformation of financial management, prompting enterprises to constantly seek innovation to adapt to the increasingly complex market environment and business needs. In summary, the following hypotheses are proposed:

H3: There is a positive impact of leadership support level on the digital transformation of enterprise financial management.

H4: There is a positive effect of team cognition level on enterprise financial management digital transformation.

H5: There is a positive impact of digital technology investment on enterprise financial management digital transformation.

2.2.3. The role of heterogeneity:

1) The role of regional heterogeneity. The geographical location of the enterprise determines, to a certain extent, the advantages and disadvantages of its business environment and the difficulty of acquiring resources, and to compare the effect of digital transformation of enterprise financial management under different regions, it can be analyzed mainly from the aspect of external support. In terms of external support, the level of digital development in the eastern region has a leading advantage, complete Internet infrastructure, a large number of high-end digital talents, and a huge market, so that the degree of digitalization of enterprise financial management in the eastern region is generally higher than in other regions. In addition, the eastern region has a higher degree of marketization and a more complete legal system, which creates good conditions for the digital transformation of enterprise financial management, and at the same time, it is also conducive to the effective supervision of the decision-making behavior of external stakeholders on the enterprise, to promote the prudent operation of enterprises, and to prevent enterprises from falling into financial difficulties.

Therefore, from the point of view of the effect of the digital transformation of enterprise financial management, the effect of the digital transformation of enterprise financial management in the eastern region is more obvious than that in the central and western regions. So this paper proposes the following hypothesis:

H6: In the case of other conditions remain unchanged, the effect of enterprise financial management digital transformation in the eastern region is more obvious.

2) The role of heterogeneity of ownership. The difference between state-owned enterprises and non-state-owned enterprises in the process of digital transformation of financial management can be analyzed from resource constraints. State-owned enterprises have more advantages in resource acquisition, market share, and the digital transformation of financial management is one of the country's current key strategies, state-owned enterprises will get more preferential treatment in policy, so the road of digital transformation of financial management of state-owned enterprises will be relatively smoother, and its digital transformation of financial management to enhance the effect will be better. While non-state-owned enterprises are at a disadvantage in terms of access to capital, technology, talent, etc., their financial management digital transformation journey will be more

arduous, the probability of success of the transformation is lower, and it will take longer, so from the perspective of resource constraints, the effect of financial management digital transformation of state-owned enterprises may be stronger. As a result, the following hypothesis is proposed:

H7: Other things being equal, the effect of digital transformation of financial management in state-owned enterprises is stronger.

3. Data sources and research design

Currently, China is fully moving towards the era of digital economy, which has become an important engine of China's economic growth. Under the background of the continuous development of China's digital economy, the wave of enterprise digital transformation is emerging. Therefore, how to use digitalization to drive enterprise change and realize the in-depth integration of digital technology and enterprise operation and management has become a hot issue of common concern to the whole society. As the enterprise's core data and lead the enterprise informationization construction of the enterprise finance department, naturally become the pioneer of enterprise digital transformation.

3.1. Data sources and standard processing

3.1.1. Python based data crawling. Under the rapid development of big data and artificial intelligence, Python, as an efficient, easy-to-learn, cross-platform programming language, has been widely used in the field of financial analysis. Python's powerful functions and flexibility give it a significant advantage in processing financial data, conducting financial analysis, and developing financial decision support systems. In this paper, we mainly use Python technology to obtain the financial data of relevant enterprises to provide data support for analyzing the influencing factors and practice path of digital transformation of enterprise financial management under digital economy [34].

1) Development platform construction. In this paper, Anaconda and PyCharm are used in combination to build a Python development environment. Anaconda is a set of software packages specifically designed to facilitate the use of Python for data science research, covering common Python libraries in the field of data science, and comes with conda packages specifically designed to solve the problem of dependency on the software environment. PyCharm is an integrated development environment (IDE) that manages environments and packages directly in Anaconda, and can be referenced directly in PyCharm by downloading and installing the required packages in Anaconda. The specific steps are as follows:

Step1 Search Anaconda official website in search engine and download and install Anaconda.

Step2 Search PyCharm official website in the search engine, and download and install PyCharm.

Step3 For the convenience of learning and using, you can set the PyCharm interface to Chinese. Open PyCharm, click [File] → [Settings] → [Plugins], search for Chinese in the search bar, and click [Install] to install "Chinese Language Pack".

2) Data acquisition. In this paper, we mainly use the Tushare data interface to obtain the required financial data. The steps to invoke the Tushare interface are as follows:

Step1 Install Tushare library. Here we use the conventional pip installation method. That is, select "Anaconda Prompt" to enter the terminal, type "pip install Tushare" to install.

Step2 Introduce Tushare library and call Token credentials. Query the stock code of the related company, and the corresponding data interface for "main business" is "fina_mainbz".

Step3 Use print() function to print out the obtained data.

3.1.2. Standardization of financial data. The data obtained through web crawlers is native data, which is irregular data and often fails to meet the basic needs of users for data. In order to improve the quality of data and to improve the quality of mining results, it is necessary to use many different preprocessing techniques, such as data cleaning or data integration. Data cleansing is used to remove

noise from data, correct inconsistencies, fill in missing values, eliminate them, etc. according to business needs. Data integration is the integration of data from multiple data sources, which can reduce redundancies and inconsistencies in the data, thus increasing the speed of mining. Data reduction is the reduction of the size of the data by aggregating, removing redundant features or clustering, which is much smaller than a dataset but is able to produce the same analytical results. The so-called data change mainly refers to the effective transformation of the original data, which leads to the formation of a new normalized type of data form. The general data change process is known as data preprocessing process.

Based on Python technology, the initial financial data of a total of 3,498 enterprises listed in Shanghai and Shenzhen A-shares from 2010 to 2023 were obtained, and after standardized processing, a total of 3,207 listed enterprises' financial data were retained, of which 485 were state-owned enterprises and 2,722 were non-state-owned enterprises.

3.2. Variable selection and model construction

3.2.1. Linear regression models. We assume that the dependent variable is Y and there are M independent variables $x_1, x_2, \dots, x_m$, Y which are linearly intrinsically related to these M independent variables, the multiple linear regression model is as follows:

$$Y = b_0 + \sum_{i=1}^m b_i X_i \quad (1)$$

where $b_0, b_1, \dots, b_m$, is the $M+1$ parameter to be estimated.

If we have N sets of observations $(x_{t1}, x_{t2}, \dots, x_{tm}; y_t), t=1, 2, \dots, n$ then these N sets of observations have the following structural form:

$$\left. \begin{aligned} y_1 &= b_0 + b_1 x_{11} + b_2 x_{12} + \dots + b_m x_{1m} \\ y_2 &= b_0 + b_1 x_{21} + b_2 x_{22} + \dots + b_m x_{2m} \\ &\vdots \\ y_n &= b_0 + b_1 x_{n1} + b_2 x_{n2} + \dots + b_m x_{nm} \end{aligned} \right\} \quad (2)$$

Order:

$$Y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix} X = \begin{bmatrix} 1 & X_{11} & X_{12} & \dots & X_{1m} \\ 1 & X_{21} & X_{22} & \dots & X_{2m} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 1 & X_{n1} & X_{n2} & \dots & X_{nm} \end{bmatrix} b = \begin{bmatrix} b_0 \\ b_1 \\ \vdots \\ b_m \end{bmatrix} \quad (3)$$

Then the mathematical model (2) of multiple linear regression can be written in the following form:

$$Y = bX \quad (4)$$

Regression solving is to solve for b in equation (4), if we have n a set of independent variable (x_i) data and its corresponding y inside the regression equation, the best way to solve for the regression coefficients corresponding to the characteristics is to use the sum of squared minimization errors, which represent the difference between the predicted y values and the actual y values [35]. If the accumulation of errors is simply used, then the positive and negative values of these errors will cancel each other out, and in order to avoid this, so it is the sum of squared errors (least squares) that is used. The formula for adding squared errors is as follows:

$$Q(b) = \sum_{i=1}^n (y_i - b_0 - b_1 x_{i1} - \dots - b_m x_{im})^2 \quad (5)$$

Then the above formula is transformed into a mathematical problem, that is, to find a set of b to make the above formula to reach the minimum value, the solution method is commonly used gradient descent method, ordinary least squares and so on. The ordinary least squares method is simpler and more convenient than the gradient descent method. The mathematical formula of ordinary least squares is:

$$b^2 = (X^T X)^{-1} X^T Y \quad (6)$$

Solving b is the coefficients of the multiple linear regression model, X, Y is the matrix defined in equation (3), and X^T is the transformation of the X matrix, which is applied when the inverse matrix of $X^T X$ exists.

3.2.2. Selection of research variables:

1) Explained variables. The research object of this paper is the influencing factors of the digital transformation of enterprise financial management in the digital economy. In this paper, the panel data entropy value method is used to construct the evaluation index system of the level of digital transformation of enterprise financial management and measure its specific figures, so as to analyze the influence factors of digital transformation of enterprise financial management (DTFM).

The specific steps are as follows:

In this paper, the quarterly operating data of listed enterprises are set as n indicators for m enterprises in d quarter, and $x_{\theta ij}$ denotes the j th indicator for listed enterprises i in the θ th quarter.

Step1 Normalize the data using extreme difference normalization. That is:

$$Z_{\theta ij} = \begin{cases} X_{\theta ij} - \min(X_{\theta ij}), \max(X_{\theta ij}) - \min(X_{\theta ij}) & \text{Term } j \text{ is a positive indicator} \\ \max(X_{\theta ij}) - X_{\theta ij}, \max(X_{\theta ij}) - \min(X_{\theta ij}) & \text{Term } j \text{ is a negative indicator} \end{cases} \quad (7)$$

Step2 Normalize the indicator and calculate the entropy value. I.e:

$$P_{\theta ij} = \sum_{\theta=1}^d \sum_{i=1}^m Z_{\theta ij} \quad (8)$$

$$E_j = -\frac{1}{\ln(dm)} \sum_{\theta=1}^d \sum_{i=1}^m X_{\theta ij} [P_{\theta ij} * \ln(P_{\theta ij})] \quad (9)$$

Step3 Calculate the weights and derive the final enterprise financial management digital transformation level. I.e:

$$W_j = \sum_{j=1}^n 1 - E_j \quad (10)$$

$$G_{\theta j} = P_{\theta ij} * W_j \quad (11)$$

2) Core explanatory variables. Based on the previous research hypothesis, it is known that the digital transformation of enterprise financial management will be affected by both external and internal motivators, so this paper takes the external motivators of policy support (PS) and digital technology environment (DTE) and the internal motivators of leadership support (LS), team cognitive level (TCL) and digital technology investment (DTI) as the core explanatory variables.

3) Control variables. Based on existing research, this paper controls the relevant indicators that may affect the digital transformation of enterprise financial management, specifically including enterprise size (Size), board structure (Indep), equity concentration (Top1), enterprise age (Age), gearing ratio

(Lev), return on total assets (ROA) and cash flow ratio (Cash). All relevant data were obtained through Python techniques and normalized.

3.2.3. **Research modeling.** Based on the previous analysis, this paper incorporates multiple linear regression models used to test the research hypothesis that:

$$DTFM_{i,t} = \alpha_0 + \alpha_1 PS_{i,t} + \alpha_2 DTE_{i,t} + \alpha_3 LS_{i,t} + \alpha_4 TCL_{i,t} + \alpha_5 DTI_{i,t} + \alpha_6 \sum Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (12)$$

Where $DTFM_{i,t}$ is the level of digital transformation of enterprise financial management, $PS_{i,t}, DTE_{i,t}, LS_{i,t}, TCL_{i,t}, DTI_{i,t}$ is each core explanatory variable, and $\sum Control_{i,t}$ is each control variable. $Year, Industry$ is the dummy variable representing year and industry respectively, α_0 is the constant term, $\alpha_1 \sim \alpha_6$ is the regression coefficient of each variable, and $\varepsilon_{i,t}$ is the random disturbance term.

4. Analysis of empirical results

The convergence and integration of information technology and enterprise financial management has changed the way of financial management of many enterprises, making financial data and information become an important strategic resource for enterprises, which has a far-reaching impact on enhancing the level of corporate decision-making. Enterprises in the digital economy to promote the digital transformation of financial management, opportunities and challenges exist. The value of the financial sector in modern enterprise management can not be ignored, therefore, the financial sector needs to promote the transformation of financial functions in accordance with the laws of market development, as well as the country's new requirements for accounting management. Enterprises can take the digital economy as an opportunity to combine enterprise financial management and digital information technology, the use of information technology instead of financial accounting, to promote the transformation of financial management to management accounting, so as to realize the transformation of financial management functions.

4.1. Descriptive statistics and correlation analysis

4.1.1. **Descriptive statistical results.** Based on the financial data of listed enterprises obtained by Python technology, descriptive statistics are performed on the samples during the period from 2010 to 2023, and its specific results are shown in Table 1. As can be seen from the table, the mean value of the level of digital transformation of enterprise financial management is 0.892, and its standard deviation reaches 5.921, which indicates that the level of digital transformation of financial management varies greatly among different enterprises. The standard deviation of the internal and external drivers affecting the digital transformation of enterprise financial management is more than 1.5, which indicates that there are also large differences in the internal and external drivers of enterprises and that enterprises with a high degree of digital transformation of financial management account for a minority. In addition, the kurtosis and skewness of the level of digital transformation of financial management of different enterprises are 1.001 and -0.659 respectively, and the overall fluctuation is between [-3,3], which indicates that the acquired data on the level of digital transformation of financial management of enterprises conforms to normal distribution. Therefore, the data obtained in this paper can truly reflect the level of digital transformation of enterprise financial management and can provide reliable data for multiple linear regression analysis.

Table 1 Descriptive statistical results of variables

Variable	Means	SD	Max	Min	Skewness	Kurtosis
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DTFM	0.892	5.921	1.438	0.248	-0.659	1.001
PS	1.244	2.139	6.278	0.977	-0.663	-0.328
DTE	1.348	1.923	3.145	1.046	-0.891	0.736
LS	0.935	2.296	1.341	0.761	-0.645	0.788
TCL	0.927	1.802	1.177	0.275	-1.016	-0.062
DTI	0.883	1.638	1.653	0.439	-0.872	-0.027
Size	0.519	0.916	1.689	0.082	-0.919	-0.493
Indep	0.748	1.937	1.943	0.245	-1.167	0.815
Top1	0.421	2.304	0.524	0.075	-0.685	1.264
Age	0.149	0.936	0.646	0.106	-0.863	1.182
Lev	0.058	0.985	0.867	0.009	-1.256	0.719
ROA	0.554	1.552	1.295	0.246	-1.185	-0.204
Cash	0.727	2.219	1.082	0.364	-0.751	0.048

4.1.2. **Correlation analysis.** Before carrying out multiple linear regression analysis, it is necessary to clarify whether there is a strong correlation between the variables in the regression model, and in order to avoid the existence of multiple covariance between the variables, this paper carries out the test of multiple covariance through the variance inflation factor (VIF). Table 2 shows the correlation and multicollinearity test results of the main variables of the model, where ***, ** and * indicate the significance levels of 1%, 5% and 10%, respectively.

As can be seen from the table, there is a significant correlation between both the explained variables and the core explanatory variables at the 1% level, but the correlation coefficients between the variables are less than 0.3, which indicates that there is a correlation between the variables but there will not be any interactions between them. In addition, from the results of variance inflation factor, the VIF value of each variable is less than 3, which indicates that there is no verified multicollinearity among the variables designed in this paper.

Table 2. Correlation and multiple conlinear tests

Variable	DTFM	PS	DTE	LS	TCL	DTI	VIF	1/VIF
DTFM	1.000	-	-	-	-	-	1.238	0.808
PS	0.216 ***	1.000	-	-	-	-	2.006	0.499
DTE	0.238 ***	0.106 **	1.000	-	-	-	1.664	0.601
LS	0.274 ***	0.162 ***	0.225 ***	1.000	-	-	1.317	0.759
TCL	0.087 ***	0.335 ***	0.106 **	0.128 ***	1.000	-	1.465	0.683
DTI	0.135 ***	0.069 **	0.007 *	0.085 **	0.253 ***	1.000	1.141	0.876

4.2. Regression results and robustness tests

4.2.1. **Benchmark regression results.** Through the Hausman test, the article adopts the fixed effect model to analyze the role of internal and external drivers of enterprises on the level of digital transformation of enterprise financial management in the digital economy, and its regression results are shown in Table 3. Where models (1) and (2) are univariate analyses of the external and internal drivers of enterprises on the level of digital transformation of financial management, respectively, and model (2) is the regression results of the external drivers of enterprises on the level of digital

transformation of financial management model (3) is the regression results after adding control variables. Parentheses indicate robust standard errors, and ***, **, and * represent 1%, 5%, and 10% significance levels, respectively, as in the following.

In model (1), both policy support strength and digital technology environment of external drivers can affect the level of digital transformation of enterprise financial management at 1% level, and their regression coefficients are 0.127 and 0.108 respectively. Superior policy support can help enterprises strengthen their commitment to financial information management, thus facilitating the digital transformation of their financial management. In addition, enterprises in the digital technology environment are more willing to enjoy the dividends of the era brought by the digital economy through the digital transformation of financial management, thus promoting the development of their own financial management informationization. H1 and H2 can be verified.

In model (2), the internal drivers of leadership support, team awareness level and digital technology input all have extremely significant effects on the level of digital transformation of enterprise financial management at the 1% level, and the coefficients of the three on the digital transformation of enterprise financial management are 0.156, 0.132 and 0.219, respectively. Among them, the degree of influence of digital technology input on the level of digital transformation of enterprise financial management is the deepest, which is reflected in the enterprise's willingness to provide the necessary technological inputs for financial management, and then promote the innovation and reform of the enterprise's financial management model. H3~H5 are verified.

In model (3), after adding each control variable, there is a certain decline in the impact of external and internal drivers on the level of digital transformation of enterprise financial management, but the overall level of digital transformation of enterprise financial management have a significant impact at the 1% level, and still five variables on the level of digital transformation of enterprise financial management in descending order of the level of impact of digital technology investment > leadership support > policy support > team cognitive level > digital technology environment. At this time, whenever the enterprise in the financial management of digital technology investment increases by 1 percentage point, the level of enterprise financial management digital transformation will increase by 0.204 percentage points.

As for other variables, all control variables are significantly positive at the 1% or 5% level, except for the age of the firm. When the management power of the enterprise is highly centralized, the level of digital transformation of the enterprise's financial management may be further enhanced, which is more conducive to the development of the enterprise.

Table 3. Benchmark regression

Variable	Model (1)	Model (2)	Model (3)
PS	0.127*** (0.335)	-	0.115*** (0.316)
DTE	0.108*** (0.287)	-	0.101*** (0.274)
LS	-	0.156*** (0.418)	0.152*** (0.412)
TCL	-	0.112*** (0.359)	0.113*** (0.331)
DTI	-	0.219*** (0.474)	0.204*** (0.458)
Size	-	-	1.159*** (0.205)
Indep	-	-	1.557* (0.838)
Top1	-	-	0.035*** (0.016)
Age	-	-	0.006* (0.043)
Lev	-	-	4.227** (0.735)
ROA	-	-	3.226** (1.037)
Cash	-	-	1.524*** (0.669)
(Con_)	4.512*** (0.272)	4.663*** (0.286)	26.417*** (4.225)

Year	YES	YES	YES
Industry	YES	YES	YES
R2	0.286	0.297	0.314

4.2.2. Robustness Tests. In order to further test the robustness of the benchmark regression results and enhance the interpretability of the model, this paper demonstrates the validity of the benchmark regression by replacing the explanatory and interpretive variables and varying the sample size. Table 4 shows the robustness test results of the model.

1) Replacement of explanatory variables. First of all, with reference to the existing relevant research methods, the enterprise digital economy revenue growth rate is used to replace the index system of this paper to measure the level of digital transformation of enterprise financial management to re-participate in the regression. The results are shown in models (1) and (2) in Table 4. The coefficients of the degree of digitization are significantly positive, and their corresponding signs are positive and consistent with the previous benchmark regression, indicating that the internal and external drivers of enterprises can significantly improve the level of digital transformation of enterprise financial management, and the results of the benchmark regression of this paper have a certain degree of robustness.

2) Replacement of explanatory variables. Next, this paper also replaces the internal and external drivers of enterprises with the practice of enterprise digitalization level, from the number of disclosure of digital technology application statistics keywords. On this basis, the word frequency data is standardized, and the entropy value method is used to determine the weight of each index, and finally calculate the level of digital transformation of financial management of listed enterprises. This replaces the original explanatory variables, and the regression is re-conducted under the premise that other variables remain unchanged, and the results are shown in the model (3) in Table 4. The replacement variable has a significant positive effect on the level of digital transformation of enterprise financial management, and it is significant at the 1% significance level, which further indicates that the benchmark regression results of this paper have a certain degree of robustness.

3) Variable sample size. In addition, the internal and external drivers of enterprises are vulnerable to major financial shocks, such as a significant drop in policy support, the rapid decline in yields in the digital technology environment will stall the digital transformation process to a certain extent, and ignoring such factors is likely to cause regression bias. For this reason, this paper refers to existing research and excludes financial crisis factors. In the time series of this study, there exists 1 typical financial event shock that is the Chinese stock market crash in 2015, considering the ripple effect and posteriority of the shock, this paper deletes the samples of 2015 and the years before it to re-run the regression test, and the results are shown in model (4) of Table 4. After changing the sample size, the coefficients of the internal and external drivers of enterprises are still significantly positive, which is consistent with the previous benchmark regression and proves the validity of the benchmark regression.

4) Clustering robust standard errors. Finally, there is usually autocorrelation between the perturbation terms in the panel data of the same body in different periods, which will have a certain impact on the regression results, in order to consider as many factors as possible, and get more robust conclusions, this paper chooses to use the clustering robust standard error, clustering to the level of the industry, as a way to verify the accuracy of the benchmark regression. The results are shown in model (5) of Table 4. After adopting the clustering robust standard error, the regression coefficients of the internal and external drivers of enterprises are positive and pass the 1% significance test, indicating that the internal and external drivers of enterprises can significantly improve the level of digital transformation of enterprise financial management, which is consistent with the benchmark regression in the previous paper. It further indicates that the benchmark regression results in this paper are somewhat robust.

Table 4. Robustness test results

Variable	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
PS	0.113*** (0.312)	0.108*** (0.306)	0.115*** (0.315)	0.112*** (0.311)	0.116*** (0.312)
DTE	0.105*** (0.282)	0.101*** (0.279)	0.107*** (0.283)	0.106*** (0.285)	0.109*** (0.281)
LS	0.157*** (0.432)	0.154*** (0.417)	0.156*** (0.421)	0.145*** (0.406)	0.147*** (0.411)
TCL	0.119*** (0.335)	0.122*** (0.342)	0.118*** (0.338)	0.121*** (0.332)	0.123*** (0.335)
DTI	0.209*** (0.467)	0.215*** (0.472)	0.216*** (0.478)	0.208*** (0.465)	0.212*** (0.458)
(Con_)	4.359*** (0.242)	4.361*** (0.245)	4.358*** (0.247)	4.357*** (0.251)	4.349*** (0.252)
Control	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES
R2	0.306	0.311	0.315	0.309	0.312

4.3. Heterogeneity analysis

4.3.1. Analysis of regional heterogeneity. In this paper, all sample firms are divided into the eastern region and the central and western regions, of which the number of sample firms in the eastern region is 2,158 and the number of sample firms in the central and western regions is 1,049. Given that the number of cross-sectional samples is reduced after the subdivision according to the nature of enterprises, the fixed-effects method is uniformly used in the estimation process of all models to ensure accuracy. The estimation results of the models are shown in Table 5.

In the eastern region sample, the regression coefficients of internal and external enterprise drivers on the level of digital transformation of enterprise financial management are 0.138, 0.116, 0.172, 0.145, and 0.226, respectively, with each variable showing significance at the 1% level for the level of digital transformation of enterprise financial management, indicating that internal and external enterprise drivers have a significant contributing effect. In addition, in the sample of enterprises in the central and western regions, all variables are significant at the 5% or 10% level, but their regression coefficients are smaller than those in the eastern region. In summary, the internal and external drivers of enterprises have a greater role in promoting the level of digital transformation of enterprise financial management in the eastern region than in the central and western regions. The reason for this is that the eastern region, because of superior geographic conditions, the development of a solid foundation, earlier access to advanced equipment and digital reform, therefore, the level of digital transformation of enterprise financial management in the eastern region is more significant than in the central and western regions. H6 can be verified.

Table 5. Regional heterogeneity test results

Variable	Model (1)	Model (2)	Model (3)
PS	0.138*** (0.335)	0.131** (0.331)	0.128** (0.327)
DTE	0.116*** (0.294)	0.112** (0.285)	0.107* (0.282)
LS	0.172*** (0.463)	0.169** (0.458)	0.161** (0.451)
TCL	0.145*** (0.376)	0.138** (0.369)	0.131** (0.348)
DTI	0.226*** (0.482)	0.223** (0.476)	0.207** (0.455)

(Con.)	4.238*** (0.216)	4.225* (0.207)	4.217* (0.213)
Control	YES	YES	YES
Year	YES	YES	YES
Industry	YES	YES	YES
R2	0.315	0.305	0.307

4.3.2. Analysis of firm heterogeneity. In order to test the heterogeneous performance of digital transformation in state-owned and non-state-owned enterprises, this paper sets the dummy variable SOE to divide the total sample into state-owned enterprises and non-state-owned enterprises, with SOE taking the value of 1 to indicate that the group of samples are state-owned enterprises, and 0 to indicate that they are non-state-owned enterprises. The regression results are shown in Table 6, in which model (1) and model (2) are the group samples of state-owned enterprises and non-state-owned enterprises, respectively.

As can be seen from the table, the influence of internal and external drivers on the level of digital transformation of financial management in state-owned enterprises have shown significance at the 1% level, with regression coefficients of 0.143, 0.122, 0.165, 0.144, 0.231, respectively, whereas the level of digital transformation of financial management in non-state-owned enterprises have significance at the 5% or 10% level. This indicates that state-owned enterprises more intuitively obtain the policy support strength, combined with the digital technology environment to better realize the digital transformation of financial management. And the leaders in state-owned enterprises have stronger support and are willing to introduce digital technology into financial management to provide a reliable foundation for promoting the digital transformation of enterprise financial management. Therefore, the promotion effect of state-owned enterprises on the level of digital transformation of financial management is more obvious with the support of internal and external motivations, i.e., H7 is verified.

Table 6. Enterprise heterogeneity test results

Variable	Model (1)	Model (2)
PS	0.143*** (0.327)	0.135** (0.318)
DTE	0.122*** (0.303)	0.108** (0.281)
LS	0.165*** (0.458)	0.151** (0.442)
TCL	0.144*** (0.381)	0.132** (0.354)
DTI	0.231*** (0.479)	0.224** (0.473)
(Con.)	4.242*** (0.234)	4.241* (0.231)
Control	YES	YES
Year	YES	YES
Industry	YES	YES
R2	0.323	0.316

4.4. Digital transformation path for financial management

4.4.1. Building a digital financial management system. In the digital transformation of finance, an efficient digital financial management model needs to be constructed. The model should integrate financial information management systems, data storage and processing technologies and intelligent information processing systems to realize real-time capture, processing and transmission of financial and accounting big data, and to create an intelligent and immediate financial risk management framework. In this process, the support of advanced technology is required, as well as the adjustment of organizational structure and business processes. Enterprises should also pay attention to the introduction of cutting-edge financial information management systems to efficiently manage financial databases, while adopting new types of data storage and processing technologies to ensure

the proper storage of big data. The introduction of intelligent information processing systems can help enterprises to deeply interpret financial data information and provide professional information support for managers.

In this process, the statistical analysis of financial data needs to pay attention to the construction and optimization of the model in order to achieve effective management of financial operating conditions, risks and opportunities. This complex data aggregation and analysis process involves multiple levels, from data collection, storage to reuse, all need to use complex data mining algorithms and statistical models. At the same time, innovation should also be actively promoted to fully integrate information technology with financial management, such as through the implementation of new strategies such as e-financial auditing and virtual financial teamwork, in order to improve operational efficiency. In the process of enterprise transformation, an in-depth understanding of business processes is needed to realize core transformations through digital technology, making financial management more efficient and adapting to the ever-changing business environment.

4.4.2. Strengthening cross-sectoral collaboration and communication. Financial digitization is not only the business of the finance department, but also involves a number of related departments such as sales, purchasing, production, R&D, etc. Therefore, the promotion of financial digitization requires the close cooperation and efficient communication among all departments. In order to promote the exchange and sharing of information between departments, enterprises can establish an effective communication mechanism through regular departmental meetings, workshops or online collaboration platforms, etc. During the communication process, each department should clearly define their respective roles and responsibilities in the financial digitization project, to ensure the accurate transmission of information and the smooth implementation of tasks.

As financial digitization may involve the integration of multiple systems, data format conversion and other complex issues that require technical support from various departments, it is necessary to focus on solving these problems through cross-departmental collaboration to improve the efficiency and accuracy of digitization. Enterprises can set up a cross-departmental digitization project team to coordinate and promote financial digitization, and team members should include representatives from various departments to ensure the comprehensiveness and feasibility of the project. The project team can hold regular meetings to review the progress of the project, coordinate the allocation of resources, and solve problems that arise during the implementation process. In order to strengthen cross-departmental collaboration and communication, enterprises may also consider introducing project management methodologies, such as agile development, to promote cooperation among departments and ensure the successful implementation of financial digitization projects.

4.4.3. Multiple measures to cultivate composite talents. Enterprises should take the way of going out and bringing in to strengthen the construction of composite talent teams, obtain composite talents with rich financial knowledge reserves, high information quality and familiarity with enterprise business, and meet the demand for composite talents in the digital transformation of enterprise finance under the intelligent service mode.

First of all, enterprises should cooperate with universities, adopt the industry-academia fusion training mode, formulate talent training programs, optimize the curriculum system, provide a large number of practice opportunities, and select outstanding graduates on the basis of merit, so as to inject fresh blood into the digital transformation of finance. Secondly, organize regular training activities for financial management personnel, continuously improve the professional quality and competence of financial management personnel, and promote the phased implementation of financial digital transformation. Finally, use a variety of incentives to mobilize financial managers to optimize and innovate themselves, so that they can quickly become successful and actively participate in the digital transformation of finance.

5. Conclusion

The article uses Python technology to obtain the financial data of A-share listed enterprises in Shanghai and Shenzhen, and combines the multiple linear regression model to explore the relevant factors affecting the digital transformation of enterprise financial management. The digital transformation of enterprise financial management in the context of the digital economy will be affected by the internal and external factors, of which the internal factor of digital technology investment has the greatest influence, with a regression coefficient of 0.204. The level of digital transformation of enterprise financial management will be affected by the equity of the enterprise and the location of the region, and the level of digital transformation of financial management of the enterprises in the eastern region is higher than that in the central and western regions, and the effect of the digital transformation of financial management of state-owned enterprises is stronger. The level of financial management digital transformation of enterprises in the eastern region is higher than that in the central and western regions, and the effect of financial management digital transformation of state-owned enterprises is stronger. Therefore, under the digital economy, the digital transformation of enterprise financial management should be based on the digital financial management system, strengthen cross-departmental communication and collaboration, combined with composite talents, in order to promote the digital development of enterprise financial management.

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