Research Article

The Influence of Digital Transformation of Foreign Trade Enterprises on Their Business Performance

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In the context of digital economy, the international trade mode has undergone profound changes, so digital transformation has become the key to the sustainable development of foreign trade enterprises. In this paper, by collecting the data of 27 foreign trade enterprises listed in Shanghai and Shenzhen A shares from 2010 to 2020 and adopting the method of full text identification of enterprise comprehensive financial reports to quantify the intensity of enterprise digital transformation, the influence of digital transformation of foreign trade enterprises on the main business performance and the effect of two mediating variables of internal control and innovation ability of enterprises were studied. The result shows that the digital transformation of foreign trade enterprises has a significant role in promoting their main business performance. From the mechanism of action, digital transformation promotes the overall improvement of the main business performance of enterprises by improving the internal management of enterprises and enhancing the mediating role of enterprise innovation ability. Finally, from the perspectives of government and enterprises, some suggestions were put forward for foreign trade enterprises to choose the development path of digital transformation.

1. Introduction

According to the White Paper on the Development of Digital Economy in China, China’s digital economy reached 39.2 trillion yuan in 2020, accounting for 38.6% of GDP, and has become an important support for high-quality development of the national economy. In the era of rapid development of digital economy, digital transformation is gradually reflected in the specific production behavior of enterprises, which makes the integration of digital technology with enterprises as a development direction actively explored by many enterprises. In 2021, China’s total (goods) import and export volume was 39100.9 billion RMB, which was 21.4% increased over the previous year, and the import and export surplus was 4368.7 billion RMB. At the Central Economic Work Conference, it was pointed out that China should open up to the outside world at a high level in 2022 and adopt various measures to stabilize foreign trade. Hence, it is of great significance for the future development of China’s foreign trade to promote the sustainable development of China’s foreign trade enterprises through digital transformation. In this paper, based on the existing literature research, the data of 27 foreign trade enterprises listed in Shanghai and Shenzhen A shares from 2010 to 2020 were collected. Based on the benchmark regression of the impact of the digital transformation of foreign trade enterprises on the main business performance, the robustness of the research results is ensured through the introduction of control variables and robustness testing, and the mediating effect of enterprise internal control and enterprise innovation ability is explored.

2. Literature Review

2.1. Informatization and Business Performance. The research on the influence of digital transformation on business performance can be traced back to the research on the influence of informatization on business organizational
2.2. Digitalization and Enterprise Performance. Byun et al. believed that the use of digital technology can improve the structural efficiency among business organizations [6]. Caputo et al. surveyed European high-tech enterprises from the perspective of management and found that the use of digital technology improved the elements of human resource management, thus improving the performance of enterprises [7]. However, Hajli et al. concluded by using a panel regression analysis that the improvement in digitalization level will only have a positive effect on some enterprises, while other companies are not affected [8]. Li and Jia put forward the innovation resource arrangement model and examined the role of IT in three different innovation processes, and concluded that digital technology has no obvious influence or role on the overall performance of enterprises [9]. Zhou et al. found that the digital transformation at the regional level has an inverted “U” shaped influence on the innovation performance of enterprises, and that the innovation performance will be significantly improved with the digitalization at the regional level [10].

In view of the fact that no consistent conclusion has been drawn in the above research, some scholars have carried out more detailed empirical research in the manufacturing industry. Li et al. studied the influence of digitalization on manufacturing industry performance and reached a similar conclusion, that is, the digital transformation of manufacturing has a positive impact on its industry performance [11, 12]. Zheng and Gu examined whether the digitalized transformation of manufacturing enterprises has an impact on the service level and performance of enterprises and concluded that the digitalized transformation of enterprises is significantly and positively related to their interests in the manufacturing industry, and the service level plays the role of an intermediate variable [13]. Wang took 173 manufacturing enterprises in the Yangtze River Delta and Pearl River Delta as the research objects, and conducted an empirical study by introducing individual forgetting and entrepreneurial orientation as mediating variables. It was concluded that digital transformation has a positive effect on the dynamic capability of enterprises, and with the development of individual forgetting and entrepreneurial orientation, digital transformation will improve the dynamic capability and innovation performance of enterprises more significantly [14]. Yi et al. used Python tools to identify the text of the annual reports disclosed by listed companies, counted and characterized the words related to digital transformation as quantitative and specific indicators of the intensity of digital transformation, and studied the mediating effect from different angles. The former concluded that digital transformation of enterprises can effectively promote the performance improvement of their main businesses, and is more effective for state-owned enterprises and enterprises in the growth stage; the latter concluded that digital transformation has a significant role in promoting corporate performance, and it promotes corporate performance by improving the degree of integration of corporate supply chains [15, 16].

2.3. Digitalization and International Trade. The research on the relationship between digitalization and international trade can be traced back to the research on the influence of the Internet on international trade. Freund analyzed by time series and cross-section regression and concluded that the development of the Internet has a certain degree of impact on trade, and the reduction of fixed costs related to the Internet may promote the growth of exports [17]. Meijers proved with a simultaneous equation model that the use of the Internet promoted the growth of trade and thus promoted the positive development of the economy [18]. Abeliasky found that the number of mobile phones and Internet users has a greater impact on the trade surplus of developed countries, while the speed and stability of broadband are more important factors for developing countries [19]. Although the above scholars’ research has provided a powerful explanation for the promotion of digitalization in international trade, the variables they selected cannot fully represent digitalization, and there is still a lack of research on digitalization and import and export in China. Yi and Wang used the data published by the World Bank in 2012 to study the impact of digital transformation of enterprises on their exports from the micro level, with innovation, competition, and environment as mediating variables, and concluded that digital transformation is helpful for enterprises to expand their exports [20].
3. Research Mechanism and Hypothesis Proposition

3.1. The Influence of Digital Transformation on Main Business Performance. The use of the Internet and digital technology can reduce costs and differentiate products, thus promoting the performance of enterprises [21]. Digital transformation can also help integrate digital transformation with industry [22] by promoting cooperation between the internal learning atmosphere and external network and promote enterprise performance by improving production and operation efficiency. Investment in digital transformation has a significant impact on enterprise performance but lags behind, and different degrees of investment in digital transformation have different effects on enterprise performance [23]. Thus, the relevant hypothesis is made in this paper:

H1: Keeping other variables unchanged, the higher the degree of digital transformation of foreign trade enterprises, the more conducive it is to the improvement of their main business performance.

3.2. Mediating Effect of Internal Control. Digital transformation can promote enterprises strengthen their own internal management, promote the interconnection of various departments within enterprises, and thus help enterprises reduce the transparency of production and sales to transportation. Based on this, it can strengthen the upstream supply's understanding of downstream demand, adjust production strategies in time, and respond to changes in market conditions, further improving the ability of enterprises to identify opportunities and avoid risks [24]. The internal control ability of an enterprise is positively correlated with its performance, and the stronger the internal control ability, the more obvious the help it brings to the improvement of enterprise performance [25]. The level of digitalization of enterprises has significantly improved the operational performance of enterprises, which can be realized by improving the level of information symmetry within enterprises and promoting the business model of enterprises [26]. Therefore, the mediating effect characterized by “digital transformation—internal control—main business performance” is theoretically tenable. Thus, the relevant hypothesis is made in this paper:

H2: The digital transformation of foreign trade enterprises affects the main business performance by enhancing the mediating effect of internal control.

3.3. Mediating Effect of Enterprise Innovation Ability. Digital transformation is an innovative project in itself to improve the innovation ability of enterprises, which can take a two-pronged approach from the supply side and the demand side and add impetus to the technological innovation of enterprises. With the development of digital transformation, enterprises can make better use of consumer data and their own production data to assist their own decision-making and optimize the production and sales process, so as to improve production efficiency and effectively enhance the competitiveness of enterprises [27]. The effect of digitalization level on enterprise innovation performance will be affected by industries, and a threshold change effect exists in the information technology industry, wholesale and retail industry, and social service industry [28]. The digital transformation of enterprises can more effectively promote enterprises to create a more innovative corporate culture and an ecological environment in their production and operation. The enhancement of the enterprise’s innovation capability will promote its operational efficiency and the distribution of production factors to a greater extent, thus improving its performance [29]. Based on this, the mediating effect characterized by “digital transformation—innovation ability—main business performance” is theoretically tenable. Thus, the relevant hypothesis is made in this paper:

H3: The digital transformation of foreign trade enterprises improves the innovation ability of enterprises and indirectly affects the improvement of the main business performance of enterprises.

4. Research Design

4.1. Data Sources. In this paper, the listed foreign trade enterprises in the Shanghai Stock Exchange and Shenzhen Stock Exchange were selected as research samples to analyze the impact of the digital transformation of foreign trade enterprises on their main business performance. Taking into account the listing years of some enterprises, the sample time of this paper was determined to be 2010-2020, and the data were from the Royal Flush iFinD database. On this basis, the collected data were screened and processed. Firstly, companies with import and export business in their main business were screened out from the listed companies. Secondly, listed companies with import and export business income accounting for less than 30% of the total operating income during the sample period were excluded. Finally, the samples of listed companies with special circumstances in the ST and ST* financial data during the sample period were excluded. At last, a sample of 27 foreign trade listed companies was formed.

4.2. Specification of Variables. The explained variable of this study is the main business performance (MRS). Referring to the research of Du et al., the return on assets (excluding financial revenue) was used to express the main business results of listed companies, which helps to explain the import and export business income of foreign trade listed companies indirectly [30]. Specific calculation method of MRS: \( MRS = \frac{\text{annual operating profit of the enterprise} - \text{annual investment income} - \text{annual fair value change income} + \text{annual investment income in associates and joint ventures}}{\text{total assets of the enterprise}} \)

The core explanatory variable of this study is digital transformation (DT), that is, the digital transformation of listed foreign trade enterprises studied in this paper. Digital transformation is an abstract and highly concise indicator whose quantification and measurement have always been...
difficult to define. At present, there is still a lack of universally recognized methods to describe digital transformation. Management often publicly discloses its investment and practice in the field of “digital transformation” in the annual report of listed companies, which can largely reflect the company’s future development and positioning from the side [31, 32]. Therefore, learning from the research methods of Wu et al., the annual reports of foreign-trade listed companies in Shanghai and Shenzhen were obtained through Python software, all the text contents were extracted through the “jieba” text analysis package, and the frequency of relevant keywords in the company’s digital transformation was identified and counted by using the text analysis method to measure the degree of digital transformation of relevant companies [31, 33].

In this paper, the digital transformation keyword matching lexicon is constructed as follows: From the highly relevant and important policy learning documents and research reports, a series of keywords based on “Digital Transformation” was finally sorted out using the Special Action Plan for Digital Empowerment of Small and Medium-sized Enterprises, Digital Transformation Index Report (2021), Digital Transformation Trend Analysis (2021), Big Data Industry Development Standards (2016–2020) and the Government Work Report in recent years as the basis of the lexicon. In the category identification of digital transformation, referring to the classification method of Yi et al., considering that digital transformation will be applied to manufacturing, decision-making, and system management in the initial stage of enterprise digital transformation, technologies are divided into four typical categories: artificial intelligence, blockchain, cloud computing, and big data, and on the basis of these four types of underlying technologies, their related “implemented” applications were introduced [15]. Based on this, 288,614 digital transformation characteristic records were obtained.

In this paper, control variables were added to improve the goodness of fit of the output results of the model. The control variables in this paper include enterprise assets (Asset), duality (Dual), equity concentration (S-D, equity concentration of the largest shareholder of the company), listing years (Age), stock turnover rate (TR), business income (Income), and audit opinions in financial reports (Audit, 0 for standard unqualified opinion, and 1 for qualified opinion). Descriptive statistics of each variable are shown in Table 1.

4.3. Modeling. To study the influence of digital transformation of foreign trade enterprises on the main business performance, the following empirical research model is proposed in this paper.

\[
MRS_t = \alpha + \beta_1 DT_{t-1} + \sum \beta_i CV_i + \sum \beta_j Year + \epsilon,
\]

where CVs represent all the above control variables and \(\epsilon\) represents the stochastic error term.

At the same time, in order to improve the reliability of the regression results, the data were processed as follows: First of all, considering that the digital transformation is a continuous process, and there is a certain time lag from the implementation to the main business performance of the enterprise, the core explanatory variables in this paper lag by one period, which is also helpful to offset a part of the reverse causal endogenous interference. Secondly, the robust standard error-adjusted t-statistic of cluster clustering was used in all regression equations in this paper. Thirdly, the virtual variable of time (Year) was controlled in this paper to ensure that it can absorb the fixed effect.

5. Empirical Results and Test

5.1. Collinearity Test. In order to prevent the obvious multicollinearity of the data itself, which reduces the accuracy of parameter estimation, the multicollinearity test was performed before the benchmark regression (see Table 2).

According to the results in the table, the coefficient of multicollinearity between the explained variables and the core explanatory variables is 0.0976, and that between the controlled variables is less than 0.85. Therefore, there is no obvious multicollinearity among the variables studied in this paper.

5.2. Unit Root Test. In this paper, the unit root test of variables was performed to avoid spurious regression (see Table 3). The test results show that the variables selected in this paper all pass the unit root test and the level is stable, which will not have an adverse impact on the regression results.

5.3. Benchmark Regression. Table 4 shows the test results of the relationship between “digital transformation and main business performance” of foreign trade enterprises. From the data in the table, it is concluded that in the model (1), under the premise of controlling the fixed effect of time, the regression coefficient between digital transformation and main business performance is 0.0051 and passes the significance test of 1%. Therefore, the digital transformation of foreign trade listed enterprises can play a significant role in promoting the enterprise’s main business performance. After the control variable group is introduced in the model (2), the regression coefficient converges to some extent, but its positive effect is still significant, and the goodness of fit of the model is improved. To sum up, the higher the degree of
digital transformation of foreign trade enterprises, the more conducive it is to the improvement of their main business performance, so H1 holds. Follow-up tests will be performed to observe the robustness of the conclusion.

5.4. Marginal Effect Test and Robustness Test. After determining that the digital transformation of foreign trade enterprises can promote their performance, it does not test whether there will be a deviation in the promotion effect of digital transformation on the main business performance based on a certain level. Therefore, in this paper, the marginal effect test was used for analysis. In Figure 1, the horizontal axis (DT) indicates the degree of digital transformation, and the vertical axis (β₁) indicates the regression elasticity of digital transformation to the main business performance.

The figure shows that, on the whole, the influence of the digital transformation of foreign trade enterprises on the performance of their main businesses remains positive, and the regression elasticity of this variable is relatively low when the degree of digital transformation is low. With the
improvement of the degree of digital transformation, it generally shows an upward trend. Therefore, it is concluded that the higher the degree of digital transformation of foreign trade enterprises, the more obvious its promotion effect on enterprise performance.

As the global economy is a dynamic, whole business performance, related key strategies will be affected when a major financial event occurs, resulting in the stagnation of some strategic projects. Therefore, after excluding the influence of the large-scale decline in the Chinese stock market in 2015, the observed objects during the period from 2010 to 2014 were intercepted for regression, and the final results are shown in Table 5.

Table 5 shows that the conclusion has not changed significantly after excluding the impact of the stock market crash in China. Therefore, H1 in this paper holds and is robust.

In this paper, the robustness of the digital transformation of foreign trade enterprises in promoting their performance was further tested by changing the statistical specification. For the core explanatory variables, the proportion of digital technology-related parts in the year-end intangible assets details disclosed in the notes to the annual financial reports of listed companies to the total intangible assets was used to depict the digital transformation (DTZ) from another perspective for the robust test [34]. At the level of explained variables, on the basis of the main business performance, the statistical standard of performance indicators was relaxed by using the research method of Yi et al. for reference, and Tobin Q value (Tobin Q) and return on net assets (ROE) were adopted as substitute variables of main business performance (MRS) [15]. After the substitute variables were defined, the above variables were subjected to benchmark regression to observe the regression results (Table 6).

The results show that the digital transformation of foreign trade enterprises still has a positive impact on the performance after using variables instead of changing the statistical specification of data, and the regression coefficient also passes the significance test at a level of no more than 5%, which shows that the conclusion of this paper reflects a high degree of robustness.

5.5. Mediating Effect Analysis. In order to further explore the mediating effect between the explained variables and the explanatory variables, a three-step regression model of mediating effect was adopted to verify hypotheses H2 and H3.

\[
\begin{align*}
\text{MRS}_{it} &= \alpha + \beta_1 \text{DT}_{it-1} + \sum \beta_i \text{CV}_s + \sum \delta_i \text{Year} + \epsilon_i, \\
\text{Mediator}_{it} &= \alpha' + \delta_1 \text{DT}_{it-1} + \sum \delta_i \text{CV}_s + \sum \delta_i \text{Year} + \epsilon_i, \\
\text{MRS}_{it+1} &= \alpha + \gamma_1 \text{Mediator}_{it} + \gamma_i \text{DT}_{it-1} + \sum \gamma_i \text{Year} + \sum \gamma_i \text{CV}_s + \epsilon_i,
\end{align*}
\]

where “Mediator” means the group of mediating variables. The meanings of other variables are the same as above. Meanwhile, in order to improve the accuracy and precision of the mediating effect results, a further Sobel test was carried out on the basis of the three-step regression, and various indicators in the tests were reported in detail.

5.5.1. Internal Control. In this paper, based on the mediating effect path of “digital transformation—internal control—main business performance” of foreign trade enterprises, the “DIB China Listed Company Internal Control Index” (ICI) was adopted as the representative indicator of enterprise internal control [15].

According to Table 7, the Sobel coefficient is 0.0029, which is significant at the level of 5%, so it is concluded that the mediating effect is significant and accounts for 19% of the total effect. Therefore, it is judged that the mediating effect of “digital transformation—internal control—main business performance of enterprises” is effective, and the digital transformation of foreign trade enterprises affects the main business performance of enterprises by improving the mediating effect of internal control, thus H2 holds. In practice, the digital transformation of foreign trade enterprises can effectively improve internal control, improve the transparency of internal information through digital means, help all internal departments improve communication efficiency, and make more reasonable and scientific decisions and strategies.

5.5.2. Innovation Ability. In the research on the mediating effect path of “digital transformation—innovation ability—main business performance” of foreign trade enterprises, the research method of Li et al. [16] was used for reference, and the total number of patent applications...
of listed enterprises was treated as the representative indicator of the technological innovation ability of enterprises (PA).

According to Table 8, the Sobel test coefficient is 0.0028, which is significant at the level of 1%, and the mediating effect ratio is 28%, indicating that the digital transformation of foreign trade enterprises can enhance the innovation ability of enterprises, which indirectly affects the improvement of the main business performance of enterprises. Thus, H3 holds. As a matter of fact, digital transformation, as a comprehensive project integrating many technologies, not only has high requirements for the innovation of enterprises but also will encourage enterprises to continuously absorb and train relevant R&D personnel, continuously promote the systematic integration of digitalization and industry, and fundamentally improve the main performance of enterprises.

### 6. Conclusions and Enlightenment

In this paper, based on the publicly disclosed data of 27 foreign trade listed companies in Shanghai and Shenzhen A shares from 2010 to 2020, the digital transformation indicators of foreign trade enterprises were depicted by means of text recognition data analysis, and the impact of digital transformation on the main business performance of foreign trade enterprises was empirically analyzed, and the mediating role of internal control and innovation capability of enterprises was verified. The following conclusions are drawn: First, for foreign trade enterprises, digital transformation can effectively improve their main business performance, and the conclusion is still significant and robust after introducing control variables, marginal effect tests, and changing the statistical specification of core variables. Second, in the impact mechanism of digital transformation of foreign trade enterprises on enterprise performance, digital transformation of foreign trade enterprises can improve the internal control of enterprises, thus improving the main business performance, and also significantly improve the innovation ability of enterprises, thus improving the main business performance.

According to the above conclusions, the following suggestions are put forward in this paper: First, the government needs to further promote the cooperation between foreign trade enterprises and relevant research institutions, play the mediating role of foreign trade enterprises’ innovation ability, and accelerate the application of digital technology to the ground. At present, many cutting-edge digital technologies are still in the incubation stage in the laboratory. In order to better promote the main business performance and enhance the competitiveness of foreign trade enterprises, foreign trade enterprises should cooperate with research institutions and jointly explore the R&D and application of digital transformation technologies applicable to them. Second, foreign trade enterprises should choose digital technology according to their own situation, better apply it to internal control of enterprises, and improve their main business performance by improving internal management. At the same time, foreign trade enterprises have different main business segmentation directions, so they should choose the digital transformation technology that matches the different development stages of enterprises according to their own situation, so as to maximize the role of digital transformation in improving the main business performance.

Based on the text analysis of digital transformation of foreign trade enterprises and the model of the influence of digital transformation of foreign trade enterprises on their business performance, this paper points out the role of internal control and innovation ability of enterprises in promoting the main business performance in the digital transformation of enterprises. The research bridges the gap between the theory and practice of digital transformation of foreign trade enterprises. In the current situation, improving enterprise performance is crucial to the sustainable development of China’s foreign trade enterprises. This paper demonstrates the path and impact of the digital transformation of foreign trade enterprises on their performance improvement and puts forward suggestions to promote the digital transformation of foreign trade enterprises from the two aspects of government policies and enterprise behavior, which have important enlightened significance.

**Data Availability**

The data used to support the findings of this study are available from the corresponding author upon request.
Conflicts of Interest

The authors declare that they have no conflicts of interest regarding the publication of this article.

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