



Impact of Digital Transformation on the Exports of Manufacturing Firms: Evidence from Chinese data

Zhaoliang Ma, Yuyan Guo*

School of Economics, Anhui University, Hefei 230000, China

mz1ahdx@163.com; 934844927@qq.com*

Abstract. With the development of digital economy, digital transformation has emerged a new engine for Chinese enterprises to enhance their export competitiveness and improve their export advantages. This research searches and uses data from Chinese manufacturing A-share listed firms from 2009 to 2021 and employs a fixed-effect model for empirical testing. The findings suggest that digital transformation can greatly boost the export of manufacturing enterprises, and the conclusion remains after endogeneity treatment and robust-type test. The study presented in this paper extends and expands on previous research on enterprise exports and provides a realistic path to improve the export competitiveness of enterprises.

Keywords: digital transformation; manufacturing; firms' export levels

1 Introduction

The report of the 20th National Congress of the Communist Party of China proposed making dedicated efforts to turn the country into a strong trading nation. However, China is currently confronting many challenges, including the global economic downturn, shrinking demand in the international market and trade friction. In this context, it is critical to optimize Chinese export trade model and strengthen Chinese export competitiveness and comparative advantage. New technologies such as cloud computing and artificial intelligence and other digital technologies are also emerging. The digital economy has become the key force for the sustained and stable development of Chinese economy and the construction of a trade powerhouse. Digital transformation has also become a fundamental prerequisite for enterprises to enhance their export competitiveness and comparative advantages in the international market in this regard.

The concept of digital transformation involves enterprises utilizing digital technology and boost value production and induce changes in corporate features [1]. Through optimized resource allocation, faster industrial structure upgrades [2], improved internal control, it can help promote the improvement of enterprise's productivity. In addition, the enterprise value growth model can also be reshaped by digital transformation, which can alter the organizational structure, strategic model and business process [3]. It can also change the market factors and value creation model, innovate the internal

governance structure of the enterprise [4] and increase the ability to obtain exogenous innovation resources and the ability of resource integration, so as to promote the development of disruptive technological innovation [5]. The digital transformation performance of enterprise includes the use of the Internet and the digital technology, the use of the Internet can reduce enterprise trade costs and improve trade efficiency [6]. Internetization can significantly promote China's enterprise export activities [7]. The use of digital technology can effectively promote the cooperation, openness and innovation among enterprises, integrate internal and external resources, promote product renewal and iteration [8]. Digital transformation can not only improve the information processing capacity of enterprises, but also promote the flow and sharing of information elements inside and outside the enterprise [9].

As the foundation and pillar of Chinese economy, the manufacturing industry is the base of our country and the basis of its strength. For manufacturing enterprises, digital transformation can reduce operating costs, increase total factor productivity [10], improve enterprise innovation capability, and realize cost reduction and efficiency gains, thus improving export product quality [13][12]. Digitalization of manufacturing enterprises can stimulate the development of export trade [13] and market influence [14] by reducing the cost of exporting, increase the rate of resource allocation, and enhancing the human capital level of enterprises. It can also reduce the exit risk of exporting, extend the duration of exporting and improve the stability of exporting [15]. In view of this, this paper chooses manufacturing enterprises for research.

Generally speaking, the influence of digital transformation on enterprise exports has been fully discussed, but there are still some shortcomings: the existing literature is mostly focused on the study of enterprise export-related indicators, which are difficult to intuitively reflect the effect of digital transformation. Therefore, the marginal contribution of this paper are as follow: first of all, the research content. This paper selects indicators that can intuitively reflect the export performance of enterprises, which enriches the research in the field of export-related areas. Secondly, the research object. This article chooses the manufacturing industry to investigate whether the digital transformation is conducive to enterprise export, which has certain representativeness and provide reference for other industries.

2 Analysis and Hypothesis

The facilitation mechanism of the digital transformation of the manufacturing industry for the export side of enterprises can elaborate in the following aspects:

First, digital transformation can improve production efficiency, reduce costs and increase the price competitiveness of enterprises. Through digital transformation, enterprises realize the intelligence of production lines, improve productivity and reduce production costs. Digital technology can change the way of factor input and output, instantly adjust the production plan and optimize the allocation of resources [16], so as to enhance the total factor productivity. Selling through digital platforms can reduce the cost of enterprises' overseas marketing, and the consumer groups are more likely to buy products that meet their personal preferences, reducing the cost of information

matching between buyers and sellers [17]. Remote communication and negotiation with the help of the Internet and specialized language translation tools for can not only increase the efficiency but also reduce the cost of communication [18].

Secondly, digital transformation can promote technological upgrading and product innovation, improve export quality and help enterprises increase their market share. Enterprises can master new technologies and improve the level of enterprise's technology through digital transformation, which can optimize production processes and products, thus enhancing the scale of exports and export product quality. Utilizing big data, enterprises can conduct market research more conveniently, so that they can grasp market demand more precisely, develop new products that meet market demand timely [19], enrich the variety of trade products, and broaden consumer choices. In addition, digital transformation makes it easier to realize personalized customized design of products, so as to create products that cater to consumers.

Finally, digital transformation can optimize enterprise management, enhance the enterprise's rapid response capacity and realize high-speed and high-accuracy decision-making. The application of digital technology can not only strengthen internal management, but also realize intelligent management of the enterprise's supply chain, so as to optimize its decision-making. The use of cloud computing and big data can strengthen the acquisition and flow of enterprise information resources, improve the efficiency of information circulation and help enterprises to obtain real-time information about the market, so as to respond quickly to market changes, adjust production and export sales strategies. In the international marketplace, quick response to market changes, timely adjustment of business strategies and making right judgements are also a major condition for enterprises to improve their export level.

In summary, there is a hypothesis in this paper:

H1: Digital transformation can drive exports for manufacturing firms.

3 Research Design

3.1 Model Setup

Combining the mechanism analysis and hypotheses, this paper chooses two-way fixed effect model, by fixing the time and industry in order to better explore the hypothesis, and constructs the benchmark model as follows:

$$Export_{it} = \alpha_0 + \alpha_1 DigA_{it} + \alpha_2 Control_{it}^k + \delta_t + \delta_j + \varepsilon_{it} \quad (1)$$

In Equation (1), subscripts i and j denote the enterprise and its industry, and t denotes the year. $Export$ denotes the export of the enterprise, $DigA$ denotes the digital transformation of enterprise, $Control_{it}^k$ denotes all the control variables affecting the export of the enterprise (k is the number of control variables). δ_t, δ_j is the time and industry fixed effect respectively, and ε_{it} is the random disturbance term. The VIF values of this model are all greater than 1 and less than 2. Therefore, there is no multicollinearity in this model.

3.2 Variable Selection

Explained Variable.

Enterprise Export (Export). Combined with the previous analysis, this paper adopts the natural logarithm of the ratio of the annual export value of listed manufacturing companies to the export value of the province in which they are located to measure the export of enterprises.

Explanatory Variable.

Digital Transformation (DigA). This paper chooses text analysis, extracts the text content from the annual reports of A-share listed companies and refer to Wu Fei's [20] characteristic word spectrum for statistics, and take the logarithm of the total word frequency plus 1 as the digital transformation index.

Control Variables.

Gearing ratio (Lev), expressed as the ratio of liabilities to total assets at the end of the year of the enterprise; Return on Equity (ROE), expressed as net profit divided by the average balance of shareholders' equity; Total Asset Turnover (ATO), expressed by using the ratio of operating income to the average total assets; and Cashflow Ratio (Cashflow), expressed by using the net cash flow from operating activities divided by the total assets; Tobin's Q (TobinQ), this paper uses the ratio of market capitalization A to total assets (market capitalization A is calculated using the product of the market value of outstanding shares, the number of shares of non-outstanding shares, and the net assets per share, as well as the sum of the book value of liabilities); the number of years of incorporation (FirmAge), which is expressed by the difference between the current year and the year of the company's incorporation, plus 1 to take the natural logarithm.

3.3 Data Sources and Processing

The research object of this paper is A-share listed companies in the manufacturing industry, and the specific data come from Cathay Pacific (CSMAR) database, China Customs database, China Statistical Yearbook. Based on the availability and integrity of the data, the study selects the data from 2009-2021 and pre-processes the original data samples, 17,113 sample observations were obtained.

4 Analysis of Empirical Results

4.1 Base Regression Analysis

Based on the model constructed above, the digital transformation of enterprises and export indicators are benchmarked and estimated, and the regression result is significantly positive at the 1% level and the coefficient is 0.0091, which can initially verify

hypothesis H1. After adding all control variables and fixed effects, the regression results are still significantly positive. Based on this, it can be concluded that digital transformation can significantly enhance the export performance of enterprises, which verifies the previous hypothesis.

4.2 Robust Check

Instrumental Variable Approach.

Due to the endogeneity problem in the model construction process, this paper this paper selects the digital transformation (L.DigA) of the lagged one period as a tool variable, and uses the two-stage least squares (2SLS) to identify the causal relationship between the two. The first stage regression indicates that the selection of instrumental variables is effective; the second stage regression results show that the digital transformation of enterprises is still significant at the 1% confidence interval for the level of exports, indicating that the endogeneity test has passed, and the regression results of this paper have certain robustness

Replacement of Explanatory Variable Indicators.

For the metrics of the explanatory variable, this paper chooses to replace the keywords that measure the digital transformation of enterprises, carries out the word frequency statistics and takes the natural logarithm to get the proxy indicator (DigB), and then re-regresses the model. The regression shows that the DigB coefficient is still positive at the 1% level, i.e., the degree of digital transformation of enterprises still has a great contribution to the export comparative advantage, proving that the regression results are robust.

Excluding Time-specific Samples.

Within the time range of sample delineation, the COVID-19 epidemic in 2020 seriously affected the process of digital transformation of enterprises and global trade, so this paper eliminates 2020 for regression. According to the results, the digital transformation coefficient is still significantly positive at the 1% level, so the conclusions of this paper and the benchmark model regression results are robust.

5 Conclusions and recommendations

Digital transformation now is an important engine for cracking the current domestic and international difficulties, accelerating the construction of a new development pattern, promoting the construction of a strong trade country. Based on this, this paper theoretically analyzes and empirically researches the influence of digital transformation on the export of enterprises, and finally draws the following conclusions: the digital transformation can significantly enhance the export level of manufacturing enterprises, and this conclusion is still good after a series of robustness tests. Promote the digital

transformation of enterprises, the use of digital technology to improve the level of enterprise innovation, promote the development of enterprises in production, sales and other aspects, so as to enhance the export level of China's enterprises in the international market.

Based on the above conclusions, this article puts forward the following suggestions for reference: First, accelerate the promotion of digital transformation. Enterprises should strengthen their attention, formulate clear digital transformation strategies, innovate internal production organization models, and optimize external operation and communication platforms; The government should encourage and support enterprises in their digital transformation efforts, provide more assistance, and create a positive business environment. Second, strengthen the construction of digital infrastructure. The government should increase fiscal investment in infrastructure, consolidate the external technical foundation of enterprise digital transformation, improve the coverage and open sharing of digital infrastructure, and give play to its social and economic value. Third, cultivate talents for digital transformation. Enterprises should attach importance to the training and introduction of digital talents, strengthen cooperation with colleges and universities and research institutes, and build a digital talent training system. The government should introduce talent attraction policies to break through the dilemma of digital talents and realize the supply of compound talents.

References

1. Elisa T., Laura B., Léo-Paul D.(2021) Digitalisation boosts company performance: an overview of Italian listed companies. *Technological Forecasting & Social Change*,173. DOI: 10.1016/J.TECHFORE.2021.121173.
2. Mingyang L., Yong W., Xiaochao T.(2024) Study on the Impact of Digital Transformation on the High-Quality Development of Manufacturing Industry in the Context of "Belt and Road" Initiative--Based on the Perspective of Industrial Structure Upgrading and Digital Trade.*Social Sciences in Xinjiang*,2024,(01):71-84+164-165. DOI:10.20003/j.cnki.xjshkx.2024.01.007.
3. Yoo Y., Boland J R., Lyytinen K., et al.(2012) Organizing for Innovation in the Digitized World. *Organization Science*, 23(5):1398-1408. <https://doi.org/10.1287/orsc.1120.0771>.
4. Chenyu Z.(2022) Research on the Impact of Digital Transformation on Corporate Social Responsibility. *Modern Economic Science*,44(02):109-116. <https://link.cnki.net/urlid/61.1400.F.20220214.1535.002>.
5. Xianhai H., Yongming S., Mengtao C.(2024) Digital Transformation and Disruptive Technology: Evidence from Patent Networks and the SBERT Model. *China Industrial Economics*, (10): 137-154. DOI:10.19581/j.cnki.ciejournal.2024.10.008.
6. Yong H.,Xinguang C.(2015)The Theoretical and Empirical Research on the Impact of Internet on International Trade. *Economic Survey*,32(04):54-60.DOI:10.15931/j.cnki.1006-1096.2015.04.010.
7. Guobing S., Zhengyu Y.(2020) Internetization, Innovation Protection and the Promotion of Chinese Enterprises' Export Quality. *The Journal of World Economy*,43(11): 127-151. DOI:10.19985/j.cnki.cassjwe.2020.11.007.

8. Lele S., Qiantao F., Hongmin L. (2023) How Digital Transformation Enhances Export Competitiveness of Enterprises--A Study Based on Chinese Manufacturing Enterprises. *Statistics and Management*, 38(09):104-113. DOI:10.16722/j.issn.1674-537x.2023.09.003.
9. Acemoglu D., Akcigit U., Alp H., et al. (2018) Innovation, Reallocation, and Growth. *American Economic Review*, 108(11):3450-3491. DOI:10.1257/aer.20130470.
10. Dan S., Guanglin S. (2022) Influence Mechanism of Big Data Development on the Total Factor Productivity of Manufacturing Enterprises. *Finance & Trade Economics*, 43(09):85-100. DOI:10.19795/j.cnki.cn11-1166/f.20220906.006.
11. Qing Z., Jinping Y. (2023). Manufacturing Digitalization and Quality of Export Products--Empirical Research Based on Chinese Manufacturing Enterprises. *International Business*, 2023, (05): 21-39. DOI:10.13509/j.cnki.ib.2023.05.002.
12. Chen Z., Yanmei W. (2024). How Enterprise Digital Transformation Improve the Quality of Export Products? Empirical Evidence from Listed Manufacturing Companies. *Research on Financial and Economic Issues*, 2024, (12): 83-96. DOI:10.19654/j.cnki.cjwtyj.2024.12.007.
13. Fenglan C., Lichao W., Xiang D. (2022) Digital Transition of Manufacturing Industries and Export Enhancement. *Journal of International Trade*, (12):70-89. DOI:10.13510/j.cnki.jit.2022.12.002.
14. Haoguang L., Qinghua Q. (2023). Digitalization of Manufacturing Industry, Digital Trade Barriers and Market Power of Export Firms. *Economic Perspectives*, 2023, (07):47-68. https://kns.cnki.net/kcms2/article/abstract?v=fAsipVvIRrib0T3COK2pdf9Lfm74dFMdR7qjHmUYpV8kP_uFbTx-FJvaKVj_UoHPMNE2ODKx1JuCYkYtZBgPnFHfig8Nxr5m4hTvJa5P3tnl2WNCZ6pb7AtJeLDkcmLvACsmvhI8G6bDnSWcBJe20ujz9zzpYe7AbblL9YJb2Sdy-a18zPpI5Rs4zDJVEL5vfkH8n4b0zM8=&uniplatform=NZKPT&language=CHS
15. Libo F., Anqi H., Yiming W. (2022) Digital Transformation and Export Stability of Manufacturing Enterprises. *International Economics and Trade Research*, 38(12):4-18. DOI:10.13687/j.cnki.gjjmts.2022.12.003.
16. Haijian L., Yuexin T., Wenjie L. (2014) Internet thinking and traditional enterprise reengineering. *China Industrial Economics*, (10):135-146. DOI:10.19581/j.cnki.ciejournal.2014.10.011.
17. Chaney, T. (2014) The Network Structure of International Trade. *The American Economic Review*, 104(11): 3600-3634. DOI:10.1257/aer.104.11.3600.
18. Xin F. (2020) The Development of Digital Economy and the Efficiency and Uncertainty of International Trade-Finance & Trade Economics, 41(08):145-160. DOI:10.19795/j.cnki.cn11-1166/f.2020.08.010.
19. Kai Z., Jun C. (2025) Research on the impact of digital transformation on export resilience of enterprises--Based on the data of listed manufacturing companies. *Prices Monthly*, 1-13[2025-01-14]. <http://kns.cnki.net/kcms/detail/36.1006.F.20241120.1447.010.html>.
20. Fei W., Huizhi H., Huiyan L., et al. (2021) Enterprise digital transformation and capital market performance--Empirical evidence from stock liquidity. *Journal of Management World*, 37(07):130-144+10. DOI:10.19744/j.cnki.11-1235/f.2021.0097.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

