Digital Transformation and Foreign Direct Investment of Enterprises:Evidence from Listed Companies in China

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Abstract. The rapid development of the digital economy has been instrumental in driving corporate digital transformation, exerting profound effects on enterprises' outward foreign direct investment (OFDI). Concurrently, advancements in digital technologies have led to qualitative and quantitative leaps in the quality and scale of trade and investment. Based on theoretical analysis, this paper focuses on A-share listed companies on the Shanghai and Shenzhen Stock Exchanges between 2011 and 2021, examining how digital transformation promotes enterprises' outward OFDI and its underlying mechanisms. The research reveals that corporate digital transformation significantly enhances their engagement in outward foreign direct investment, and this conclusion remains robust after being subjected to various robustness checks, including indicator substitution, interaction fixed effects, double clustering robust standard errors, and panel quantile regressions.Moreover, upon conducting endogeneity tests using the mean value of a digital transformation index grouped by year and industry as an instrumental variable, the findings still hold firm. This study enriches the body of knowledge on the economic consequences of digital transformation for tangible businesses and the factors influencing corporate outward foreign direct investment. It provides valuable insights to guide enterprises in more effectively expanding into overseas markets.

Keywords: digital transformation; outward foreign direct investment; listed companies; overseas markests.

1. Introduction

In recent years, the global epidemic has been raging and geopolitical tensions have caused anti-globalization sentiments. The world economy remains sluggish, and the number of restrictive investment policies in various countries has increased significantly. There is huge downward pressure on global investment and development, and all countries, especially developing countries, face great challenges in foreign investment cooperation. In the face of global economic weakness and uncertainties in external markets, Chinese enterprises face the challenge of rising risks in overseas investment. Therefore, exploring new dynamic mechanisms and strategic means to promote the steady development of OFDI and enhance the vitality of growth has become increasingly prominent in the pursuit of high-quality development by Chinese enterprises. The report to the 20th CPC National Congress clearly pointed out the need to "promote high-level opening-up" and "maintain a diversified and stable international economic pattern and economic and trade relations". Accelerating enterprises' OFDI is not only an important starting point for China to move forward from a big country of foreign investment to a powerful country of foreign investment, but also a key force to build a new development pattern.

At present, digital economy has become a key force to restructure global factor resources, reshape global economic structure and change global competition pattern. With the emergence and application of digital technology, the traditional business model of enterprises has been greatly impacted, and at the same time, it also provides new ideas for the innovation and development of enterprises (Hu et al., 2023; Sun and Lu, 2023). Digital transformation refers to the process in which an organization or enterprise uses digital technology to completely transform and upgrade its business, process, culture and values. The essence of enterprise digital transformation is to promote systematic changes in entity's information exchange, management mode, operation process and service delivery mode through the introduction of digital technology, and drive enterprise operation management to upgrade

to the direction of intelligence, accuracy and efficiency, so as to achieve disruptive innovation (Li et al., 2023; Vial, 2019). In November 2021, the "14th Five-Year Plan for High-quality Development of Foreign Trade" issued by the Ministry of Commerce listed "digital strong trade" as a key project of foreign trade during the 14th Five-Year Plan period, and proposed to "adhere to digital empowerment, accelerate digital transformation, promote the deep integration of digital technology and trade development, and constantly strengthen the new engine of foreign trade development." According to the White Paper on China's Digital Economy Development (2023), the scale of China's digital economy will reach 50.2 trillion yuan in 2022, up 10.3% year on year in nominal terms, accounting for 41.5% of GDP. The G20 Digital Economy Development and Cooperation Initiative and other initiatives have won broad consensus around the world, remarkable progress has been made in information infrastructure connectivity, and fruitful achievements have been made in Silk Road e-commerce cooperation. China's platform enterprises in the field of digital economy have accelerated their overseas presence, increasing their influence and competitiveness. Therefore, how to enhance enterprises' foreign investment through the application of digital technology has increasingly become an important research topic.

Previous scholars' research on enterprise digital transformation mainly focused on the influencing factors and economic effects of enterprise digital transformation. The existing literature mainly focuses on the impact of digital transformation on capital market performance (Wu et al., 2021), innovation quality (Xiao and Zeng, 2023), input-output efficiency (Liu et al., 2021), improving the company's financial performance (Zhai et al., 2022) and organizational performance (Zhao et al., 2021). With the rising labor cost in China, other developing countries are gradually "low-end embedding" in the global value chain (Du et al., 2022), and the traditional comparative advantage of China's export trade is becoming weaker. It is very important to accelerate the cultivation of new advantages in the international competition of export trade and promote the high-quality development of trade to take new steps. In recent years, there is only a small amount of literature linking the digital transformation of enterprises with OFDI.

The existing theoretical analysis shows that digital transformation has a two-sided impact on enterprises' OFDI. On the one hand, digital transformation has brought new opportunities and dividends to the internationalization decision-making of enterprises in the home country. Better control of operating costs, avoidance of OFDI risks, and creative solutions to more complex problems increase the possibility for enterprises in the home country to make internationalization decisions. But on the other hand, traditional multinational enterprises have doubts when dealing with the contradiction between digital transformation and corporate economic benefits, which leads to enterprises falling into difficulties such as "cannot turn," "dare not turn," and "will not turn." According to the Research on Digital Transformation Index of Chinese Enterprises in 2020, less than 11% of Chinese enterprises have effectively improved their performance and value through digital means, which means that the matching degree between digital transformation and their own development is low.

On the whole, the research topics related to digital transformation and enterprises' OFDI still have a large space for expansion. On the one hand, most of the existing research on digital transformation is carried out from a macro perspective, and mainly focuses on the influencing factors and economic effects of enterprises' digital transformation. On the other hand, as for the external factors of enterprises' OFDI, scholars mostly start from the market-oriented and command-oriented policies at the macro level and the industrial structure and market environment at the meso level, while the impact of changes in the external environment led by the development of digital transformation has not been widely paid attention to. Based on this, this paper, based on the micro perspective, explores the relationship between digital transformation and enterprises' OFDI and its action mechanism, hoping to form a beneficial supplement to the existing research.

The marginal contribution of this paper lies in the following three aspects. Second, this paper takes A-share listed companies in Shanghai and Shenzhen stock markets from 2011 to 2021 as samples for empirical test, providing empirical evidence for the enhancing effect of digital transformation on

enterprises' OFDI and its mechanism, helping enterprises to adopt differentiated and dynamic strategies in the practice of digital transformation, and taking into account both economic and social benefits.

2. Theoretical mechanisms and research hypotheses

2.1. Research on the influencing factors and economic consequences of digital transformation.

The existing literature on enterprise digital transformation is mainly divided into the following two aspects:

On the one hand, it is to explore the driving factors of enterprise digital transformation. Digital transformation refers to that enterprises rely on digital technology, take data as the key element, and realize innovation-driven high-quality development by realizing intelligent production, intelligent management and accurate marketing of enterprises. The goals and value orientation of enterprises to improve production efficiency, reduce production cost, and maintain differentiated competitive advantages are the basic motivations for enterprises' transformation and upgrading (Wen and Zhong, 2022). Competitive pressure from competitors (Chen et al., 2021), consumer demands (Teece, 2018), government policy support (Shi et al., 2021), economic policy uncertainty (Zhu et al., 2023) are external factors driving enterprises' digital transformation.

Another strand of literature focuses on the economic consequences of enterprise digital transformation. The digital transformation of enterprises can significantly improve the level of industrial investment, inhibit "from real to virtual," and promote the deep integration of digital economy and real economy (Li et al., 2022). Digital transformation will simplify the material approval process of multinational enterprises, help enterprises reduce the cost of entering the national market, and break the entry barrier (Zhang et al., 2023). At the same time, it will also improve the management efficiency of overseas subsidiaries and innovate overseas business models, thus affecting the strategic deployment and scale of the parent company's OFDI. At the same time, the digital transformation of enterprises can reduce the cost of information search, bargaining and signing, post-conversion and financing (Yi et al., 2021); Improving stock liquidity (Wu et al., 2021) and corporate innovation capability (Zhang and Dong, 2023); It promotes the platform-based transformation and development of enterprises (Yi and Liang, 2023) and ultimately helps to enhance the value of enterprises (He and Liu, 2019). In addition, some scholars pointed out that the impact of digital transformation on enterprise performance is negative or uncertain, for reasons including that the digital divide caused by the difference in the level of digital transformation among different enterprises increases the difficulty of collaboration among cooperative enterprises, and the weak technological innovation ability of Chinese enterprises leads to low R&D efficiency of digital transformation related projects (Dong et al., 2022). It can be seen that the existing literature has not reached a consistent conclusion on the economic effect of enterprise digital transformation.

2.2. About the impact of digital economy development on enterprises' outward foreign direct investment

China attracted a record $189.1 billion in outward foreign direct investment in 2022, up 5 percent, according to the Statistical Bulletin on China's Outward Foreign Direct Investment in 2022, jointly released by the Ministry of Commerce, the National Bureau of Statistics and the State Administration of Foreign Exchange. In 2022, China's OFDI accounted for US $163.12 billion and US $2.75 trillion in global flows and stocks, ranking second and third in the world respectively. At present, there is a lack of specialized research on digital transformation for enterprises' OFDI, and only a small amount of literature links enterprise digital transformation with OFDI in recent years. Except for a small number of scholars who believe that digital economy is not conducive to the expansion of OFDI, especially market-seeking OFDI (Banalieva and Dhanaraj, 2019), most scholars hold the view that digital economy can promote the increase of OFDI scale.

From the perspective of influence mechanism, digital transformation of enterprises can effectively improve information asymmetry and enhance positive market expectations, thus providing effective motivation for the improvement of OFDI of enterprises. Through digital transformation, enterprises have improved their information availability and reduced information asymmetry, thus enhancing their ability to acquire information and setting up an efficient organizational structure (Chen et al., 2020). In particular, by using their own digital technology, enterprises can improve their information processing ability and improve the efficiency of financial operation through their own digital technology, so as to achieve the maximum utilization of capital under the constraints of limited financial resources. The digital transformation of enterprises can improve the performance of enterprises' capital market, solve the restriction of information asymmetry, and ease the financing constraints of enterprises (Yuan and Zeng, 2020).

From the perspective of internal production and operation, a large amount of data and information has been accumulated in the whole process of production and operation practice of enterprises, but only when such data and information are transformed into effective information output and used in enterprises' production decisions can they produce positive effects (Hou et al., 2023). However, before the enterprise carries out digital transformation, the processing of information data can only remain in the original inefficient mode, and the information dividend implied in the information cannot be effectively mined by the enterprise but can only be deposited in the enterprise system. When an enterprise effectively promotes its own digital transformation, it means that it can better use digital technology to process massive internal and external, non-standardized and unstructured data, and encode and output it into structured and standardized information, which improves information availability and information circulation (Zheng and Zhou, 2023). Enterprises can make full use of this kind of information to serve their own production decision-making, market orientation tracking, and optimize the production process. Moreover, the connection between supply and demand should be strengthened to improve the quality and efficiency of enterprises' production and operation, so as to enhance the transaction activity of the market (Shi and You, 2021).

As an important source for enterprises to obtain competitive advantages, innovation ability is the premise and guarantee for enterprises to participate in international direct investment. The report of the 20th National Congress of the Communist Party of China (CPC) proposed to "accelerate the implementation of the innovation-driven development strategy" and stressed the need to strengthen the deep integration of enterprises led by enterprises, universities and research institutes, and "strengthen the dominant position of enterprises in scientific and technological innovation." By strengthening the degree of data sharing, digital technology promotes the linkage development between enterprises and between enterprises and between enterprises and markets, thus improving the innovation efficiency of enterprises, changing the innovation mode and expanding the innovation field (Li et al., 2022). Due to the high innovation intensity of the investment in digital technology, it can effectively drive the optimization of enterprises' production process or production mode, thus promoting the improvement of enterprises' innovation ability (Liu et al., 2023). In addition, digital transformation promotes the integration of the R&D end and the consumer end. The investment in digital technology improves the acquisition and integration ability of data elements of enterprises, such as the application of cloud technology, big data and digital platforms, which can help enterprises accurately locate consumers' demand preferences, thus optimizing the R&D mode of enterprises and improving the efficiency of innovation investment while reducing the cost of effective information acquisition (Du and Cao, 2023). The digital transformation of enterprises plays a positive role in improving the total factor productivity of enterprises by optimizing their operation modes, reducing their costs and enhancing their innovation capabilities (Hua et al., 2022).

Digital transformation can fully integrate market and internal information, so as to promote the company's technological innovation and productivity improvement, and cultivate employees' digital skills and data processing ability, so as to further improve the company's internal operation efficiency and the collaboration efficiency of the upstream and downstream of the industrial chain (Yu and Tian, 2023). In particular, following the above logic, in the context of high-quality development of digital

economy, the digital transformation of enterprises is more likely to be favored by the market. At the same time, digital transformation can help enterprises better grasp the new market trend, optimize product supply, and then realize enterprise innovation. In addition, Li et al. (2023) pointed out that the level of enterprise digitalization can promote enterprise innovation activities by influencing the depth of enterprise innovation network. Furthermore, the level of enterprise innovation capability will affect the decision of OFDI. Hu et al. (2023) believed that enterprises with technological innovation advantages could more flexibly choose the mode of entering the host country market and promote their OFDI.

Based on the above analysis, digital transformation is bound to have a significant impact on enterprises' OFDI behavior, that is, digital transformation is conducive to improving the probability and ability of enterprises' OFDI. In essence, the digital transformation of enterprises is a systematic process in which the efficient flow of data improves the allocation of technology, capital, talents, materials and other elements in time and space, and alleviates the impact of environmental uncertainty on enterprises (Chen et al., 2021), which will certainly have a significant impact on the development of OFDI of enterprises. In view of this, this paper proposes the core research hypothesis.

H1: There is a significant positive correlation between enterprises' digital transformation and their OFDI.

3. Indicator construction, data sources and identification strategies

3.1. Indicator Construction

3.1.1 Dependent variable

Outward foreign direct investment of enterprises. The data of OFDI in this paper come from the annual reports of listed companies and the related party transaction database of listed companies in China. When the amount of outward foreign direct investment in the annual report of a listed company is missing, referring to the existing research (Wang and Zhang, 2023), this paper replaces it with the actual registered capital of all subsidiaries of the listed company in different host countries. In addition, this paper takes the natural logarithm of the data of enterprises' OFDI by adding 1.

3.1.2 Selection of independent variables

Enterprise Digital Transformation (DIGT). The quantification of enterprise digital transformation has always been a hot topic in the theoretical and practical fields. The digital transformation of enterprises is not only as simple as digitizing the information of enterprises, but also a systematic process that closely combines the all-round elements of enterprises with digital technology (Wu and Yao, 2023). As the core strategy of the current high-quality development of enterprises, digital transformation is easier to be reflected in the summary and guiding annual report of enterprises. The usage of words in the annual report reflects the strategy of the enterprise, reflects the business philosophy and development path of the enterprise. Referring to the research of Wu et al. (2022), this paper measures the degree of enterprises' digital transformation through the word frequency statistics related to enterprises' digital transformation in the annual reports of listed companies. The specific processing methods are as follows: first, this paper uses Python crawler function to obtain and sort out the annual reports of all A-share listed companies in Shanghai Stock Exchange and Shenzhen Stock Exchange, and then extracts all the text content through Java PDFbox library. Secondly, based on the feature words of "underlying technology application" (including artificial intelligence technology, big data technology, cloud computing technology and blockchain technology) and "technology practice application" (including digital technology application), this paper extracts the high-frequency words related to enterprise digital transformation in the annual reports of listed companies. Finally, this paper uses the Jieba function to segment all the samples and form a data pool. The natural logarithm of the sum spectrum plus 1 is taken as the index of digital transformation of listed companies, which is expressed by DIGT.

3.1.3 Selection of control variables

In order to solve the endogeneity problem caused by missing variables, this paper refers to the existing literature and introduces the control variable (Zit), enterprise size (size), which is measured by the logarithm of the total assets of the enterprise. Enterprise age (age) is measured by the logarithm of the establishment years of the enterprise; Corporate profitability (roa), measured by net profit/total assets; board size (board) is measured by the logarithm of the number of board members; Ownership concentration (top1) is measured by the shareholding ratio of the largest shareholder; duality is measured by the dual position of chairman and general manager; Enterprise value (TobinQ), measured by (market value of outstanding equity at the end of the period + market value of non-outstanding equity at the end of the period + market value of net debt at the end of the period)/total assets at the end of the period.

3.2. Model Design

$$OFDI_{it} = \alpha_0 + \alpha_1 DIGT_{it} + \alpha_2 Z_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (1)$$

Among them, $OFDI_{it}$ is the amount of foreign investment of enterprise i during the t period, and $DIGT_{it}$ is the degree of digital transformation of enterprise i during the t period. δ_t is the random error term. The estimated coefficient ε_{it} indicates the identification of the causal effect between the degree of enterprise digital transformation and foreign investment. The estimated coefficient of α_1 is significantly greater than 0, indicating that digital transformation has a positive effect on promoting enterprises' foreign investment;The estimated coefficient of α_1 is significantly less than 0, indicating that digital transformation has a negative effect on promoting enterprises' foreign investment; The estimated coefficient of α_1 is not significant, which indicates that the impact of digital transformation on promoting enterprises' foreign investment is not significant.

3.3. Data sources and descriptive statistics

This paper selects A-share listed companies in Shanghai and Shenzhen from 2011 to 2021 as the research object and selects them according to the following steps: (1) excluding financial listed companies; (2) Eliminate the samples with missing financial data or insolvency; (3) Eliminate the samples marked ST or *ST in the current year. Firm-level cluster regression is conducted on the samples to eliminate the interference of differences between data groups and to reasonably control the effect of heteroscedasticity. The financial data used in the study were derived from the CSMAR database and the Wind database.

Table .1 Descriptive statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
DIGT	14804	1.383	1.367	0.000	6.301
OFDI	14804	10.663	2.305	-1.139	21.597
size	14804	22.411	1.466	17.813	29.350
age	14804	2.845	0.355	0.000	4.143
roa	14804	0.043	0.077	-2.646	2.163
board	14804	2.139	0.204	1.099	3.045
top1	14804	35.558	15.389	3.000	89.410
duality	14804	0.278	0.448	0.000	1.000
TobinQ	14804	2.069	2.002	0.684	102.430

4. Empirical analysis

4.1. Benchmark regression.

Table 2 reports the impact of enterprises' digital transformation on OFDI behavior. Column (1) and Column (1) only add the index of enterprise digital transformation, and it is found that the

estimated coefficient is 0.288, which is significant at the 1% confidence level, indicating that digital transformation is conducive to improving the probability of enterprise OFDI. In Column (2), indicators such as enterprise size (size), enterprise age (age), enterprise profitability (roa), board size (board), equity concentration (top1), duality rate (duality) and enterprise value (TobinQ) are added. It is found that the estimated coefficient of enterprise digital transformation (DIGT) is still positive, which is consistent with the conclusion of Column (1). Column (3) and Column (4) use fixed effect model to control variables and prevent endogeneity problems caused by missing variables. Column (3) only adds enterprise digital transformation index and found that its estimated coefficient is 0.098, significant at 1% confidence level. It is significant at the 1% confidence level, which once again confirms the empirical result that digital transformation is conducive to improving the probability of enterprises' foreign investment.

Table .2 Benchmark regression.

	(1)	(2)	(3)	(4)
	OLS		Fixed effect model	
DIGT	0.288***	0.247***	0.098***	0.047**
	(0.013)	(0.013)	(0.024)	(0.024)
size		0.537***		0.509***
		(0.014)		(0.056)
age		0.086		0.532*
		(0.054)		(0.304)
roa		3.340***		0.315
		(0.434)		(0.248)
board		-0.402***		0.195
		(0.089)		(0.163)
top1		0.000		-0.005
		(0.001)		(0.003)
duality		0.239***		-0.014
		(0.040)		(0.059)
TobinQ		0.010		-0.003
		(0.009)		(0.013)
_cons	10.265***	-1.334***	10.549***	-2.560*
	(0.027)	(0.345)	(0.036)	(1.555)
Firm FE	N	N	Y	Y
Industry FE	N	N	Y	Y
Year FE	N	N	Y	Y
N	14804	14804	14283	14283
adj.R^2	0.029	0.145	0.604	0.610

Note: The figures in parentheses are robust standard errors clustered to the enterprise level, *p<0.1, **p<0.05, ***p<0.01

4.2. Robustness analysis

4.2.1 Substitution of variables

Considering the impact of the differences in the measurement methods of indicators on the research conclusions, this paper conducts robustness test by replacing the core explanatory variables and explained variables. First of all, in the benchmark regression part, the number of enterprises' OFDI is used to measure the level of enterprises' OFDI, while in the robustness test part, the number of enterprises' OFDI (OFDI2) is used to measure. Secondly, in the benchmark regression part, this paper adopts Wu et al. (2022) for regression. The results in columns (1) and (2) of Table 3 show that the results after replacing variables are basically consistent with the benchmark regression results, so the core conclusions of this paper are proved to be reliable.

4.2.2 Alternative measurement method

Industries with a high level of technology or cities with a high level of economic development may have relatively perfect digital infrastructure, and enterprises have more advantages in the development of digital transformation. Based on this, this paper adds the interactive fixed effects of industry and year, as well as province and year, to control the influence of factors that change with year at the industry and city levels, so as to alleviate the changes in the macro environment caused by the development of digital economy. The regression results of columns (3) and (4) of Table 3 show that the estimated coefficient of enterprise digital transformation is significantly positive, which is consistent with the benchmark regression results.

Since the sample period of this paper is from 2011 to 2021, the COVID-19 epidemic in 2020 has a profound impact on the digital transformation process of enterprises (Liu et al., 2022). To this end, this paper divides the sample into two periods, 2011-2019 and 2020-2021, to examine the model estimation effect in the sample sub-intervals. The test results in columns (5) and (6) of Table 3 show that if the impact of major public health crises is excluded, the estimated coefficient of the core explanatory variable enterprise digital transformation is consistent with the benchmark regression results, which again supports Hypothesis 1 of this paper.

Table .3 Robustness Test1

	(1)	(2)	(3)	(4)	(5)	(6)
	OFDI2	OFDI	Interactive Fixed Effect		2011-2019	2020-2021
DIGT	0.017**		0.051**	0.049**	0.050*	0.095*
	(0.008)		(0.025)	(0.024)	(0.027)	(0.057)
DIGT2		0.070**				
		(0.035)				
size	0.128***	0.509***	0.503***	0.501***	0.546***	0.408**
	(0.009)	(0.057)	(0.061)	(0.056)	(0.064)	(0.163)
age	0.009	0.554*	0.216	0.567*	0.944***	2.656*
	(0.027)	(0.315)	(0.330)	(0.312)	(0.350)	(1.389)
roa	0.145	0.347	0.484*	0.318	0.298	-0.246
	(0.127)	(0.257)	(0.266)	(0.253)	(0.289)	(0.421)
board	-0.092*	0.125	0.115	0.172	0.316*	0.078
	(0.052)	(0.167)	(0.165)	(0.164)	(0.188)	(0.422)
top1	-0.000	-0.005	-0.003	-0.005	-0.009**	0.033***
	(0.001)	(0.003)	(0.003)	(0.003)	(0.004)	(0.011)
duality	0.055***	-0.013	-0.014	-0.001	-0.009	-0.182
	(0.020)	(0.061)	(0.060)	(0.059)	(0.071)	(0.156)
TobinQ	0.003	0.001	-0.006	-0.008	0.007	0.001
	(0.005)	(0.013)	(0.014)	(0.013)	(0.016)	(0.039)
_cons	-1.706***	-2.472	-1.444	-2.428	-4.776***	-7.307
	(0.221)	(1.596)	(1.615)	(1.560)	(1.804)	(5.268)
Firm FE	N	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
*Industry*Year FE*			Y			
*Pro*Year FE*				Y		
N	3461	13655	14179	14277	11323	2482
adj.R^2	0.160	0.602	0.615	0.614	0.635	0.804

4.3. Panel quantile regression

The benchmark regression model describes the effect of digital transformation in the mean interval on enterprises' OFDI but ignores the impact of digital transformation on the OFDI of enterprises with the entire conditional distribution, which may make it difficult to accurately estimate the impact of digital transformation on enterprises' OFDI. This paper further selects the panel quantile regression

model to test whether there are differences in the impact of digital transformation on enterprises' OFDI at different quantiles, fully reflecting the distribution of explanatory variables without being affected by extreme values, and on this basis, mining more rich information about the impact of digital transformation on enterprises' OFDI. Columns (1) to (3) of Table 4 report different regression results of digital transformation on enterprises' OFDI at different quantiles.

4.4. Endogeneity analysis

Enterprises' digital transformation can promote enterprises' OFDI, and enterprises with high OFDI level will also affect the development of their digital transformation. The endogeneity problem caused by such simultaneous equations is relatively common, so finding appropriate instrumental variables is the key to solve the endogeneity problem.

Referring to the practice of Xiao et al. (2021), this paper uses the mean value (IV_Mean) of the digital transformation index divided by year and industry as the instrumental variable to deal with the endogeneity problem.

Table 4 shows the estimation results of instrumental variables, and the model is estimated by the two-stage least squares method. The first-stage estimation results in the model in Column (4) show that there is a significant correlation between instrumental variables and enterprise digital transformation variables, and the estimated coefficient of enterprise digital transformation in the second-stage estimation results in Column (5) is significantly positive at the level of 1%, which is consistent with the benchmark regression estimation results. At the same time, both the under-identification test and the weak identification test reject the null hypothesis, which also confirms the rationality of the selection of instrumental variables.

Table .4 Robustness Test2

	(1)	(2)	(3)	(4)	(5)
	Q=0.25	Q=0.5	Q=0.75	IV_MEAN	
DIGT	0.330***	0.225***	0.149***		0.471***
	(0.018)	(0.013)	(0.009)		(0.142)
IV_MEAN				0.462***	
				(0.028)	
size	0.451***	0.493***	0.594***	0.316***	0.375***
	(0.020)	(0.013)	(0.013)	(0.021)	(0.074)
age	0.001	0.081	-0.011	0.559***	0.162
	(0.080)	(0.050)	(0.045)	(0.074)	(0.259)
roa	6.025***	4.917***	2.776***	-0.107	0.413*
	(0.571)	(0.389)	(0.388)	(0.096)	(0.249)
board	-0.380**	-0.486***	-0.459***	0.168***	-0.007
	(0.171)	(0.106)	(0.082)	(0.066)	(0.168)
top1	0.001	0.002*	-0.000	-0.005***	-0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.004)
duality	0.340***	0.203***	0.100***	0.003	0.024
	(0.069)	(0.040)	(0.032)	(0.023)	(0.061)
TobinQ	-0.017	0.007	0.017*	0.020***	0.024*
	(0.020)	(0.008)	(0.010)	(0.006)	(0.013)
Firm FE	Y	Y	Y		
Industry FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Kp rk LM					234.564***
Kp rk Wald F					270.385***
Stock-Yogo 10%				16.380	
N	14804	14804	14804	14190	14190

5. Conclusion

Based on the CSMAR overseas direct investment database, CNRDS database and listed company database from 2010 to 2021, this paper uses Python to crawl the annual reports of listed companies and uses text analysis to construct the digital transformation system of listed companies. And the two-way fixed effect is used to empirically test the impact of digital transformation on enterprises' OFDI and the relevant path mechanism. The study finds that digital transformation significantly promotes the OFDI behavior of enterprises. This paper verifies that digital transformation has a significant role in promoting the OFDI of Chinese listed enterprises, which not only enriches the literature on the economic effects of digital transformation, but also has important policy implications for the digital transformation and internationalization selection strategies of Chinese listed enterprises. According to the research conclusions, this paper puts forward the following suggestions.

From the macro level, first, the government should follow the development trend of digital economy, constantly improve economic policies, help enterprises in digital transformation from the policy perspective, empower traditional enterprises, and promote high-quality development of enterprises. At the social level, we should strengthen the training of digital talents to provide a talent foundation for further implementing the digital economy strategy and promoting the digital transformation of enterprises. Second, focusing on sustainable development while strengthening the digital transformation of enterprises is of great significance to the national strategy of achieving the "dual carbon" goal. Continue to pay attention to the changes in ESG performance of enterprises and pay attention to whether the innovative development and application of the new generation of digital information technology represented by artificial intelligence, blockchain, cloud computing and big data can enhance the practical ability of enterprises ESG and become a technical force to promote the development of enterprises ESG. Third, comprehensively promote the process of digital construction, encourage enterprises to use digitalization to speed up the pace of "going global". From the perspective of enterprises, first of all, multinational enterprises should actively use digital technology to build data-driven strategic closed-loop management and control and dynamic optimization mechanism, improve the communication efficiency between parent and subsidiary companies, and enhance the competitiveness and innovation of enterprises. Secondly, enterprises should lay out emerging industries in advance, build new models and cultivate new forms of business, promote business innovation and transformation, deeply mine the value of data, break the information island, optimize supply chain management, and help enterprises to make outward foreign direct investment.

From the micro subject level, first, enterprises should fully grasp the major strategic opportunities brought by the rapid development of digital information technology, accelerate the deep integration of digital technology with the production, research and development, management, sales and service of enterprises, give full play to the micro subject role of enterprises in high-quality economic development, and improve the international competitiveness of enterprises. Strengthen the integrated development of digital economy and real economy, promote its own digital transformation, and pay attention to the economic benefits that OFDI can bring. Second, take advantage of the competitive advantages of digital transformation to seek new opportunities for overseas investment and development of enterprises. By introducing digital technology, improving the innovation ability of enterprises, and reducing the cost of information search and management, the institutional risks faced by enterprises in transnational investment can be alleviated, so as to explore overseas markets more effectively and participate in international competition. Third, strengthen the ability of enterprises themselves and pay attention to the regional environment of digital construction. Enterprises should vigorously enhance their own innovation ability, improve production efficiency, improve the quality and efficiency of product production, reduce costs and strengthen the international competitiveness of products. The government should pay close attention to the construction of soft environments such as fintech environment, market environment and business environment, promote the integration and sharing of innovation elements, improve the coordination and supporting capacity of industrial chain and supply chain, promote the coordinated development of regional digital economy, realize the precise docking between digital technology and investment enterprises, and enhance the feasibility

of enterprises' OFDI. At the same time, it can solve the problem of "difficult, expensive and slow financing" of enterprises.

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