Thriving Amid Turbulence: Economic Downturns and the Drivers of Enterprise Digital Transformation

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Abstract

Existing literature focuses on the positive effects of digital transformation of enterprises. However, few studies have examined whether enterprises have the motivation and ability to implement digital transformation in the current situation of increasing downward pressure on China's economy. Theoretically, on the one hand, in order to cope with the various challenges brought about by the economic downturn, enterprises have the motivation to implement digital transformation to cultivate internal strength, improve quality and increase efficiency. But on the other hand, under the pressure of economic downturn, enterprises need to invest more resources to cope with the challenges of external market changes; thus, even if enterprises have the motivation to digitally transform, they may be forced to slow down or even suspend digital transformation due to lack of corresponding resources. The empirical results support the theoretical expectation that enterprises will increase the degree of digital transformation in the context of economic downturn. The cross-sectional analysis identifies the prerequisites for digital transformation of enterprises in the context of economic downturn: transformation mainly occurs in enterprises with higher quality managers and more abundant resources. The economic consequence analysis proves the motivation for digital transformation of enterprises under the pressure of economic downturn: as the economy enters a downturn, increasing the degree of digital transformation can improve the financial performance and operational efficiency of enterprises. At a time when downward pressure on the economy is increasing, the research conclusions of this article not only provide evidence from micro-enterprises for the resilience of my country's economy but helps to recognize and understand the motivations and prerequisites for the digital transformation of enterprises, thus having certain implications for how to better promote and assist the digital transformation of enterprises.

Keywords: Economic downward pressure; enterprise digital transformation; improving quality and efficiency; resilience

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1. Introduction

In the wave of the country's vigorous development of the digital economy, the digital transformation of enterprises, as an important micro-foundation for realizing the macro digital economy, has been vigorously promoted by the decision-making level, vigorously developed by the practical community, and widely concerned by the academic community. Existing literature focuses on the positive effects that digital transformation can play in improving the quality and efficiency of enterprises, including helping enterprises to revitalize digital assets and improve management efficiency internally, and helping enterprises to prevent and control risks, gain the favor of investors, and increase stock liquidity externally. As a result, some scholars believe that at a time when China's economic downward pressure continues to increase, digital transformation is a key factor in enhancing corporate resilience and helping enterprises to cross cyclical fluctuations (Benmelech & Frydman, 2015).

The above studies or opinions all assume or default to a theoretical premise when conducting logical deductions, namely, that enterprises have the motivation and ability to implement digital transformation. However, this theoretical premise does not always hold true. According to the "2021 China Enterprise Digital Transformation Index Research" released by Accenture, only 16 % of Chinese companies have achieved significant results in digital transformation, and the process of enterprise digital transformation has not been smooth. Faced with the bumpy road of digital transformation and the pressure of economic downturn, do companies still have the motivation and ability to transform digitally? If an enterprise lacks the motivation and ability to achieve digital transformation, the effectiveness of digital transformation will be like water without a source and a tree without roots (Liu, et al., 2023; Fang & Li, 2024). In this context, studying how downward economic pressure affects the digital transformation of enterprises will help deepen the literature's understanding of the motivations and prerequisites for the digital transformation of enterprises under the current economic situation, and thus provide theoretical guidance for accelerating the digital transformation of enterprises and ensuring their smooth digital transformation (Zhang, Wang, Sun, & Hossain, 2021; Wei & Li, 2024). From a practical perspective, based on the practical needs of enterprise digital transformation and the current reality of increasing downward pressure on China's economy, examining how economic downward pressure affects enterprise digital transformation will help the government introduce more targeted policies to promote enterprise digital transformation.

In theory, economic downturn pressure may have both positive and negative impacts on the digital transformation of enterprises. Economic downturn pressure will aggravate the business difficulties, risks and financing difficulties of enterprises (Hossain & Sultana, 2024). At this time, on the one hand, the various challenges brought about by the downward pressure of the macro-economy may force enterprises to cultivate internal strength and improve quality and efficiency. Digital transformation can help enterprises improve quality

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and efficiency internally and improve management efficiency and prevent and control risks externally and gain the favor of investors (Jardak & Ben Hamad, 2022). Therefore, enterprises have the motivation to implement digital transformation to cope with the various challenges brought about by the economic downturn. But on the other hand, economic downturn pressure may also inhibit the motivation of enterprises to transform digitally (Du & Wang, 2025). Under the pressure of economic downturn, it is more difficult for enterprises to achieve their short-term performance goals; at this time, in order to achieve short-term performance goals, the management of enterprises may cut investment projects that require long-term investment but have no effect in the short term. As a systematic project that requires long-term investment and is slow to take effect, the digital transformation of enterprises will inevitably be affected (Fang & Li, 2024). At the same time, under the pressure of economic downturn, enterprises may have to invest more resources to cope with the challenges of external market changes. In this way, economic downturn pressure may squeeze out various resources used by enterprises for digital transformation and inhibit the digital transformation of enterprises (Khatib, 2025).

The above opposing logic analysis was tested using data from my country's A-share listed companies. The results showed that as the economy entered a downward period, the degree of digital transformation of enterprises increased accordingly. The above results support the theoretical logic that in order to cope with the various challenges brought about by the economic downturn, enterprises are motivated to implement digital transformation to improve internal strength, improve quality and increase efficiency (Liu, Zhu, & Cheng, 2024). Secondly, the cross-sectional analysis provides further evidence for the theoretical logic of this paper, and the test finds that the effect of economic downturn on increasing corporate digital transformation is more significant in companies with higher-quality managers and more abundant resources (Ho & Mallick, 2010). Next, the economic consequence analysis proves the motivation for enterprises to transform digitally under the pressure of economic downturn: as the economy enters a downward period, the financial performance and operational efficiency of digitally transformed enterprises will improve. This shows that the digital transformation of enterprises in the context of economic downturn does help enterprises improve quality and efficiency. At the same time, this paper also conducted a series of stability tests and endogeneity tests and eliminated the interference of potential alternative explanations (Arellano & Bond, 1991).

2. Literature Review

The possible contributions of this paper are as follows. First, it supplements the literature on micro-enterprise resilience. In recent years, China has been hit by the Sino-US trade war and the COVID-19 pandemic, and the frequent occurrence of major events has exacerbated the downward pressure on the overall economy. Despite this, the decision-makers pointed out that China's economy still has great development resilience. Graham et al. provided a macro explanation for the source of China's economic resilience: when the economy encounters an adverse shock, the government quickly implements target-oriented policies to offset the negative impact of the adverse shock. Enterprises, as the most basic and important market entities, are the micro-foundation of macroeconomic resilience (Fang & Yuan, 2024). However, there are currently few literatures that reveal the micro-

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foundation of China's current economic resilience from the enterprise level. The only literature is mainly based on survey data, lacks large-sample empirical research, and the research perspective is mostly focused on the impact of the COVID-19 pandemic, and the conclusions obtained may not be universal (Wang, et al., 2020). Based on the data of listed companies in my country, this article finds that in order to cope with the various challenges brought about by the economic downturn, companies will implement digital transformation to improve their internal strength, improve quality and increase efficiency. The relevant results supplement the micro-enterprise evidence for the source of my country's economic resilience (Henderson & Venkatraman, 1999).

Second, it expands the research on the determinants of enterprise digital transformation. Existing literature focuses on how digital transformation can play a positive role in improving the quality and efficiency of enterprises. Only a small number of literatures focus on the determinants of enterprise digital transformation; and related research is limited to the impact of single external environmental factors such as the economic growth targets of regional governments and fiscal science and technology expenditures, as well as the market-oriented reform of financial interest rates on the digital transformation of enterprises. Based on the current reality of China's increasing downward pressure on the economy, this paper examines how this more lasting and realistically challenging macroeconomic factor affects the digital transformation of enterprises, thereby expanding the research on the determinants of enterprise digital transformation (Li & Wang, 2024).

Third, at a time when economic downward pressure is increasing, the practical contribution of this article is that it cannot only provide ideas for enterprises to smoothly transform into digital ones but also provides a useful reference for the country to introduce targeted policies to promote digital transformation of enterprises. This article identifies the prerequisites for digital transformation of enterprises under the background of economic downturn: only enterprises with higher-quality managers and more abundant resources can digitally transform under the background of economic downturntransformation (Larios-Hernandez, 2021). Therefore, in order to promote the smooth digital transformation of enterprises under the pressure of economic downturn, enterprises should improve the quality of managers and the preparation of relevant resources; as for policies, they should create a good environment and provide favorable conditions for the digital transformation of enterprises from multiple aspects such as funds, personnel, and technology supply, thereby providing important assistance for enterprises to achieve digital transformation with high quality and efficiency (Nienhaus, 2022; Chen, et al., 2023).

3. Research Hypothesis

In the context of economic downturn, enterprises are facing more severe external challenges and more stringent living conditions. On the one hand, economic downturn will suppress market demand and intensify market competition, which will cause sales difficulties, continuous increase in factor costs, narrowing profit margins, rising inventories, and difficulties in capital turnover, which will increase corporate risks and even cause a concentrated outbreak of debt default risks in some enterprises. On the other hand, economic downturn will increase the prudence of financial institutions in foreign investment and lending, thereby increasing the difficulty of financing for enterprises. More seriously, the problem of financing constraints will increase the financing costs of

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enterprises, aggravate the capital gap of enterprises, and in turn worsen the risks of enterprises (Rupeika-Apoga & Petrovska, 2022).

In order to cope with the various challenges brought about by the economic downturn, enterprises may take various measures to achieve the purpose of cultivating internal strength and improving quality and efficiency. One of the feasible measures is to implement digital transformation. The reason is that digital transformation can help enterprises to activate digital assets, improve management efficiency, achieve quality and efficiency improvement internally, and help enterprises to prevent and control risks and gain the favor of investors externally (Brynjolfsson & Hitt, 2003). First of all, digital transformation can activate the digital assets of enterprises and stimulate digital dividends. A large amount of data information is accumulated in the entire process of enterprise operation, but this data information can only produce positive effects when it is converted into effective information output and used for enterprise production decision-making. Before the enterprise carries out digital transformation, the processing of information data can only remain in the original inefficient mode, and the laws implied in the information cannot be effectively mined by the enterprise and can only be deposited inside the enterprise system. With the help of digital technology, enterprises are able to process massive, non-standardized, and unstructured internal data, and encode and output it into structured and standardized information, thereby improving the availability of information (Zaki, 2019). For example, digital technology can be used to analyze customer preferences to make targeted product introductions and services; and then more refined and flexible production can be achieved through data calculation and information processing. Intelligent transformation of production lines or service processes can improve the quality reliability and stability of products or services (West, 2015). By building a digital business analysis center, in-depth analysis and closed-loop management of indicators in various fields such as R&D, procurement, design, manufacturing, and inventory are carried out, and data channels in the upstream and downstream of the supply chain are opened up to achieve cross-departmental, cross-enterprise, and cross-industry resource optimization and allocation, and reshape the sales service industry structure and ecosystem (Bellantuono, et al., 2021).

Secondly, digital technology can reshape the internal management process of an enterprise and improve management efficiency. With the help of digital technology, enterprises can break the "data islands" between different links, modules, and departments within the enterprise, which is conducive to the timely communication and analysis of information between departments within the enterprise, reducing the coordination costs between departments, and thus improving the efficiency of integrated enterprise management decision-making. From the perspective of corporate governance, the implementation of digital technology is also conducive to the real-time and transparent implementation of important activities such as internal management processes, R&D processes, production processes, and financial control , which helps to compress the space for opportunistic behavior within the enterprise , thereby reducing the supervision costs of vertically integrated enterprises and the efficiency losses caused by branch agency problems (Müller, Kiel, & Voigt, 2018). In short, the release of digital asset dividends and

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the improvement of management efficiency brought about by digital transformation will help enterprises improve their competitiveness and achieve the goal of reducing costs and increasing efficiency during economic downturns.

Thirdly, the economic downturn will increase the risk of the business environment in which enterprises are located, and digital transformation can promote the automation and intelligence of internal control systems by providing complete and convenient software and hardware tools, thereby reducing corporate risks (Straková, Talíř, & Váchal, 2022; Teece, 2010). For example, before external transactions, the use of big data technology can effectively screen potential counterparties, increase the probability of matching with high-quality counterparties (customers and suppliers) based on information such as credit level, performance record, and market evaluation, and reduce the risk of counterparty default from the source. In transactions, using the Internet of Things and big data technology, enterprises can establish timely contact and real-time tracking with counterparties and target products or services (Chen, Zhang, & Wang, 2023). Once the counterparty's behavior deviates from the direction of cooperation, or other unexpected situations occur when the contract is signed, the enterprise can intervene in time to ensure the normal progress of the transaction or flexibly adjust the transaction details according to immediate needs. At the same time, monitor abnormal data and transactions, and take timely measures to prevent and control compliance risks and operational risks. In addition, the smooth and transparent flow of information under digital technology means that once a counterparty defaults, it will suffer significant reputational losses (Liu, et al., 2023). In this way, digital technology will effectively reduce the risk of counterparty default during an economic downturn.

Finally, digital transformation can also help companies gain the favor of external investors and gain valuable financial advantages for companies during economic downturns (Zhai, Yang, & Chan, 2022). First, the digital transformation of enterprises sends positive signals to the outside world, conforms to the development trend of the digital economy era, and can boost investor confidence (Hauser, 2003). Second, the improvement of the quality and efficiency of the actual operation of enterprises by digital transformation can strengthen the fundamentals of enterprises and thus improve the financial status of enterprises (Jean, Sinkovics, & Kim, 2008; Wu & Lu, 2023). Finally, digital transformation also provides a solid software and hardware foundation for enterprises to build a flat organization (Wang, et al., 2020). The flat management system can provide systematic support for organizations to quickly adjust their business, enhance flexible and immediate response to the market, and innovate and try and fail, so as to win competitive opportunities for enterprises in economic downturns (Lubnina, et al., 2017).

In summary, as the economy goes into a downturn, companies are facing more severe external challenges and more stringent living conditions. Considering that digital transformation can help companies internally mobilize digital assets, improve management efficiency, and achieve cost reduction and efficiency improvement, and externally help companies prevent and control risks and gain investor favor, companies may be motivated to accelerate digital transformation (Nadkarni & Prügl, 2021; Teece, 2010). Therefore, the following research hypothesis is proposed.

H1a: Economic downturn will significantly drive corporate digital transformation.

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But at the same time, economic downward pressure may also inhibit the motivation and ability of enterprises to transform digitally. From the perspective of motivation, under the pressure of economic downward pressure, it is more difficult for enterprises to achieve their short-term performance goals; at this time, enterprise management may tend to short-sighted behavior in order to achieve short-term performance goals (Soluk, 2022). This includes investing in financial assets to make up for losses and improve financial conditions; in order to maximize liquidity, defaulting on accounts payable to upstream and downstream enterprises, reducing investment scale; cutting investment projects that require long-term investment but cannot see results in the short term (Graham et al., 2005). In this process, the process of enterprise digital transformation is inevitably affected: enterprise digital transformation is a systematic project with long-term investment and slow results (Navarro, 2018; Teece, Pisano, & Shuen, 1997; Joel, et al., 2024). From software development, hardware configuration to business operations, from organizational structure adjustment to employee digital transformation training, long-term and continuous investment of funds and personnel is required. However, in the short term, the digital transformation of enterprises may not see positive effects. Enterprise digital transformation is not simply driven by digital technology, nor does increasing capital investment necessarily lead to output growth. The digital transformation of enterprise management, from the initial investment stage (mainly including software and hardware investment and training services) to the mid-term internalization stage (including enterprises learning and adapting to the invested software and hardware and services and integrating them with the original enterprise management system), to the later output value, often requires a complex and tortuous process to achieve the expected goals (Hess, et al., 2020; Yucel, 2018; Schallmo, et al., 2019; Aldoseri, et al., 2024; Schneider & Imai, 2019). In the face of new changes in the wave of digitalization, if traditional enterprises find it difficult to improve their knowledge and capabilities based on the traditional industrialization system, it will lead to difficult, slow and long transformation (Henderson & Venkatraman, 1999). Worse, the downward pressure on the economy may further hinder the positive effects of digital transformation, resulting in the possibility that the benefits of digital transformation of enterprises in the short term may be far less than the investment costs (Siachou, Vrontis, & Trichina, 2021; Mu, Chen, & Zhang, 2025; Zeng, Xie, & Tam, 2010).

In addition, the digital transformation of business teams is the key to the digital transformation of enterprises, but the downward pressure of the external economy may increase the difficulty of transformation of business teams (Liu, et al., 2023; Fang & Li, 2024). Generally speaking, since business teams lack digital genes, in order to ensure the smooth digital transformation of enterprises, the middle and senior management of business teams need to cultivate digital thinking awareness, and the grassroots business need to learn digital knowledge and skills (Moschko, Blazevic, & Piller, 2023; Suvalova, Ashurbekov, & Suvalov, 2021). However, under the pressure of economic downturn, business teams need to devote most of their time and energy to cope with market challenges, and cultivating digital transformation-related thinking and skills will distract time and energy, which will affect the motivation of business teams to participate in the digital transformation of enterprises. From the perspective of capabilities, economic downward

pressure may also inhibit the digital transformation of enterprises. Enterprise digital transformation is a systematic project with a long cycle, large investment, and multiple stages. The long-term investment of a large amount of resources is a necessary condition for the success of digital transformation (Rueckel, Muehlburger, & Koch, 2020). However, under the pressure of economic downturn, enterprises may have to invest more resources to cope with the challenges of external market changes. In this way, economic downward pressure may squeeze out the various resources used by enterprises for digital transformation, causing enterprises to be forced to slow down or even suspend digital transformation (Zhai, et al., 2024).

In addition, digital transformation requires enterprises to form digital teams and change and cooperate with business teams. However, under the pressure of economic downturn, enterprises may face the problem of difficulty in recruiting digital talents when forming digital teams. Compared with high-paying industries such as the Internet, traditional industry enterprises have a salary disadvantage in attracting and retaining digital talents. This easily leads to a dilemma: if traditional enterprises provide competitive salaries for digital talents, the salary may be higher than the average salary of the business team, which will hit the morale of the business team (Mendes, et al., 2023; Koivunen, et al., 2019). If enterprises provide digital talents with similar salaries to business teams, the salary may not be competitive, which will hinder enterprises from recruiting high-quality digital talents and thus affect the quality of digital transformation. Under the pressure of economic downturn, in order to cope with external market challenges, enterprises need to boost the morale of business teams, including investing more resources in business teams, which will weaken the motivation and ability of enterprises to provide competitive salaries for digital talents (Benmelech & Frydman, 2015). The above difficulties caused by the economic downturn will inevitably affect the cooperation between business teams and digital teams, thereby inhibiting the digital transformation of enterprises (Brunetti, et al., 2020). In summary, the pressure of economic downturn may also inhibit the motivation and ability of enterprises to transform digitally. Therefore, the following opposing research hypothesis H1a is proposed (Cascio & Montealegre, 2016).

H1b: During economic downturns, companies will delay digital transformation.

4. Sample selection and research design

4.1 Sample selection and data sources

Considering that the trend of rapid development and gradual application of digital technology in China is mainly reflected after 2010, this paper uses all A-share listed companies between 2010 and 2020 as the initial sample, following the reference method. The data of listed companies involved in the study come from the CSMAR database. On this basis, the annual observations of each company are screened according to the following standards: (1) Considering the particularity of financial listed companies, the sample observations of financial companies are eliminated; (2) Considering the abnormality of the financial data of ST companies and insolvent companies, the sample observations of related companies are eliminated; (3) The annual observations with incomplete relevant financial data are eliminated. Finally, 20,562 company annual observations are obtained. In order to

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eliminate the influence of extreme values, the continuous variables are winsorized at both ends by 1%.

4.2 Study design and variable definition

In order to study the impact of economic downward pressure on enterprise digital transformation, this paper estimates the following regression model:

$$DCG_{i,t} = \beta_0 + \beta_1 Downturn_{i,t-1} + \sum Controls_{i,t-1} + Year + Firm + \varepsilon \quad (1)$$

Among them, the independent variable *Downturn* is a dummy variable for economic downturn. References, first, the industry-weighted total asset return rate of each industry in the sample period is calculated with the total assets of the enterprise as the weight. Secondly, the industry-weighted total asset return rate of each year is ranked within each industry. The years in the lower quartile (25%) of the industry are defined as being in an economic downturn, and the value is 1. Otherwise, it is defined as a normal economic period, and the value is 0.

The dependent variable *DCG* is the digital transformation of enterprises. References measure the degree of digitalization of micro-enterprises (*DCG*) by dividing the sum of the frequency of digital keywords in the "Management Discussion and Analysis" (MD&A) of the annual reports of listed companies by the total number of MD&A words. For the convenience of expression, this article multiplies this indicator by 100. The larger the value of the DCG indicator, the higher the degree of digitalization of the enterprise. See Figure 1 for specific digital transformation-related words.

Referring to relevant literature, this paper also controls variables such as stock return rate (RET), profitability (ROE), institutional investors (In_Share), enterprise size (Firm_Size), enterprise age (Firm_Age), financing constraints (WW), and market position (Mkt_Position). Please see Table 1 for the explained variables, explanatory variables, control variables and corresponding detailed explanations. In addition, enterprise fixed effects and year fixed effects are added to the model to control the influence of enterprise and year factors. In order to alleviate the interference of endogeneity problems that may be caused by reverse causality, the independent variables and control variables are lagged for one period relative to the dependent variable. In order to avoid the influence of heteroskedasticity and company-level clustering effects on standard errors, the model standard errors are adjusted for heteroskedasticity and company-level clustering.

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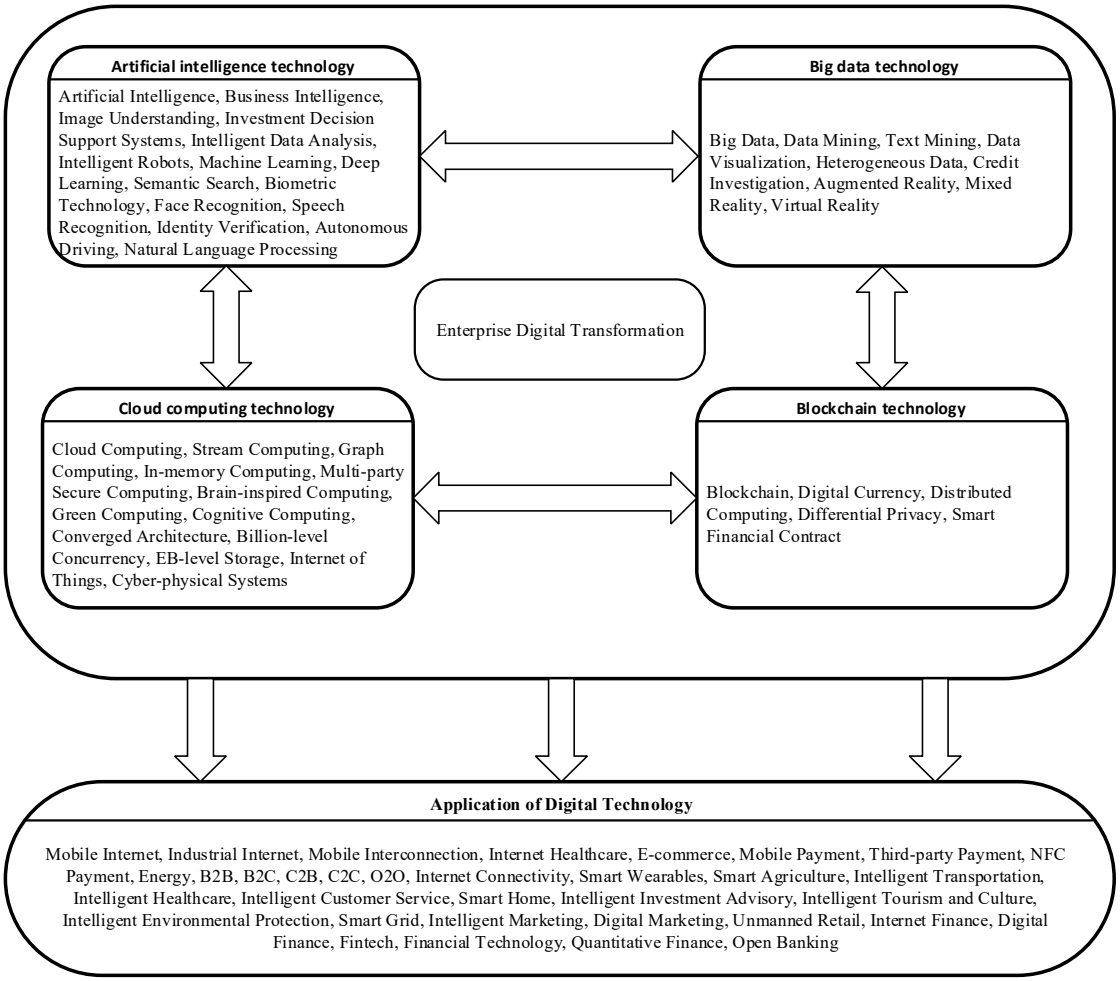

Table 1 Variable Description Table

Variable Name	Variable Symbols	Metrics
Degree of digital transformation	*DCG*	Frequency of digitalization-related words / total number of words in annual report
Downward economic pressure	*Downturn*	The weighted return on total assets of all industries during the sample period are ranked, and the lower quartile (25%) of the industry-year weighted return on total assets is defined as a period of economic downturn, with a value of 1; otherwise, it is defined as a normal economic period, with a value of 0.
Stock Return	*RET*	Annual excess stock returns of enterprises, calculated using the Buy-and-Hold Return method
Institutional Investors	*In_Share*	Shareholding ratio of institutional investors
Financing	*WW*	WW = -0.091×cash flow/total assets-

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constraints		0.062×whether dividends are paid+0.021×total long-term liabilities/total assets-0.044×natural logarithm of total assets+0.102×sales growth rate of the industry-0.035×sales growth rate of the company
Market Position	*Mkt_Position*	Net cash flow from operating activities / total assets
The largest shareholder's shareholding	*Top1*	Shareholding ratio of the largest shareholder
Company age	*Firm_Age*	ln (age of enterprise)
Corporate income	*Lnrev*	ln (income)
Two jobs in one	*DUAL*	If the chairman and general manager are both held by the same person, the value is 1; otherwise, the value is 0
Audit opinion	*AO*	The standard unqualified audit opinion is 1, and the others are 0
Tobin Q	*Q*	Tobin Q
Profitability	*ROE*	Net Profit / Net Assets
Enterprise scale	*Firm_Size*	ln (total assets)

5. Empirical results

5.1 Descriptive Statistics

Table 2 reports the descriptive statistics of the relevant variables of the entire sample. It can be seen that the meaning of the dependent variable enterprise digital transformation (*DCG*) is 2.523 and the standard deviation is similar to the existing literature. The distribution of other variables is basically consistent with the existing literature **(Jardak & Ben Hamad, 2022)**.

Table 2 Descriptive statistics

variable	Obs	Mean	SD	P5	Median	P95
DCG	20562	2.523	5.272	0.000	0.465	13.566
Downturn	20562	0.280	0.449	0.000	0.000	1.000
RET	20562	0.026	0.717	-1.486	-0.010	1.294
In_Share	20562	6.142	6.721	0.011	3.840	20.180
WW	20562	-1.028	0.065	-1.148	-1.021	-0.939
Mkt_Position	20562	0.005	0.014	0.000	0.001	0.022
Top1	20562	0.343	0.147	0.134	0.323	0.616
Firm_Age	20562	2.809	0.354	2.197	2.833	3.296
Lnrev	20562	21.461	1.430	19.381	21.298	24.176
DUAL	20562	1.721	0.449	1.000	2.000	2.000
AO	20562	0.969	0.173	1.000	1.000	1.000
Q	20562	2.562	1.766	0.985	1.998	6.139
ROE	20562	0.066	0.121	-0.114	0.070	0.226

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Firm_Size	20562	22.108	1.266	20.372	21.921	24.536

5.2 Basic Empirical Results and Analysis

Table 3 presents the basic regression estimation results. The results show that the regression coefficient of economic downturn (*Downturn*) is 0.255 and is still significant at the 1% level. This shows that after considering control variables such as stock returns, profitability, market position, financing constraints, and the impact of annual and enterprise-level fixed effects, the positive correlation between economic downturn and enterprise digital transformation still exists, which supports the research hypothesis H1a that enterprises will accelerate digital transformation during economic downturns. The main control variables are consistent with existing literature or common sense.

Table 3 Basic regression and Robustness Test

	(1)	(2)	(3)	(4)
Model	**Basic regression**	**Changing the dependent variable**	**Changing the dependent variable**	**Sample replacement period**
Dependent Variable	***DCG***	***LnDG***	***DCG2***	***DCG***
Downturn	0.255***	0.039**	0.010***	0.237***
	(3.457)	(2.482)	(3.723)	(3.763)
RET	-0.005	-0.045***	-0.003*	0.022
	(-0.109)	(-3.651)	(-1.733)	(0.462)
In_Share	-0.008	-0.001	0.000	-0.008
	(-1.114)	(-0.961)	(0.818)	(-1.321)
WW	0.363	0.092	0.046	0.187
	(0.460)	(0.456)	(1.509)	(0.269)
Mkt_Position	-3.424	-1.222	0.377*	-5.975
	(-0.794)	(-0.774)	(1.791)	(-1.551)
Top1	-1.554**	-0.711***	-0.045*	-1.643***
	(-2.251)	(-3.854)	(-1.905)	(-2.589)
Firm_Age	1.353*	0.001	-0.038*	1.199
	(1.653)	(0.007)	(-1.902)	(1.623)
Lnrev	0.157	0.070**	-0.005	0.145
	(1.147)	(2.120)	(-1.266)	(1,112)
DUAL	-0.056	0.001	0.004	-0.031
	(-0.464)	(0.050)	(0.999)	(-0.278)
TO THE	-0.011	-0.055	-0.006	0.074
	(-0.068)	(-1.166)	(-1.102)	(0.490)
Q	0.182***	0.037***	-0.002*	0.182***
	(4,938)	(4,314)	(-1.662)	(5,180)
ROE	0.181	0.004	0.005	0.104
	(0.871)	(0.056)	(0.702)	(0.551)
Firm_Size	0.900***	0.272***	0.012**	0.823***
	(5.787)	(7.153)	(2.263)	(5.630)
Strategy	0.012	0.006	0.000	0.018

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	(1)	(2)	(3)	(4)
Model	**Basic regression**	**Changing the dependent variable**	**Changing the dependent variable**	**Sample replacement period**
Dependent Variable	***DCG***	***LnDG***	***DCG2***	***DCG***
	(0.718)	(1.428)	(0.007)	(1.129)
Constant	-24.729***	-6.644***	0.071	-22.493***
	(-7.011)	(-9.089)	(0.767)	(-7.288)
Firm_Effect	Yes	Yes	Yes	Yes
Year_Effect	Yes	Yes	Yes	Yes
N	20562	20562	20562	22296
R-squared	0.113	0.343	0.051	0.122

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. The values in brackets are t values. Same as below

6. Robustness test and endogeneity test

6.1 Robustness test

In order to ensure that the conclusions of this article are not affected by the selection of indicators, we change the measurement method of enterprise digital transformation. First, we use the logarithm of the number of digital transformation vocabulary in annual reports (*LnDCG*) to measure the degree of digital transformation of enterprises. The regression results are shown in column (2) of Table 3, and the results are still significantly positive. Secondly, according to the reference, the proportion of digital technology intangible assets to total intangible assets (DCG2) is used to measure the degree of digital transformation of enterprises. The regression results are shown in column (3) of Table 3, and the results are still significantly positive. Finally, using the sample test from 2007 to 2020, the regression results are shown in column (4) of Table 3, and the regression results are still held.

6.2 Endogeneity test

Endogeneity problems are mainly caused by reverse causality and omitted variables. For this article, since it is difficult for individual enterprises' digital transformation to affect the economic downturn, it is unlikely that there will be endogenous problems caused by reverse causality. In addition, in order to alleviate the interference of endogenous problems that may be caused by reverse causality, the empirical test adopts the method of lagging the independent variables and control variables by one period relative to the dependent variable.

In terms of omitted variables, although this paper has controlled the impact of omitted variables at the enterprise level that do not change over time by adding enterprise-level fixed effects in the main regression, there may still be omitted variables at the industry or regional level that affect the digital transformation of enterprises. For example, if an economic downturn causes other companies in the same industry to implement digital transformation, our company may follow suit and transform digitally. For another example, in the context of an economic downturn, local governments may introduce corresponding support subsidy plans for the digital transformation of local companies. In order to eliminate the impact of the omitted variables at the industry or region level mentioned

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above, we further control industry fixed effects and province fixed effects. The results are shown in columns (1) to (3) of Table 4. Regardless of whether the industry fixed effect (*Ind_Effect*) and province fixed effect (*Pro_Effect*) are added separately or simultaneously, the regression coefficient between economic downturn and enterprise digital transformation is still significantly positive, and the conclusion of this article still holds.

Table 4 Endogeneity test

	(1)	(2)	(3)
Model	**Controlling for industry fixed effects**	**Controlling for province fixed effects**	**Controlling for industry and province fixed effects**
Dependent Variable	***DCG***	***DCG***	***DCG***
Downturn	0.208***	0.251***	0.206***
	(2.920)	(3.405)	(2.885)
RET	0.009	-0.006	0.009
	(0.180)	(-0.114)	(0.186)
In_Share	-0.008	-0.008	-0.008
	(-1.107)	(-1.113)	(-1.097)
WW	0.815	0.388	0.850
	(1.014)	(0.491)	(1.054)
Mkt_Position	-6.948	-4.208	-7.087
	(-1.234)	(-0.978)	(-1.237)
Top1	-1.511**	-1.633**	-1.552**
	(-2.245)	(-2.375)	(-2.313)
Firm_Age	1.502*	1.308	1.482*
	(1.860)	(1.597)	(1.833)
Lnrev	0.130	0.162	0.135
	(0.972)	(1.179)	(1.007)
DUAL	-0.040	-0.056	-0.044
	(-0.337)	(-0.464)	(-0.371)
AO	0.075	-0.035	0.050
	(0.482)	(-0.220)	(0.319)
Q	0.174***	0.180***	0.174***
	(4.808)	(4.877)	(4.781)
ROE	0.257	0.161	0.232
	(1.225)	(0.779)	(1.113)
Firm_Size	0.887***	0.902***	0.894***
	(5.830)	(5.763)	(5.837)
Strategy	0.025	0.012	0.026
	(1.602)	(0.706)	(1.616)
Constant	-23.532***	-25.546***	-24.888***
	(-6.805)	(-6.794)	(-6.670)
Firm_Effect	Yes	Yes	Yes
Ind_Effect	Yes	No	Yes
Pro_Effect	No	Yes	Yes

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	(1)	(2)	(3)
Model	**Controlling for industry fixed effects**	**Controlling for province fixed effects**	**Controlling for industry and province fixed effects**
Dependent Variable	***DCG***	***DCG***	***DCG***
Year_Effect	Yes	Yes	Yes
N	20562	20562	20562
R-squared	0.121	0.114	0.122

7. Excluding alternative explanations

7.1 Is enterprise digital transformation just empty talk?

The positive correlation between economic downturn and corporate digital transformation demonstrated above has the following alternative explanation in theory: under the pressure of economic downturn, companies will disclose information about their digital transformation in their annual reports in order to boost investor sentiment, but the relevant information is essentially just empty words (cheap words) talk), companies have not put digital transformation into action. If the above explanation is true, then we can expect that (1) economic downturn pressure will not affect corporate digital assets. (2) Under economic downturn pressure, companies may also boost investor sentiment by manipulating positive tones. (3) When the economy is down, companies accelerating digital transformation will not affect their actual operations.

(3) of Table 3 in the robustness test section show that economic downward pressure will increase the digital assets in the company's intangible assets, which is inconsistent with expectation (1) under the alternative explanation. Secondly, to test expectation 2), we replace the dependent variable in model (1) with the tone of the company's annual report to examine how the economic downturn will affect the tone of the company's annual report. The results are shown in column (1) of Table 5 below. The economic downturn will reduce the positive tone of the company's annual report, which is the opposite of the result of expectation (2).

Finally, in Table 8 of the economic consequence analysis section, we found that when the economy is in a downturn, companies that accelerate digital transformation can increase their total asset turnover and performance, which is contrary to the expected result (3). In summary, the above results prove to a certain extent that the digital transformation information disclosed in the annual reports of companies reflects the actual digital actions of the companies rather than empty words (cheap words). talk).

Table 5 Alternative explanations

	(1)	(2)	(3)
Dependent Variable	***Tone***	***DCG***	***DCG***
Grouping variables		**State-owned enterprises**	**Private Enterprises**
Downturn	-0.045***	0.125**	0.306***
	(-3.603)	(2.234)	(4.316)
RET	0.007	0.008	0.038

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	(1)	(2)	(3)
Dependent Variable	***Tone***	***DCG***	***DCG***
Grouping variables		**State-owned enterprises**	**Private Enterprises**
	(0.717)	(0.134)	(0.623)
In_Share	0.004***	-0.006	-0.011**
	(3.490)	(-1.155)	(-2.057)
WW	-0.014	0.595	-0.192
	(-0.096)	(0.796)	(-0.211)
Mkt_Position	-0.644	-1.294	-2.377
	(-0.516)	(-0.375)	(-0.381)
Top1	0.029	-0.919**	-1.422***
	(0.210)	(-2.296)	(-2.733)
Firm_Age	-0.358***	-0.776*	0.490
	(-2.841)	(-1.696)	(1.094)
Lnrev	0.027	0.102	0.073
	(1.108)	(1.209)	(0.749)
DUAL	-0.022	-0.079	-0.059
	(-1.094)	(-0.856)	(-0.663)
AO	0.242***	0.251	0.132
	(6.016)	(1.471)	(0.756)
Q	-0.012**	0.111***	0.184***
	(-2.165)	(3.580)	(6.870)
ROE	0.602***	0.226	0.219
	(11.477)	(1.002)	(0.772)
Firm_Size	0.045	0.340***	1.076***
	(1.499)	(3.351)	(9.123)
Strategy	0.003	-0.007	0.025*
	(0.979)	(-0.683)	(1.932)
Constant	-0.199	-6.244***	-25.434***
	(-0.353)	(-3.204)	(-12.687)
Firm_Effect	Yes	Yes	Yes
Year_Effect	Yes	Yes	Yes
N	20237	7015	13547
R-squared	0.277	-0.090	-0.050
Test of difference between groups (P value)		0.203	

7.2 Is enterprise digital transformation affected by policies?

The positive correlation between economic downturn and enterprise digital transformation demonstrated above has the following alternative explanation in theory: in recent years, the state has vigorously promoted the development of the digital economy and enterprise digital transformation, and has given certain policy preferences; thus, enterprise digital transformation under the background of economic downturn may be affected by national policies. Considering that state-owned enterprises are more susceptible

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to policy influences, if the above explanation is valid, we can expect that the positive correlation between economic downturn and enterprise digital transformation in state-owned enterprises should be greater than that in private enterprises.

To this end, we divided the samples into two groups according to the nature of property rights and then conducted group regression. The results are shown in columns (2) and (3) of Table 5. Contrary to expectations, the positive correlation between economic downturn and enterprise digital transformation is even greater in private enterprises (*SOE = 0*); however, according to the inter-group difference test, there is no significant difference between private and state-owned enterprises. The above results do not support the alternative explanation that enterprise digital transformation is influenced by policies.

8. Further analysis

8.1 Prerequisites for digital transformation of enterprises under economic pressure

(1) Manager quality

Similarly, we examine the role of managerial quality. Managerial quality here mainly includes managerial competence and managerial agency problems. Under the pressure of the economic downturn, managers need to devote most of their time and energy to cope with market challenges. If managers are not competent enough, they will not be able to devote time and energy to developing digital transformation-related thinking and skills, which will hinder the digital transformation of enterprises. In addition, if managerial agency problems are high, managers are more likely to be short-sighted in order to achieve short-term performance goals, thereby temporarily postponing the digital transformation of enterprises that require long-term investment and have a slow effect. If this logic holds, this paper expects that in enterprises with stronger managerial quality, the possibility of implementing digital transformation is higher in the context of economic downturn. Referring to, this paper uses managerial competence and excess on-the-job consumption to measure the managerial quality of enterprises. The samples are divided into two groups according to the annual median of the above variables, and then grouped regression is performed. The results in columns (1) and (4) of Table 6 show that in the sample group with stronger managerial competence (higher managerial competence and lower excess on-the-job consumption), the positive relationship between economic downturn and enterprise digital transformation is more significant. The above results are in line with expectations, confirming that strong management capabilities are also a prerequisite for the successful digital transformation of enterprises in the context of economic downturn.

Table 6 Managerial Qualities

	(1)	(2)	(3)	(4)
Dependent Variable	***DCG***	***DCG***	***DCG***	***DCG***
Grouping variables	**Manager Capabilities**	**Manager Capabilities**	**Excess on-the-job consumption**	**Excess on-the-job consumption**
	high	**Low**	**high**	**Low**
Downturn	0.408***	0.046	0.050	0.393***
	(5.630)	(0.582)	(0.609)	(5.294)
RET	-0.006	0.022	0.018	0.083

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	(1)	(2)	(3)	(4)
Dependent Variable	***DCG***	***DCG***	***DCG***	***DCG***
Grouping variables	**Manager Capabilities**	**Manager Capabilities**	**Excess on-the-job consumption**	**Excess on-the-job consumption**
	high	**Low**	**high**	**Low**
	(-0.088)	(0.347)	(0.234)	(1.208)
In_Share	0.000	-0.007	0.002	-0.013**
	(0.035)	(-1.189)	(0.337)	(-2.180)
WW	-0.620	1.437	1.316	-1.610
	(-0.664)	(1.384)	(1.232)	(-1.460)
Mkt_Position	-10.853**	4.164	-6.479	0.294
	(-2.069)	(0.738)	(-0.909)	(0.045)
Top1	-1.456**	-0.882*	-0.970	-0.598
	(-2.573)	(-1.704)	(-1.575)	(-1.141)
Firm_Age	0.091	1.248***	0.791	0.193
	(0.165)	(2.682)	(1.176)	(0.322)
Lnrev	0.203*	0.046	0.002	0.041
	(1.790)	(0.423)	(0.015)	(0.404)
DUAL	-0.204*	-0.087	-0.100	-0.052
	(-1.867)	(-0.941)	(-0.881)	(-0.502)
TO THE	-0.161	0.170	-0.340	0.277
	(-0.785)	(0.917)	(-1,580)	(1,438)
Q	0.207***	0.140***	0.220***	0.157***
	(6,785)	(4,697)	(6,684)	(4,623)
ROE	0.164	0.228	0.528*	0.081
	(0.502)	(0.834)	(1.689)	(0.295)
Firm_Size	1.089***	0.774***	0.926***	0.851***
	(8.119)	(6.129)	(6.142)	(6.804)
Strategy	0.032**	-0.011	0.022	-0.000
	(2.201)	(-0.869)	(1.381)	(-0.018)
Constant	-27.687***	-18.131***	-19.752***	-20.586***
	(-11.862)	(-8.569)	(-7.464)	(-8.925)
Firm_Effect	Yes	Yes	Yes	Yes
Year_Effect	Yes	Yes	Yes	Yes
N	9773	9765	8807	8800
R-squared	-0.155	-0.157	-0.227	-0.199

(2) Resource Capacity

Enterprise digital transformation is a systematic project with a long cycle, large investment and multiple stages. Therefore, long-term investment of a large amount of resources is a necessary condition for the success of digital transformation. This article predicts that in enterprises with more abundant resources, the possibility of implementing digital transformation is higher in the context of economic downturn. Reference, this paper uses financing constraints and board size to measure the resource capabilities of enterprises.

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According to the annual median of the above variables, the samples are divided into two groups, and then group regression is performed. The results in columns (2) and (3) of Table 7 show that in the sample group with stronger resource capabilities (lower financing constraints and larger board size), the positive relationship between economic downturn and corporate digital transformation is more significant. The above results are in line with expectations, confirming that long-term investment of large amounts of resources is a prerequisite for the successful digital transformation of enterprises in the context of economic downturn.

Table 7 Resource Capacity

	(1)	(2)	(3)	(4)
Dependent Variable	***DCG***	***DCG***	***DCG***	***DCG***
Grouping variables	**Financing constraints**	**Financing constraints**	**Board size**	**Board size**
	high	**Low**	**big**	**Small**
Downturn	0.104	0.293***	0.333***	-0.026
	(1.529)	(4.013)	(5.201)	(-0.340)
RET	0.051	0.079	-0.012	0.066
	(0.811)	(1.174)	(-0.209)	(0.940)
In_Share	0.000	-0.017***	-0.013**	-0.005
	(0.058)	(-2.671)	(-2.486)	(-0.790)
WW	-0.482	2.952**	-0.172	0.794
	(-0.633)	(2.469)	(-0.185)	(0.860)
Mkt_Position	-2.514	-1.912	-3.998	-3.697
	(-0.605)	(-0.250)	(-0.849)	(-0.622)
Top1	-1.144**	-1.413**	-1.676***	-0.615
	(-2.427)	(-2.329)	(-3.356)	(-1.140)
Firm_Age	-0.666	1.146**	1.126**	2.514***
	(-1.315)	(2.345)	(2.350)	(4.665)
Lnrev	0.080	0.408***	0.083	0.177
	(0.898)	(3.300)	(0.854)	(1,643)
DUAL	0.022	-0.109	-0.216**	0.112
	(0.244)	(-1.048)	(-2.193)	(1,127)
TO THE	-0.121	0.030	-0.127	0.026
	(-0.851)	(0.091)	(-0.730)	(0.127)
Q	0.072***	0.273***	0.194***	0.151***
	(2,685)	(7,310)	(6,640)	(5,219)
ROE	0.310	-1.349**	0.034	0.542*
	(1.488)	(-2.346)	(0.125)	(1.843)
Firm_Size	0.494***	1.618***	0.942***	0.789***
	(4.713)	(10.366)	(7.904)	(6.270)
Strategy	-0.004	0.028*	0.018	-0.004
	(-0.323)	(1.939)	(1.498)	(-0.308)
Constant	-9.600***	-42.414***	-23.767***	-25.333***
	(-4.733)	(-16.391)	(-11.664)	(-11.279)
Firm_Effect	Yes	Yes	Yes	Yes

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	(1)	(2)	(3)	(4)
Dependent Variable	***DCG***	***DCG***	***DCG***	***DCG***
Grouping variables	**Financing constraints**	**Financing constraints**	**Board size**	**Board size**
	high	**Low**	**big**	**Small**
Year_Effect	Yes	Yes	Yes	Yes
N	10284	10278	10284	10278
R-squared	-0.207	-0.122	-0.121	-0.150

8.2 Economic consequences analysis

The logic of this article believes that the reason why economic downturn accelerates the digital transformation of enterprises is that when the economy is down, enterprises can improve quality and efficiency by accelerating digital transformation. This section constructs the following multivariate regression model to directly test this logic.

$$\text{Outcome}_{i,t} = \beta_0 + \beta_1 \text{Downturn}_{i,t-1} + \beta_2 \text{DCG}_{i,t-1} + \beta_3 \text{Downturn}_{i,t-1} \times \text{DCG}_{i,t-1} + \sum \text{Controls}_{i,t-1} + \textit{Year Dummies} + \textit{F irm Dummies} + \varepsilon \quad (2)$$

Outcome represents corporate performance. We use the average return on equity for the next one period and the next three periods (*ROE_1, ROE_3*) to measure corporate performance, and use total asset turnover (*TA turnover*) to measure corporate operating efficiency. Column (1) of Table 8 shows that when the dependent variable is the total asset turnover rate (TA turnover) in the future period, the coefficient of the intersection term *Downturn* × *DCG*, which is the intersection of economic downturn (*Downturn*) and enterprise digital transformation (*DCG*), is significantly positive, which means that when the economy is in a downturn, enterprises can increase their efficiency by accelerating their digital transformation. Columns (2) to (3) of Table 8 show that when the dependent variable is the average return on equity for the next one period or the next three periods (*ROE_1, ROE_3*), the coefficient of the cross-product of economic downturn (*Downturn*) and enterprise digital transformation (*DCG*), *Downturn* × *DCG*, is positive. It is also noted that due to the long-term nature of digital transformation, the degree to which it increases performance in the next three periods is more significant. The above results indicate that when the economy is in a downturn, enterprises can increase their performance by accelerating digital transformation. This result verifies the theoretical logic that when the economy is in a downturn, the digital transformation of enterprises is to improve quality and efficiency. At the same time, the above results also show to a certain extent that the digital transformation information disclosed in the annual reports of enterprises reflects the actual actions of enterprises rather than empty words. talk).

Table 8 Economic consequences

	(1)	(2)	(3)
Dependent Variable	***TAturnover***	***ROE_1***	***ROE_3***
Downturn	-0.003	-0.008***	-0.004*
	(-0.690)	(-2.917)	(-1.807)
Downturn ×*DCG*	0.001*	0.000	0.001*

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	(1)	(2)	(3)
Dependent Variable	***TAturnover***	***ROE_1***	***ROE_3***
	(1.728)	(0.771)	(1.803)
DCG	0.001*	0.001**	0.002***
	(1.676)	(1.981)	(3.397)
RET	0.019***	0.046***	0.038***
	(5.045)	(18.252)	(19.195)
In_Share	0.001***	0.002***	0.001***
	(3.155)	(8.523)	(4.502)
WW	-0.219***	-0.249***	-0.130***
	(-3.281)	(-5.335)	(-3.716)
Mkt_Position	0.740*	0.167	0.282
	(1.855)	(0.804)	(1.241)
Top1	0.005	0.092***	0.096***
	(0.125)	(4.025)	(3.327)
Firm_Age	0.111***	-0.024	-0.023
	(3.296)	(-1.316)	(-1.012)
Lnrev	0.311***	0.027***	0.015***
	(26.942)	(5.090)	(2.746)
DUAL	0.003	0.002	0.001
	(0.505)	(0.510)	(0.182)
AO	0.028*	0.068***	0.033***
	(1.831)	(4.896)	(3.014)
Q	0.004**	0.014***	0.008***
	(2.308)	(11.880)	(6.256)
ROE	0.008	0.038*	-0.002
	(0.379)	(1.820)	(-0.182)
Firm_Size	-0.361***	-0.065***	-0.072***
	(-27.942)	(-10.956)	(-10.712)
Strategy	0.004***	0.002***	0.002***
	(4.339)	(3.794)	(2.881)
Constant	1.397***	0.557***	1.095***
	(6.835)	(5.776)	(9.128)
Firm_Effect	Yes	Yes	Yes
Year_Effect	Yes	Yes	Yes
N	20541	20541	20541
R-squared	0.290	0.105	0.123

9. Research conclusions and policy recommendations

The above opposing logic analysis was tested using data from my country's A-share listed companies. The results showed that as the economy entered a downward period, the degree of digital transformation of enterprises increased accordingly. The above results support the theoretical logic that in order to cope with the various challenges brought about by the economic downturn, enterprises are motivated to implement digital transformation to improve internal strength, improve quality and increase efficiency. Secondly, the cross-

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sectional analysis provides further evidence for the theoretical logic of this paper, and the test finds that the effect of economic downturn on increasing corporate digital transformation is more significant in companies with higher-quality managers and more abundant resources. Next, the economic consequence analysis proves the motivation for enterprises to transform digitally under the pressure of economic downturn: as the economy enters a downward period, the financial performance and operational efficiency of digitally transformed enterprises will improve. This shows that the digital transformation of enterprises in the context of economic downturn does help enterprises improve quality and efficiency. At the same time, this paper also conducted a series of stability tests and endogeneity tests to eliminate the interference of potential alternative explanations.

Based on the above findings, the policy implications of this paper are as follows: For policymakers, at a time when economic downward pressure is increasing, they should create a good environment and provide favorable conditions for the digital transformation of enterprises. The digital transformation of enterprises has become a new engine for economic development and an important force to hedge against economic downward pressure and promote industrial transformation and upgrading. However, the digital transformation of enterprises is a systematic project with a long cycle, large investment, and multiple stages. The long-term investment of a large amount of resources is a necessary condition for the success of digital transformation. However, under the pressure of economic downturn, enterprises may have to invest more resources to cope with the challenges of external market changes. In this way, even if enterprises are motivated to transform digitally, they may be forced to slow down or even suspend digital transformation due to the lack or inability to afford the corresponding human, financial and material resources under the pressure of economic downturn. Therefore, policies can be used from multiple angles to help enterprises achieve high-quality and efficient digital transformation. First, it can increase financial support for the digital transformation of enterprises. Second, it can promote the cultivation of digital talents, alleviate the bottleneck of digital talents in enterprises, and reduce the human cost of digital transformation of enterprises. Third, it can promote the establishment of a public service platform for the digital transformation industry, develop key common technologies, and lower technical barriers; it can promote centralized procurement of enterprise digital transformation technologies and reduce the investment costs of enterprise digital transformation.

For enterprises, digital transformation can help enterprises achieve the goal of improving quality and efficiency, and thus help enterprises cope with various challenges brought about by economic downturn; however, enterprises should also fully realize that digital transformation is a long-term investment and a slow-acting system project. Therefore, enterprises need to make various capacity preparations. Specifically, (1) Improvement of managerial quality. Under the pressure of the economic downturn, managers need to devote most of their time and energy to cope with market challenges. If managers are incompetent or have high agency problems, they will have no motivation and ability to cultivate digital transformation-related thinking skills and promote enterprise digital transformation, which will hinder enterprise digital transformation. Therefore, on the one hand, enterprises should attach importance to and increase the training and cultivation of managerial capabilities, and on the other hand, they should use equity incentives and other means to actively retain and recruit capable managers and reduce agency problems. (2) Preparation of relevant resources. Under the pressure of economic downturn, enterprises may have to invest more

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resources to cope with the challenges of external market changes. In this way, if enterprises do not have sufficient resource preparations, the pressure of economic downturn may squeeze out the various resources used by enterprises for digital transformation, causing enterprises to be forced to slow down or even suspend digital transformation. Therefore, enterprises should pay attention to the preparation of resources, especially financing resources, and should actively expand and maintain various financing channels, make various rolling financing arrangements in advance, and increase their own financial flexibility.

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