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Enterprise Digitisation, Government Intervention and New Quality Productivity

-- A study based on listed companies in China

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Abstract: The impact of enterprise digitization on new productivity is investigated by considering enterprise digitization as a micro-focus point for realizing the digital economy. The results show that digital transformation of enterprises has a positive effect on new quality productivity, which complements the theoretical findings. In addition, the moderating effect of government intervention, which operates in synergy with the market, is examined in this process, and the path of influence is explored from the perspective of multiple actors, which provides policy recommendations for further promoting the development of the digital economy and the new quality of productivity.

Keywords: New quality productivity, Government intervention, Digitalisation of enterprises.

1. Introduction

In September 2023, the General Secretary initially presented the notion of new quality productivity during his visit to Heilongjiang. As science and technology advance and society progresses, the old production methods are unable to satisfy human demands, necessitating the ongoing promotion of innovative quality productivity to align with societal advancements. From the standpoint of political economy, the novel value of productive forces encompasses those driven by creativity in science and technology, the achievement of pivotal detrimental advances in technology, the transcendent nature of old productive forces, and the necessity for new production relations to accommodate these changes [1]. In the context of assessing new quality productivity, Song Jia et al [2]. developed an innovative excellence productivity indices system, focusing on the labor force and production tools. The labor force is comprised of two sub-factors: live labor and materialized labor (labor objects), while production tools consist of two sub-factors: hard technology and soft technology. Lu Jiang et al [3]. developed a comprehensive assessment method for new quality productivity based on three tiers of indicators: scientific and technological productivity, sustainable efficiency, and digital output.

The novel quality of productivity emerges within the framework of the digital economy, driven by the swift advancement of digital technologies such as, the Web of Things, big data, AI, and computing in the cloud. This digital economy, characterized by innovation and technology, engenders new productive forces that are fundamentally distinct from those established by conventional labor and mere capital accumulation. Current research has examined the determinants of new quality productivity from several viewpoints, including the correlation between the advancement of the digital economy and new quality productivity. Jia Song et al [2]. discovered that ESG growth significantly enhances firms' NPP, improves relationships with stakeholders, reduces intermediary and debt financing costs, and increases institutional shareholding, thereby fostering the advancement of firms' NPP. Ren Yuxin et al [4]. discovered that financial agglomeration enhances new productivity, facilitated by collaboration among industry, academia, and research to advance the creation of new productivity. According to the study findings of Zhang and Wen [5], the advancement of the digital economy can enhance new quality productivity through three mechanisms: augmenting detrimental technological advances, fostering the innovation and growth of important emerging sectors, and aligning with the inherent attributes of new quality productivity. Data is a crucial element that enhances productivity quality. Data elements, through their intrinsic role and integration with other production factors, permeate the social production process encompassing production, circulation, consumption, and distribution. They function as a domestic data multiplier effect while simultaneously acting as an open multiplier effect via cross-border data circulation, thereby significantly enhancing the emergence of new quality productivity.

The relationship between the market and government is a pressing issue for advancing high-quality development, as local government intervention influences resource allocation and is intricately linked to the effects of enterprise digitization on productivity quality. Government intervention can assist enterprises in surmounting innovation challenges through policy and financial support, while also enhancing the market environment, establishing a fair competition framework, incentivizing increased R&D investment and independent innovation, advancing scientific and technological progress, and facilitating the optimization, transformation, and upgrading of industrial structures. Current studies have mostly investigated the economic impacts of governmental initiatives. Li Jian et al. [6] discovered that government subsidies mitigate external financing constraints, thereby stabilizing the volatility of innovation investment and fostering innovation sustainability; however, high equity concentration within enterprises diminishes the beneficial effect of government subsidies on innovation sustainability. Research by Wan Qiang and Chen Ling [7] indicates that government intervention exhibits an inverted U-shaped

regulatory effect on the relationship between the digital economy and the integration of the two industries. At low levels of government intervention, there is a positive influence on this relationship, enhancing the elasticity of the digital economy's impact on the integration of the two industries and amplifying the sensitivity of the positive effect. However, as government intervention increases beyond the optimal threshold, the positive effect continues to strengthen to a certain degree. As government intervention intensifies and surpasses optimal levels, the interplay between the digital economy and the integration of the two industries assumes a detrimental regulatory function, diminishing or even reversing the positive impact of the digital economy on this integration to some extent. Liu Minghui and Li Qiu [8] discovered that tax incentives can efficiently enhance the attraction and distribution of capital, fostering the emergence of new productivity via talent mobility, knowledge transfer, and risk alleviation, whereas subsidy policies stimulate the growth of new productivity through direct financial assistance and the advancement of specific sectors.

This study examines the influence of corporate digitalization on new quality productivity and its transmission mechanisms, aligning with the trends of digital transformation and the increase in new quality productivity, which holds practical value. The significance of this study is as follows: This study primarily examines enterprise digitalization as a micro-level focal point for achieving the digital economy and its influence on new quality productivity, contrasting with existing research that predominantly addresses the connotation, logic, and developmental trajectory of new quality productivity, alongside the mechanisms linking the macro-digital economy to new quality productivity. This research analyzes corporate digitalization as a focal point for achieving the digital economy and assesses its influence on enhanced productivity quality. The results indicate that the digital transformation of organizations positively influences new productivity, hence corroborating the theoretical conclusions. The moderating impact of government intervention, which functions in conjunction with the market, is analyzed, and the influence pathway is investigated from the viewpoint of many stakeholders. This offers policy proposals to enhance the advancement of the digital economy and improve qualitative production.

2. Hypothesis and Econometric Model Establishment

2.1. The Impact of Enterprise Digitalization on New Quality Productivity

The digital economy breaks the traditional model, empowers enterprise transformation, and enhances the new quality of productivity from the three aspects of labor tools, labor force, and labor objects. In terms of labor tools, digital transformation establishes a direct channel for consumers, identifies potential demand, reduces cost and uncertainty [9], and generates a large amount of data to achieve whole-process monitoring and improve the success rate of innovation [10]. In terms of labor force, digital technology establishes an industry-university-research platform to enhance the innovation atmosphere [11] and the skills of managers and employees to promote "learning by doing." New materials, new energy, and data information have become new labor objects in the digital economy, and digital transformation helps to make efficient use of them, improve efficiency, reduce costs, and realize the rise of new productivity levels [12].

Enterprise digital transformation has penetrated all aspects of an enterprise's life cycle. In the design stage, AI assisted design and make up for design defects; in the procurement stage, big data screening of high-quality suppliers and raw materials [13]; in the manufacturing stage, industrial robots to improve the efficiency and quality, digital technology to identify faults autonomously and optimize [14]; in the sales stage, big data and cloud computing to accurately locate customers; in the after-sales service stage, AI and big data to collect feedback, optimize product design, and improve the service experience . In the after-sales service stage, AI and big data collect feedback, optimize product design, and improve the service experience [15]. Digital technology promotes enterprise production and service efficiency by integrating into the various stages of enterprise survival and development, and by improving the services of various industries such as education, healthcare, finance, travelling, and logistics [16].

Hypothesis 1: Digital transformation increases a firm's level of new quality productivity.

2.2. The Moderating Role of Government Intervention

Government intervention plays a crucial role in the process of digital transformation to drive new levels of productivity in enterprises.

Government subsidies can directly support the development of new productivity by providing financial support, reducing the risk of innovation, and promoting cooperation between industry, academia, and research. Government subsidies provide financial support for enterprises, reduce the capital cost of enterprise innovation activities, and promote enterprises to increase investment in innovation activities; reduce the innovation risk of enterprises; encourage enterprises to try new innovation projects; help enterprises more actively carry out innovation activities; improve the new quality of productivity; promote cooperation between enterprises and colleges and universities; promote cooperation between industries, universities, and research institutes; and carry out innovation activities, which will help the sharing of resources, exchange of experience, and accelerate the transformation of innovation achievements. It also promotes cooperation between enterprises and universities and research institutes; promotes cooperation among industries, universities, and research institutes; and jointly carries out innovative activities, which helps to share resources and experience, and accelerates the transformation and application of innovative achievements. At the same time, government subsidies also help reduce the cost of digital transformation to ease the burden on enterprises; thus, more small and medium-sized enterprises can afford to invest in the transformation, stimulate enterprises to increase their investment in innovation, enhance their competitiveness, and explore the motivation to apply new technologies.

On the other hand, other government measures played an indirect role. First, the government supports the construction of digital infrastructure by setting up special funds to promote the development of platformization, diversification, and sharing in the digital market to reduce the technological threshold and cost of enterprises. Secondly, the government regulates market failure and protects the fair competition

rights of enterprises by means of anti-monopoly regulation and collecting digital tax [17]. These measures facilitate market order, enhance resource allocation efficiency, and provide a conducive market environment for firms' digitization and the advancement of new quality productivity. Ultimately, the government's measured deregulation of industries has enhanced the efficiency of resource allocation and fostered integration and competitiveness across various sectors. This competitive environment compels enterprises to perpetually innovate products and services, establish novel business structures and models, thereby creating greater innovation potential and market opportunities, facilitating digital transformation, and consistently enhancing the quality of productivity [18-20].

Hypothesis 2: Government assistance will enhance the beneficial effects of digital transformation on enterprises' new quality productivity levels.

3. Research Design

3.1. Data Sources

This study focused on A-share listed firms in Shanghai and Shenzhen from 2012 to 2022 as the subject of investigation. To improve the accuracy of the sample data and the reliability of the conclusions of this study and to ensure that the empirical evidence of the article is reproducible, before the study of the main variables, the sample is screened and processed as follows.

Specifically, the sample excludes listed companies in the financial and insurance sectors in Shanghai and Shenzhen A-shares, as well as those in the ST and *ST sectors, and eliminates data from companies with absent variables in the empirical analysis. Finally, we get 4374 eligible and usable sample companies. The related data of these 4374 listed companies from 2012 to 2022, with a total of 31747 observations, were used as the research object. The data utilized originates from the CSMAR database and Wind Consulting Financial Terminal as well as relevant websites and public documents of listed companies.

3.2. Definition of Variables

3.2.1. The explanatory variables

The independent variable was new quality productivity. According to Jia Song [2], the essence of new quality productivity is in creativity grounded in the two-factor theory of productivity, which takes into account the significance and value of labor objects in the producing cycle; an entropy-based approach is employed to quantify new quality productivity. The value of the indicators and the weighting results are presented in Table 1.

Table 1. Indicators of new quality productivity of enterprises

Factors	Subfactors	Indicators	Description of the value of the indicator	Weights
labour force	Living labour	Percentage of R&D staff salary	R&D costs - salaries and wages/operating income	28
		Percentage of R&D staff	Number of R&D staff/number of employees	4
		Percentage of highly educated personnel	Number of people with bachelor's degree or above/number of employees	3
	Physical labour (objects of labour)	Proportion of fixed assets	fixed assets/total assets	2
		Manufacturing costs as a percentage of	(Subtotal cash outflows from operating activities + depreciation of fixed assets + amortisation of intangible assets + provision for impairment - cash paid for purchases of goods and services - wages paid to and for employees)/(Subtotal cash outflows from operating activities + depreciation of fixed assets + amortisation of intangible assets + provision for impairment)	1
production tools	Hard Technology	R&D depreciation and amortisation ratio	R&D expenses - depreciation and amortisation/operating income	27
		R&D lease costs as a percentage of	R&D costs - leasing costs/operating income	2
		R&D direct investment as a percentage of	R&D costs - direct inputs/operating income	28
		Intangible assets as a percentage of	intangible assets/total assets	3
	SoftTech	total asset turnover	Operating income/average total assets	1
		the inverse of the equity multiplier	owners' equity/total assets	1
New quality productivity				100

3.2.2. Key explanatory variables

The key explanatory variable was enterprise digital transformation. This study employs the methodology suggested by Wu et al. and Zhang Shushan et al. [21, 22], utilizing network crawler software on the CSMAR database to conduct word frequency analysis on yearly reports of companies. The analysis focuses on keywords related to "ABCD" (artificial intelligence, blockchain, cloud computing, big data) technology and digital technology applications. The cumulative word frequency across these five categories is classified as an indicator of firm digital growth, and proxy variables for digital transformation are derived by taking the logarithmic mean of the total word frequency after adding one.

3.2.3. Moderating variable: government intervention

Currently, there are two main types of indicators used by academics to measure local government intervention: data constructed by different scholars on their own according to the corresponding theoretical basis and index-type indicators that are publicly available. The most common index is the China Marketization Index (CMI). The marketization index, as its name suggests, measures the market environment and the level of marketization development in a region. The marketization index contains five sub-indices under the general index, and the relationship between the government and the market focuses on portraying the government's status and the level of its role in the allocation of resources. This

sub-index is synthesized by three sub-indices: the proportion of economic resources allocated by the market, the reduction of government intervention in enterprises, and the reduction in the size of the government. In this paper, the sub-index of the marketisation index is used as a proxy variable for government intervention, with the larger the index, the smaller the degree of government intervention.

3.2.4. Control variables

In accordance with the previous research, we select control variables from two tiers of enterprise operation and management: total assets at year-end to assess enterprise scale, total liabilities at year-end relative to total assets to evaluate enterprise financial leverage, net profit at year-end relative to total assets to gauge enterprise profitability, the proportion of shares held by the largest shareholder to total shares to determine the concentration of shareholding, and the identity of the chairman and general manager to assess the duality of these positions. Determine if the chairman and general manager are the same individual to assess the duality of the two roles (assign a value of 1 if they are the same person, otherwise 0), and quantify the number of board members to evaluate the size of the board of directors.

In summary, the study variables were defined and calculated as shown in Table 2.

Table 2. Definition of variables

Variable type	Symbol	Variable definitions
The explanatory	Npro	New quality productivity
Explanatory	indigi	Enterprise digital transformation
	gover	Government intervention, marketisation index subcomponent - government-market relations
Control variables	size	Firm size, total assets in logarithms
	Lev	Asset-liability ratio, the ratio of total liabilities to total assets at the end of the year, measures the financial leverage of an enterprise
	roa	Net profit rate on total assets, the ratio of net profit at the end of the year to total assets measures the profitability of the enterprise
	Share	The shareholding ratio of the largest shareholder is a measure of the concentration of corporate ownership
	dual	When the chairman and the general manager are the same, the value is 1; otherwise, it is 0
	board	Board dimensions, quantified by the count of board members
	Year	Annual effect, to control the year of the company
	Ind	Industry effect, control of the company's industry

3.3. Regression Model

In this paper, the following model is constructed to test the previous research idea.

(1) Empirical Model Construction of ESG Practice Level and Financing Efficiency.

$$\mathrm{Npro}_{i,t} = \beta_0 + \beta_1 \mathrm{indigi}_{i,t} + \beta_2 \sum \mathrm{Control}_{i,t} + \xi_i + \varepsilon_{i,t}$$

(2) Empirical modelling of the moderating effect of financial flexibility.

$$\mathrm{Npro}_{i,t} = \beta_0 + \beta_1 \mathrm{indigi}_{i,t} + \beta_2 \mathrm{gover}_{i,t} + \beta_3 \mathrm{ESG\_m}_{i,t} * \mathrm{gover}_{i,t} + \beta_4 \sum \mathrm{Control}_{i,t} + \xi_i + \varepsilon_{i,t}$$

Where subscript i denotes the enterprise, t denotes the year.ε denotes the random perturbation term, the βdenotes the regression coefficient, the ξ_i is an individual effect that does not vary over time. Npro is the explanatory variable for firms' new quality productivity; indigi is the main explanatory variable for firms' digital transformation; and gover is the moderator variable for government intervention. $\sum \mathrm{Control}$ are control variables, denoting firm size, gearing ratio, profitability, the ratio of the first largest shareholder's shareholding, the situation of two positions, and the size of the board of directors. The descriptive statistics of the model variables are shown in Table 3.

Table 3. Descriptive statistics of variables

variables	Sample size	Mean	Median	Standard deviation	Min	Max
Npro	31,747	5.25	4.841	5.329	0.0464	804.5
indigi	31,747	14.19	3	35.09	0	547
gover	31,747	7.531	7.358	1.511	-7.145	12.15
size	31,743	22.25	22.06	1.336	16.16	28.64
lev	31,747	0.434	0.414	1.042	-0.195	178.3
roa	31,747	0.0352	0.0355	0.669	-30.69	108.4
share	31,747	33.7	31.31	14.9	0.29	89.99
dual	31,283	0.295	0	0.456	0	1
board	31,747	8.458	9	1.652	3	18

4. Empirical Analyses and Hypothesis Testing

4.1. The Impact of Digital Transformation on The Level of New Qualitative Productivity of Firms

Regression analyses were conducted on the basis of the model described in the previous section. According to equation (1), four regressions were carried out on the relationship between digital transformation and new quality productivity of enterprises using the model, and the results are shown in Table 4. The first column of Table 4 examines the effect of digital transformation on new quality productivity, which is initially positively correlated at the 1% level; the second column examines the effect of control variables on the level of new quality productivity of enterprises; the third column adds the key explanatory variable, i.e., Npro, on the basis of the second column, and tests it by using a mixed-OLS model; and the third column adds the key explanatory variable, Npro, on the basis of the first column, and tests it by using a fixed-effects model. test.

Table 4. Regression results of digital transformation on firms' new quality productivity

	The main explanatory variables	control variables	OLS	FE
variables	Npro	Npro	Npro	Npro
indigi	0.016***		0.006***	0.011***
	-35.25		-9.97	-24.27
size		0.563***	0.111***	0.460***
		-35.98	-8.18	-28.61
lev		0.013	0.007	0.009
		-1.55	-1.07	-1.17
roa		-0.073***	-0.070**	-0.076***
		(-5.97)	(-2.19)	(-6.26)
share		-0.021***	-0.002	-0.018***
		(-16.04)	(-1.54)	(-13.84)
dual		-0.044	-0.057*	-0.049*
		(-1.56)	(-1.68)	(-1.78)
board		-0.082***	0.071***	-0.084***
		(-8.62)	-7.72	(-8.95)
constant	5.020***	-5.847***	0.866***	-3.785***
	-499.71	(-15.87)	-2.87	(-10.12)
Sample size	31,747	31,279	28,209	31,279
R-squared	0.043	0.069	0.221	0.089
Number of enterprises	4,374	4,374	4374	4,374
Ftest	0	0	0	0
r2_a	-0.11	-0.0824	0.219	-0.0593
F	1243	333	131.9	375.8
Industry FE			YES	
Year FE			YES	

The findings indicate that the coefficients of both the mixed OSL model and the fixed-effects model are extremely positive at the 1% level, suggesting that a greater level of digital transformation in firms correlates with an elevated level of new quality productivity, thereby validating Hypothesis 1. Digital transformation promotes technological breakthroughs and integration through the introduction of a new generation of information technology, such as big data, cloud computing, and artificial intelligence, which gives rise to new production methods and business models and provides enterprises with powerful technical support and innovation power. Through the introduction of new-generation information technology such as big data, cloud computing, and artificial intelligence, digital transformation promotes technological breakthroughs and integration, gives rise to new production methods and business models, and provides enterprises with powerful technical support and innovation power. At the same time, digital transformation also promotes the comprehensive innovation of enterprise business models, processes, and value creation, optimizes business processes, improves customer experience, reduces operating costs, and enhances the competitiveness of enterprises to a certain extent. In addition, digital transformation has accelerated the development and utilization of data, enabling enterprises to better understand market demand, optimize product design, and improve production efficiency, thus providing important support for the cultivation of new productivity.

4.2. The Moderating Effect of Government Intervention on The Relationship Between Digital Transformation and New Quality Productivity of Enterprises

According to equation (2), the model was used to empirically test the moderating effect of government intervention on the relationship between digital

transformation and new quality productivity level of enterprises. Three regressions were conducted, and the findings are displayed in Table 5. The initial three columns of Table 5 are categorized into the entire sample, state-owned businesses, and non-state-owned businesses, respectively, delineating the sample range for empirical analysis.

Table 5. The moderating effect of government intervention on the relationship between enterprise digital transformation and new quality productivity

	Full sample	State-owned enterprises	Non-State-owned Enterprises
variables	Npro	Npro	Npro
indigi	0.02454***	0.05505***	0.01621***
	-9	-8.81	-5.4
gover	-0.13237***	-0.05196***	-0.18093***
	(-12.72)	(-3.18)	(-13.38)
Indigi*gover	-0.00181***	-0.00576***	-0.00069*
	(-5.00)	(-7.06)	(-1.72)
size	0.40998***	0.55361***	0.31341***
	-25.02	-19.5	-15.3
lev	0.00783	-0.50443***	0.00696
	-0.98	(-3.78)	-0.88
roa	-0.07740***	-0.59967***	-0.07785***
	(-6.39)	(-4.90)	(-6.49)
share	-0.01632***	-0.00665***	-0.02334***
	(-12.23)	(-3.12)	(-13.47)
dual	-0.05211*	-0.0621	-0.04012
	(-1.89)	(-1.21)	(-1.24)
board	-0.08050***	-0.05279***	-0.10038***
	(-8.57)	(-3.71)	(-8.01)
Constant	-1.77671***	-5.94736***	1.05734**
	(-4.43)	(-8.75)	-2.11
industryFE	YES	YES	YES
YearFE	YES	YES	YES
Sample size	31,279	11,211	20,068
R-squared	0.096	0.081	0.115
Number of enterprises	4,374	1,198	3,176
Ftest	0	0	0
r2_a	-0.0509	-0.0303	-0.0521
F	318.6	97.36	243.3

From the regression results in Table 5, it can be seen that: (1) the regression results in the first column show that the regression coefficient of indigi for Npro is significantly positive at the 1% level, and the coefficient of the interaction term of indigi and gover is significantly negative at the 1% level, contrary to the former result, that is to say, when the stronger the government intervention is, the stronger the positive impact of digital transformation on the level of new quality productivity of enterprises, verifying hypothesis 2; (2) The coefficients of the interaction terms between "indigi" and "gover" in the regression outcomes for both the second and third columns are significantly negative at the 1% level. Specifically, when state-owned enterprises are considered as the sample group in the second column, and non-state-owned enterprises in the third column, these coefficients remain consistently negative, mirroring the findings observed in the full sample group. and the coefficient of the state-owned enterprises group is larger than that of the non-state-owned group, which means that, for the state-owned enterprises, the positive effect of government intervention on the digital transformation on the level of new quality productivity of the enterprise is the same as that of the former, i.e., when the stronger the government intervention, the positive impact on the level of new quality productivity of the digital transformation of the enterprise is. This indicates that, for state-owned enterprises, the positive impact of government intervention on digital transformation on the level of new quality productivity of enterprises is greater than that of non-state-owned enterprises.

Government intervention plays a key role in promoting the process of enterprise digital transformation and its positive impact on the level of new quality productivity of enterprises is particularly significant. Through a series of policy incentives, infrastructure construction, and market order regulation, the government not only reduces the threshold and risk of enterprise digital transformation but also promotes the integration of technology and innovation, thus enhancing the productivity and product quality of enterprises and promoting the emergence of new productivity. Especially in state-owned enterprises, because of their advantages in policy implementation, financial strength, and resource integration capacity, the facilitating effect of government intervention is even more significant, which enables them to adapt to digital transformation faster and play a better role in the cultivation of digital technology in the cultivation of new quality productivity. Therefore, government intervention is not only an important force to promote the digital transformation of enterprises but also a key factor in enhancing the level of new productivity of enterprises.

4.3. Robustness Tests

4.3.1. Variable substitution

Replacing the core explanatory variable, i.e. the degree of enterprise digital transformation, with the intensity of enterprise digital technological Implementation (indigi_B), the intensity of enterprise digital technology application is ln(the total number of word frequency of enterprise digital technology application+1), and the results show that the coefficients of indigi_B are all significantly positive at 1% level, which is consistent with the basic regression results, and it verifies the hypothesis 1.

Table 6. Regression outcomes of the intensity of firms' digital technology adoption on firms' new quality productivity

	The main explanatory variables	OLS	FE
variables	Npro	Npro	Npro
indigi_B	0.009***		0.006***
	-39.9		-25.05
Control variables		YES	YES
Industry FE		YES	
Year FE		YES	

4.3.2. Heterogeneity tests

(1) Heterogeneity in the essence of property rights

State-owned enterprises have advantages in digital transformation because of policy implementation, financial strength, and resource integration capacity. Government support enables them to obtain resources quickly to promote technological upgrading; their large-scale and strong financial resources enable them to undertake more investment, and their strong ability to integrate resources promotes synergy between internal and external resources and promotes in-depth transformation. These advantages promote state-owned enterprises in the transformation of new quality productivity. Therefore, the effect of digital transformation on the new

productivity level of enterprises may be more significant for SOEs. As shown in Table 7, in both the SOE and non-SOE groups, the degree of digital transformation has a significant positive effect on the level of new productivity at the 1 per cent level, indicating that the positive effect of digital transformation on the level of new productivity is more significant in SOEs.

Table 7. Results of regressions on heterogeneity of property rights

	Full sample	State-owned	Non-State
variables	Npro	Npro	Npro
indigi	0.011***	0.012***	0.011***
	-24.27	-11.34	-21.73
Control variables	YES	YES	YES

(2) The impact of industry differences

High-tech enterprises with technological innovation and R&D strength, rapid mastery of big data, and cloud computing technology to promote automation and intelligent production, and enhance the new quality of productivity. Their product development and production advantages help launch new products and improve their quality to meet market demand. These factors make high-tech enterprises in digital transformation faster industrial upgrading, enhance competitiveness, and achieve sustainable development. The results show that the indigi coefficient of high-tech industry enterprises is higher than that of non-high-tech industry enterprises, indicating that the positive impact of digital transformation on the level of enterprise new quality productivity is more significant in Table 8, high-tech industry enterprises than in non-high-tech industry enterprises, and that the positive impact of digital transformation on the level of enterprise new quality productivity is more significant in high-tech industry enterprises.

Table 8. Heterogeneity test for high-tech industries

	Full sample	Non-high-tech industries	High-tech industries
variables	Npro	Npro	Npro
indigi	0.011***	0.009***	0.013***
	-24.27	-11.92	-20.83
Control variables	YES	YES	YES

(3) Factor-intensive heterogeneity

Technology-intensive enterprises with R&D innovation and technological resources and digital transformation to accelerate intelligent, automated production, improve efficiency and product quality, and respond rapidly to the market. Capital-intensive firms have limited room for innovation; labor-intensive firms face the challenges of skill upgrading and transformation awareness, and digital transformation is relatively limited in enhancing new quality productivity. The sample enterprises are classified as labor-, capital-, and technology-intensive, and the impact of digital transformation on the level of new productivity is examined in terms of factor intensity. The results, as shown in Table 9, indicate that the degree of digital transformation has a significant positive effect on the level of new productivity at the 1% level, which is consistent with the previous results: the indigi coefficients of technology-intensive enterprises are higher than those of labor- and capital-intensive enterprises.

Table 9. Factor-intensive heterogeneity

	qr10	qr25	qr50	qr75	qr90
variables	Npro	Npro	Npro	Npro	Npro
indigi	0.00451***	0.00798***	0.01091***	0.02127***	0.03443***
	-8.39	-19.52	-26.06	-40.6	-38.33
Control variables	YES	YES	YES	YES	YES

4.3.3. The instrumental variables approach to testing endogeneity

Although the fixed-effects model used in the previous section can reduce the endogeneity caused by individual effects to some extent, it may still have the problem of endogeneity. In this study, we select the digital transformation of enterprises with one- and two-period lags (IV1 and IV2), the mean value of digitalization of enterprises in the same industry except our company (IV3), and the mean value of digitalization of enterprises in the same industry and the same region except our company (IV4) as the instrumental variables and use the two-stage least squares method to carry out empirical tests on the model. The results are shown in Table 10, and the regression results as a whole show that the sign of the estimated coefficients of the digital transformation of enterprises is consistent with the aforementioned benchmark regression, and all of them are significant at the 1% level.

Table 10. Regression results of the two-stage least squares endogeneity test

IV1：lindigi			IV1：l2indigi			IV3：indigi_n			IV4：indigi_m		
	1st	2st		1st	2st		1st	2st		1st	2st
indigi		0.0159***	indigi		0.0229***	indigi		0.0725***	indigi		0.0579***
		-15.0200			-9.6200			-13.9300			-11.9000
lindigi	0.6541***		l2indigi	0.3476***		indigi_n	0.3630***		indigi_m	0.2658***	
	-28.6400			-11.8400			-14.8500			-11.9800	
Control variables	YES	YES	Control variables	YES	YES	Control variables	YES	YES	Control variables	YES	YES
N	26000	26000	N	23000	23000	N	31000	31000	N	8300	8300
r2_a		-0.0864	r2_a		-0.1667	r2_a		-0.6922	r2_a		0.5739

5. Conclusions and Policy Recommendations

This study responds to the green development background of the digital economy and new quality productivity target, and explores the impact of digital transformation on the new quality productivity level of enterprises. First, 4374 A-share listed enterprises from 2012 to 2022 were selected as samples, and an econometric model was established to study the impact of digital transformation on the level of new quality productivity of enterprises. The results show that digital transformation has a positive impact on new enterprise quality productivity. Second, the impact path of digital transformation on the new productivity level of enterprises, that is, the moderating role of government intervention, is studied, and the results show that government intervention contributes to the positive impact of digital transformation on the new productivity level of enterprises. Based on the above findings, the following policy recommendations are made.

First, the promotion and support systems for digital transformation should be strengthened. The government should deepen its policy support for digital transformation, and lower the threshold of transformation through tax incentives, capital subsidies, technical support and other incentives, especially for small and medium-sized enterprises (SMEs). Simultaneously, it should improve the construction of digital infrastructure, including broadband networks and data centers, to provide a solid foundation for digital transformation. In addition, the government should strengthen the cultivation and introduction of digital talent and provide talent guarantees for the transformation of enterprises through multiple channels, such as university education and vocational training. The government also needs to define its own role, not only to guide the popularity of digital transformation but also to maintain the flexibility of the market mechanism to avoid excessive intervention.

Second, optimise the synergy between government intervention and market mechanisms. The government should establish a sound policy coordination mechanism to ensure the consistency and coordination of policies related to digital transformation and, at the same time, strengthen the policy propaganda and interpretation of enterprises to improve the efficiency of policy implementation. To assess the effect of digital transformation, the government should build a perfect evaluation system to identify and solve problems in the transformation process in a timely manner. On this basis, the government should strengthen supervision to ensure the sound development of digital transformation, and at the same time, through the establishment of a cooperation platform between enterprises and the government, promote exchanges and cooperation between the two sides and jointly promote the advancement of digital transformation.

Third, deepen the cooperation and incentives between enterprises and the government. The government need energetically encourage the construction of digital transformation demonstration projects and inspire more enterprises to participate in transformation through the leadership of the demonstration projects. At the same time, the guidance and support for demonstration projects should be strengthened to ensure their effectiveness. In addition, the government should increase policy support and incentives for digital transformation enterprises, such as the establishment of special funds and financing support, to encourage enterprises to increase the transformation of inputs and enhance their new quality productivity level. Through these measures, we can jointly promote the in-depth development of digital transformation and provide strong support for sustained and healthy development of China's digital economy.

References

[1] Zhou Wen, Xu Lingyun. On the new quality of productivity: connotation, characteristics and important focus [J]. Reform, 2023, (10):1-13.

[2] SONG JIA, ZHANG JINCHANG, PAN YI. A study on the impact of ESG development on firms' new quality productivity - empirical evidence from Chinese A-share listed firms [J]. Contemporary Economic Management, 2024, 46(06): 1-11. DOI:10.13253/j.cnki.ddjjgl.2024.06.001.

[3] Lu Jiang, Wang Xiaonan. Realistic Basis and Implementation Path of Developing New Quality Productivity According to Local Conditions--Empirical Evidence from Nine Major Urban Agglomerations in Western Region [J]. Journal of Chongqing University (Social Science Edition), 2024, 30(05):13-28.

[4] REN Yuxin, WU Yan, WU Zhe. Financial agglomeration, industry-university-research co-operation and new quality productivity [J]. Financial Theory and Practice, 2024, 45(03):27-34. DOI:10.16339/j.cnki.hdxbcjb.2024.03.004.

[5] Zhang Xiaheng, Liu Caixia. Research on the inner mechanism and path of data elements to promote the realisation of new quality productivity [J]. Industrial Economic Review, 2024, (03):171-184. DOI:10.19313/j.cnki.cn10-1223/f.20240313.002.

[6] LI Jian, YANG Beibei, PAN Zhen. Government subsidies, equity concentration and corporate innovation sustainability [J]. China Soft Science, 2016, (6).

[7] Wan Qiang, Chen Ling. Analysis of the Role Mechanism of Digital Economy on the Integration of Advanced Manufacturing Industry and Modern Service Industry--Based on the Regulatory Role of Government Intervention [J]. Science and Technology Entrepreneurship Monthly, 2024, 37(08):106-116.

[8] Liu, Minghui, Li, Qiu. How can fiscal policy drive the development of new quality productivity? [J]. Shanghai Economic Research, 2024, (3).

[9] Qi Yudong, Cai Chengwei. Research on the multiple effects of digitalisation on the performance of manufacturing enterprises and its mechanism [J]. Learning and Exploration, 2020, (7):108~119.

[10] TAN Zhidong, ZHAO Xun, PAN Jun, et al. The value of digital transformation: A perspective based on corporate cash holdings [J]. Financial Research, 2022, 48(3):64~78.

[11] Hu Shan, Yu Yongze. Digital economy and corporate innovation: breakthrough innovation or incremental innovation? [J]. Research on Finance and Economics, 2022, (1):42-51.

[12] SHI Jianxun, XU Ling. Study on the Great Strategic Significance and Realisation Path of Accelerating the Formation of New Quality Productivity [J]. Research on Financial Issues, 2024, (1):3~12.

[13] Meng Xia, Dong Wenting. Enterprise digital transformation and export competitiveness improvement: Evidence from Chinese listed companies [J]. International Trade Issues, 2022(10):73-89.

[14] KusiakA. Smartmanufacturingmustembracebigdata [J]. Nature, 2017, 544(7648): 23-25.

[15] SUN Zao, HOU Yulin. How industrial intelligence reshapes the labour force employment structure [J]. China Industrial Economy, 2019(5):61-79.

[16] PAN Yi, ZHANG Jinchang, HUANG Jing. Analysis of productivity differences in digital transformation of non-industrial enterprises: A quasi-natural experiment based on A-share listed enterprises [J]. East China Economic Management, 2023, 37(1):1-14.

[17] GUO Kaiming, LIU Chong. Anti-monopoly, digital economy innovation and industrial structure upgrading of platform enterprises [J]. China Industrial Economy, 2023(10):61-79.

[18] Shi Dan. Evolution of industrial development trend under the condition of digital economy [J]. China Industrial Economy, 2022(11):26-42.

[19] Ma Jian. A Review of Industrial Integration Theory [J]. Economics Dynamics, 2002(5):78-81.

[20] Zhou Zhenhua. Analysis of market structure and its behaviour in industrial integration [J]. China Industrial Economy, 2004(2):11-18.

[21] WU Fei, HU Hui Zhi, LIN Hui Yan, et al. Corporate digital transformation and capital market performance-empirical evidence from stock liquidity. Management World, 2021, 37(7):130-144+10.

[22] Zhang Shushan, Zhang Peiwen, Gu Cheng. Enterprise digital transformation and supply chain efficiency. Statistics and Decision Making, 2023, 39(18):169~173.