ISSN: 2688-9323

Digital Economy, Technological Innovation and High-quality Development of Manufacturing

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Abstract

The paper uses data from 30 provinces across the country from 2011 to 2019, measures the level of the digital economy based on the entropy method and constructs the ML productivity index to measure the total factor productivity of the manufacturing industry, uses technological innovation as an intermediary variable, and divides technological innovation into imitation innovation and technology introduction Based on the three types of independent innovation, the relationship between digital economy, technological innovation and High-quality development of manufacturing is investigated.Research shows that the digital economy has significantly promoted green total factor productivity in manufacturing, and technology introduction and independent innovation have played a positive intermediary role in the relationship between the two, and independent innovation has a greater intermediary effect; regional heterogeneity In the eastern region, the impact of the digital economy on the green total factor productivity of the manufacturing industry is not significant, but the impact is more significant in the central and western regions, and the mediating effect of imitative innovation and independent innovation is more significant in the central and western regions.At the time when China's economic growth is transforming the old and new kinetic energy, more attention should be paid to independent innovation, to cultivate innovation platforms, to promote digital industrialization and industrial digitization, and to achieve High-quality development of the manufacturing industry.

Keywords

Digital Economy; High-quality Development of Manufacturing; Technological Innovation.

1. Introduction

The report of the 19th National Congress of the Communist Party of China pointed out that China's economy has shifted from a stage of high-speed growth to a stage of High-quality development, and emphasized the need to promote changes in the quality, efficiency, and power of economic development, and improve total factor productivity.In the long-term process, my country's manufacturing industry has formed an extensive development model dominated by resource utilization, characterized by high input, high emissions, and low efficiency.Under the "new development concept", this model is no longer sustainable.On the one hand, how to cultivate new kinetic energy of economic growth, accelerate the improvement of economic growth efficiency, and achieve High-quality economic development is a problem that needs to be studied and resolved, and it is also an important topic of concern to scholars from all walks of life.On the other hand, the digital economy has been written into the report of the 19th National Congress of the Communist Party of China, becoming the main direction of innovation-driven development of the country and the key driving force for supply-side reforms.It provides a new feasible path for the manufacturing industry to transform to High-quality development at both ends of supply and demand..Therefore, it is of great significance to

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clarify the relationship between the digital economy and the High-quality development of the manufacturing industry, and to promote China's manufacturing industry to accelerate to the mid-to-high end of the global value chain.

High-quality economic development emphasizes the transformation of growth mode and growth momentum.In the era of digital economy, the decisive factor for economic growth in developed countries has changed from the “scale effect” of factor input to the “spillover effect” of knowledge.The knowledge-intensive type with information and digital technology as the core Industry is becoming a new economic growth point.my country should also follow the historical trend of the development of knowledge-intensive industries, accelerate the innovation of a new generation of information technology, actively develop the digital content industry, promote the upgrading of the industrial structure through industrial integration and chain economy, and realize the High-quality development of the manufacturing industry.

2. Overview of the Article

2.1. Related Research on Digital Economy

At present, the measurement of digital economy is mainly divided into two categories: one is direct method, namely the scale of digital economy in a certain region, which is measured by industrial appreciation, income and employment, and secondly, the development of digital economy in different regions, such as China Institute of Digital Economy, Tencent Institute, Said Consultant, International Economy Advisory Committee, EU and US Ministry of Commerce (Xu Qingyuan et al., 2018).

Most scholars construct the index system based on the typical connotation of "digital industrialization" and "industrial digital" of digital economy development (Zhang Xueling et al., 2017, Zhang Burchao et al., 2018; Shen Yunhong, Huang truss, 2020). Although the coverage and focus of the evaluation indicators are different, the measurement method mainly adopts the main component analysis and entropy method to calculate the comprehensive index of measuring digital economy.From the spatial level of view, the measurement is mainly provinces, regions and municipalities directly under the Central Government, for prefecture-level and county level measures are few.

2.2. Research on the High-quality Development of the Manufacturing Industry

At present, the research on the High-quality development of the manufacturing industry mainly focuses on the following two aspects: First, the relevant theory and evaluation system of the High-quality development of the manufacturing industry. Most scholars study from the micro perspective and macro perspective of High-quality development of manufacturing industry. From a micro perspective, the quality of manufacturing products and the quality of manufacturing enterprises are used to measure the High-quality development of the manufacturing industry, such as Wang Mingtao and Xie Jianguo (2019).He Zhengchu et al. (2018) using the method of building the index system, from the development quality, development efficiency and development power to measure the manufacturing high quality development level, Ji Yujun, Wang Xue (2019) based on the development concept under the new economy from innovation, coordination, green, open, sharing and other aspects of the manufacturing high quality development evaluation index system.Second, the factors that affect the High-quality development of the manufacturing industry.In order to achieve the High-quality development of the manufacturing industry, it is necessary to clearly realize the shortcomings and key factors affecting the development of China's manufacturing industry.

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2.3. Research on the Impact of the Digital Economy on the High-quality Development of the Manufacturing Industry

Many literature has studied the theoretical mechanism of digital economy for High-quality economic development (Liu Shuchun, 2019; Zhang Xun et al., 2019; Ding Yifan, 2020; Ren Baoping, 2020), and concentrated in the last two years, belongs to the literature accumulation stage. Digital economy is a new type of economic form. Research on the impact of digital economy on the high quality of manufacturing industry at home and abroad can be divided into the following categories.

Foreign countries mainly include, first, ICT has a great role in promoting employment (Kilicaslan and Tongur,2019), which can improve enterprise productivity (Viollaz,2019) by promoting increasing labor productivity; second, ICT is conducive to improving the full factor productivity of manufacturing enterprises (Castiglione and Infante,2013).

Domestic research mainly includes two parts: theoretical and empirical research.In theory, First, the digital economy promotes the transformation and upgrading of the manufacturing industry (Jiao Yong, 2020; Li Chunfa et al, 2020), CAI Yanze et al (2021) based on the framework of the technology-economic paradigm research framework, It is believed that the digital economy enables the transformation and upgrading of the manufacturing industry by innovating the manufacturing innovation model and optimizing the allocation of production factors; Second, the digital economy promotes the High-quality development of the manufacturing industry, The digital economy drives the High-quality development of China's manufacturing industry by breaking the bottleneck of the innovation chain, improving the quality of the manufacturing chain, optimizing the supply chain efficiency, and expanding the service chain space (Li Fuyi, 2018; Zhao Xishan San, 2017); Third, the digital economy promoted industrial structure adjustment and productivity improvement in the manufacturing industry.

In empirical aspects, scholars study less, including yu shan (2021) using China provincial panel data, empirical test of digital economy on manufacturing high quality go out space spillover effect, nonlinear marginal incremental effect and influence mechanism, at the same time show that digital economy significantly promoted the improvement of Chinese provincial export technology complexity, the positive space spillover effect can boost the High-quality development of export trade.Liao Xinlin, Based on the perspective of Yang Zhengyuan (2021), the specific effect of the Yangtze River Delta urban agglomeration, used the dynamic panel GMM to measure the digital economy on the manufacturing upgrading level.Most of the cases use the term "Internet" instead of digital economy for empirical analysis. Guo jiatang and Luo Pinliang (2016) analyzed the impact of the Internet on the manufacturing industry from the perspective of productivity. The empirical results show that the Internet has played a positive role in the labor productivity and the improvement of total factor productivity in the manufacturing industry.

3. Theoretical Analysis and Research Assumptions

The core connotation of High-quality development is the new development concept composed of innovation, coordination, green, open and sharing, involving all fields of social economy. High-quality development of manufacturing industry is one of the basic contents of High-quality economic development. The report to the 19th National Congress of the CPC clearly stated that High-quality development of manufacturing industry takes enhancing technological innovation capacity as the basic measure to promote the quality, efficiency and driving force.The characteristics of data creation, information dissemination, sharing and reducing transaction costs of digital economy have solved the problems such as the contradiction

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between supply and demand of High-quality development of manufacturing industry, the space restriction of economic activities and the failure to balance fairness and efficiency.

3.1. Impact Mechanism of the Digital Economy on the High-quality Development of the Manufacturing Industry

The application of digital technology will encourage consumers to participate in research and development and design, customer value oriented, enterprises will have a more accurate grasp of consumer demand, more conducive to keenly perceive the future development trend, realize supply and demand interactive technology innovation, so as to promote manufacturing in production, sales, operation, management and other links, so as to reduce research and development resources search and matching costs.Integration of digital information technology changed the manufacturing industry chain structure form at the same time, gave birth to the "consumer" and application integration platform two emerging industry chain leading power, accelerate the manufacturing from production tool revolution to intelligent decision revolution, spawned the intelligent manufacturing, large-scale personalized customization, network collaborative manufacturing and service manufacturing new manufacturing mode, the most effectively formed the long tail effect.Under the new manufacturing mode, consumers in the role of "consumer" into the industrial chain of product research and development, manufacturing and sales of the whole process, through innovation resource integration and innovation power change, intelligent manufacturing can cut industrial chain each link innovation bottleneck, promote enterprise core research and development ability, intelligent equipment technology, manufacturing chain quality and supply chain efficiency, and break the industrial value chain "low-end" trap.At the same time, under the influence of the digital economy, the organizational structure of enterprises tends to be more flat, decentralized, management costs are reduced, accelerate the creation of new models of flexible manufacturing, shared manufacturing, personalized manufacturing, collaborative manufacturing, promote the optimization and upgrading of the manufacturing industrial structure, and achieve quality reform.

The H1: digital economy significantly promotes the High-quality development of the manufacturing industry.

3.2. The Impact Mechanism of Digital Economy, Technological Innovation and High-quality Development of Manufacturing

The key to the High-quality development of the manufacturing industry is whether innovation-driven. Innovation-driven is the core driving force for the High-quality development of the manufacturing industry. The economic effects brought by different models of innovation are completely different. Technological innovation can be divided into technology introduction, imitation innovation and independent innovation.New technology by greatly reduce production cost, improve labor production efficiency, promote the optimization and allocation of resources, improve the quality and efficiency of manufacturing industry; and by transforming traditional manufacturing, promote the manufacturing industry to knowledge-intensive and technology-intensive direction, thus solving the problem of high energy consumption, high pollution and high emissions, manufacturing to achieve intelligent, high-end and green development.

1. Technology introduction

Technology introduction is to directly introduce advanced management methods, technologies and high-end talents directly from developed regions or countries. The technology has the attribute of public goods and produces a "technology diffusion" effect on the manufacturing industry through three effect mechanisms.One is the demonstration effect, manufacturing enterprises by introducing software technology, self-digestion and absorption to apply to the

ISSN: 2688-9323

core technology of the production industry to achieve the competition effect, the rise of digital technology will help to eliminate the monopoly between the manufacturing industry and improve the level of competition, forcing some enterprises with monopoly rights to increase independent innovation, promote the upgrading of manufacturing technology.

2. Imitative innovation

Imitation innovation means that after the introduction of other technology, after digestion and absorption of the technical level of products, through innovation, beyond the original technical level.By saving a lot of costs in research and development and market cultivation, imitation innovation reduces investment risks, avoids the instability in the early stage of development, and reduces the risk of market development.

3. Independent Innovation

Independent innovation is the fundamental driving force for the manufacturing industry to realize its structure optimization and upgrading. The essence of technological innovation to promote the structural adjustment of the manufacturing industry is that the manufacturing industry adopts more efficient technology than before, and obtains technological progress, labor productivity improvement and industrial development, so as to promote the rationalization of the manufacturing structure and promote its high degree.Manufacturing industry not only relies on the independent research and development and self-accumulation of independent innovation, but also through the introduction, absorption and digestion of Internet industry diffusion technology on the accumulation of technical knowledge, and through "dry middle school" to form the industry's independent innovation system, and then promote the adjustment of manufacturing structure.

Based on this, this paper proposes the hypothesis 3 that H3: digital economy can drive High-quality development of manufacturing industry by improving technological innovation capacity, but there are obvious differences in such conduction mechanisms under different innovation modes.

4. Research and Design

4.1. Model Construction

1. benchmark model

In order to test the above research hypothesis, the following basic model is first constructed for the direct transmission mechanism of the digital economy to the High-quality development of the manufacturing industry:

$$GTFP_{it} = \beta_0 + \beta_1 Digital_{it} + \sum \beta_j control_{it} + \mu_{it} \quad (1)$$

2. mediation effect model

The first is the regression of the digital economy to the intermediary variables

$$inno1_{it} = \beta_0 + \beta_1 digital_{it} + \sum \beta_j control_{it} + \varepsilon_{it} \quad (2)$$

$$inno2_{it} = \beta_0 + \beta_1 digital_{it} + \sum \beta_j control_{it} + \eta_{it} \quad (3)$$

$$inno3_{it} = \beta_0 + \beta_1 digital_{it} + \sum \beta_j control_{it} + \phi_{it} \quad (4)$$

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Secondly, the return of the intermediary variable to the green total factor productivity in the manufacturing industry

$$GTFP_{it} = \beta_0 + \beta_1 Digital_{it} + \beta_2 inno1_{it} + \sum \beta_j control_{it} + \gamma_{it} \quad (5)$$

$$GTFP_{it} = \beta_0 + \beta_1 Digital_{it} + \beta_2 inno2_{it} + \sum \beta_j control_{it} + \varphi_{it} \quad (6)$$

$$GTFP_{it} = \beta_0 + \beta_1 Digital_{it} + \beta_2 inno3_{it} + \sum \beta_j control_{it} + \delta_{it} \quad (7)$$

Among them, i, t represents region and period respectively; GTFP is total factor productivity of manufacturing industry; Digital is digital economy; inno1, inno2, inno3 is imitation innovation, technology introduction and independent innovation respectively; and control is a series of control variables.

4.2. Variable Measures and Description

1. Measurement of the High-quality development of the manufacturing industry

At present, there is no clear evaluation method for the high quality development of manufacturing industry, mainly focusing on comprehensive evaluation index system, total factor productivity, added value method (Li Qiang, 2020; Cheng Huifang and Lu Jiajun, 2014; Zhang Cheng and Zhao Gang, 2018,2018; Su Yongwei, 2020). Manufacturing "high quality" development is mainly characterized by strong innovation ability, high resource allocation efficiency, industrial structure optimization, high product quality, high economic benefits and good ecological benefits.To some extent, the green manufacturing industry can promote economic restructuring, reduce the proportion of fossil energy consumption, reduce pollutant emissions, and boost the realization of the "double-carbon" goal.Therefore, the Malmquist-Luenber (M L) production index proposed by Chung et al. (1997) is used to measure the green total factor productivity including resource consumption and environmental pollution.This paper determines the input and output factors by using the methods of Li Ling and Tao Feng (2012), Investment elements, The first is the capital stock, Estimated by using the perpetual drive method, Select the fixed asset investment price index, Adjusting at 2000, Get the required fixed asset investment price index, The second is the labor input, The average number of workers in manufacturing enterprises above designated size was selected as the proxy variable, Finally, the energy input, Select the total energy consumption of each province; Output elements, Classified into expected output and unexpected output, Among them is the expected output, This article selects the sales output value of manufacturing enterprises above the scale calculated by the market price, Unexpected output selects SO2 emission from COD, waste gas, one of the main pollutants in manufacturing wastewater.

2. Measurement of the digital economy

From the perspective of output, the digital economy is a more efficient, green and open new economy, which can promote High-quality economic development by changing traditional industries, optimizing the industrial structure and improving production efficiency.Digital industry plays an important role in the construction of modern industrial system, including industrial digital and digital industrialization scale, and the modern industrial system and economic management system, the party nineteenth to promote big data, cloud computing, Internet, artificial intelligence and real economy depth integration development, deepen digital

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technology, process, management, concept in traditional industry, as micro subject application of Internet technology in related economic activities, traditional economic service mode, technology form innovation breakthrough.Digital economy helps the construction of China's modern industrial system, and the integration of digital industry and digital is the fundamental change brought about by its development.

Table 1. Digital economic indicators

System layer	Code layer	Specific index measurement
Digital industrialization	Digital infrastructure	Internet Broadband access port
		Mobile phone switch capacity
		Long-distance cable line length
	Digital business scale	Total telecommunications business
		Software Business Revenue
Industrial digitization	Digital intelligence	Enterprises with e-commerce activities account
		E-commerce transaction volume accounted for GDP proportion
	Digital life	The proportion of online retail sales accounted
		Digital inclusive finance index
Digital governance	E-government	Number of number of government microblogs per 10,000 people
		The number of government headlines per ten thousand people

3. Measurement of technological innovation

At present, the measurement of technological innovation ability mostly starts from innovation input and innovation output, but the amount of innovation input more reflects the regional tendency of innovation path. Therefore, this paper measures the technological innovation ability from the investment of innovation capital.Imitation innovation (inno1) is measured by the proportion of technical transformation funds of industrial enterprises above designated size and main business income; technology introduction (inno2) measures the proportion of foreign technology investment funds and main business income of industrial enterprises above designated size; independent innovation (inno3) measures the proportion of internal funds of R&D and main business income.

4. Control variables

This paper considers the current situation of Chinese economic development and the influencing factors of the following control variables. First, the industrial structure (ind). Since China's economic growth mainly comes from the contribution of the secondary and tertiary industries, this paper expresses the proportion of the output value of the secondary industry and the regional GDP.Second, environmental regulation (r E).According to the "Porter hypothesis", appropriate environmental regulation will stimulate the technological innovation of enterprises, and use more advanced and efficient production technology to offset the cost of enterprise pollution treatment under environmental governance. This paper uses the proportion of environmental protection investment in the added value of the manufacturing industry as the environmental regulation index. Third, the level of marketization (mark). This paper measures the proportion of employment and total employment. Fourth, the Energy structure (en). It is reflected by the input ratio of raw coal and coke to the main energy sources. Fifth, Human Capital (hc). Human capital can meet the labor demand of labor in China's

ISSN: 2688-9323

manufacturing industry. This paper draws on the practice of Jiang Cailou et al (2012) and uses the proportion of population above the specialty as the index to measure China's human capital.

5. Empirical Inspection and Analysis

5.1. Analysis of the Benchmark Regression Results

To understand the correlation between each variable and the explained variable, a Pearson correlation test of the variables was required, indicating all significant correlation.Meanwhile, to avoid multiple collinearity, multiple collinearity tests for the variables are required before regression, indicating that there is no multiple collinearity between the various variables.

Table 2. The benchmark regression results

Variable	Benchmark regression
digital	0.442***
	(0.034)
re	0.0284**
	(0.014)
ind	0.097**
	(0.047)
mark	0.0017
	(0.003)
hc	0.0228***
	(0.008)
en	0.084***
	(0.028)
_cons	0.780***
	(0.091)
N	270
R square	0.495
F	114.300
P	0.000
Note: * * *, * *, * indicate significant at 1%, 5% and 10%, respectively	

As shown from Table 2, the F test P-value of the model is less than 0.05, so at the 5% significance level, the model is not all 0, i. e., the model overall is valid.

The regression coefficient of digital economy (digital) on green total factor productivity (gtfp) of manufacturing industry is 0.442 and significant at the level of 1%, so digital economy has a significant positive impact on green total factor productivity of manufacturing industry. For each unit increase in digital economy, the green total factor of manufacturing industry is increased by 0.442 units, assuming H1 is verified.The application of digital technology has changed the extensive growth mode of traditional manufacturing enterprises, reduced transaction costs, and thus improved production efficiency, and stimulated the competitive consciousness of enterprises, and driven the high-end transformation of manufacturing enterprises.

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5.2. Analysis of the Intermediary Effect of Technological Innovation

As we can see from Table 3, the F test P of the model is less than 0 than 0.05, so at the 5% significance level, the parameters of the model are not all 0, that is, the overall model is valid. as can be seen from model 2, the regression coefficient of digital economy (digital) (inno1) is negative, but not significant, indicating that the effect of digital economy is not significant on technology introduction. From model 3, the imitation innovation (inno1) on green total factor productivity of manufacturing (gtfp) regression coefficient is positive but not significant, so the mediation effect of imitation innovation is not significant in the relationship between digital economy and manufacturing green total factor productivity.

Table 3. Mediation effects

Variable	Imitative innovation		Technology introduction		Independent innovation	
	model 2	model 3	model 4	model 5	model 6	model 7
	inno1	gtfp	inno2	gtfp	inno3	gtfp
inno1		0.037				
		(0.026)				
inno2				0.245***		
				(0.048)		
inno3						0.123***
						(0.041)
digital	-0.060	0.445***	0.399***	0.345***	0.724***	0.353***
	(0.087)	(0.034)	(0.045)	(0.038)	(0.054)	(0.045)
re	-0.002	0.0284**	0.0397**	0.019	0.008	0.0274**
	(0.035)	(0.014)	(0.018)	(0.013)	(0.022)	(0.014)
ind	-0.463***	0.114**	0.114*	0.069	-0.018	0.0990**
	(0.118)	(0.048)	(0.061)	(0.045)	(0.074)	(0.046)
mark	-0.002	0.002	0.003	0.001	-0.002	0.002
	(0.006)	(0.003)	(0.003)	(0.002)	(0.004)	(0.003)
hc	-0.023	0.0236***	-0.011	0.0254***	0.002	0.0226***
	(0.021)	(0.008)	(0.011)	(0.008)	(0.013)	(0.008)
en	-0.051	0.0857***	0.034	0.0754***	0.019	0.0814***
	(0.071)	(0.028)	(0.036)	(0.026)	(0.044)	(0.027)
_cons	0.213	0.772***	0.255**	0.717***	0.463***	0.723***
	(0.230)	(0.090)	(0.118)	(0.087)	(0.143)	(0.091)
N	270	270	270	270	270	270
R square	0.314	0.491	0.299	0.537	0.534	0.379
F	2.910	98.750	33.570	112.380	70.220	102.730
P	0.000	0.000	0.000	0.000	0.000	0.000
Note: * * *, * *, * indicate significant at 1%, 5% and 10%, respectively						

Model 4-5 is analyzed from the technology introduction dimension, When examining the impact of the digital economy on technology introduction, The digital economy variable was significantly positive, And, through a 1% significance level, It shows that the digital economy can significantly enhance the technology introduction capacity, It is known from model 5, Technology introduction (inno2) showed significant positive manufacturing green total factor productivity (gtfp) regression coefficient, Therefore, it is shown that the technology introduction plays a significant role in promoting the positive impact of the digital economy on the total factor productivity of the manufacturing industry, Suppose that the H2a is verified; It

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was significant when considering both the digital economy and technology introduction variables, Moreover, when the impact coefficient of digital economy is lower than model 1, we do not consider the impact factor of digital economy when the technology is introduced, A three-phase test of the mediation effect is thus satisfied.

Model 6-7 is based on the result of independent innovation dimension test. In model 6, digital economy (digital) is significantly positive for independent innovation (inno3) regression coefficient. In model 7, independent innovation (inno3) is significantly positive for manufacturing green total factor productivity (gtfp) regression coefficient, which shows that independent innovation has a significant role in promoting the positive impact of digital economy on green total factor productivity of manufacturing industry.

In sum, compared with the regression coefficients of the three types of technological innovation, we can know that the regression coefficients of independent innovation are the largest, so the intermediary effect of independent innovation is the most obvious. The transmission path of "digital economy-Technology Innovation-High quality development of manufacturing industry" was established under independent innovation and technology introduction, but not under imitation innovation, confirming the hypothesis of H3. In today's era, China's manufacturing quality development put forward higher requirements for technological innovation, manufacturing high quality development needs high technology support, however, China is facing "neck" problem, core technology, then need independent innovation high-end technology or introduce cutting-edge technology, to stimulate the potential of digital economy, promote the development of manufacturing high quality.

5.3. Test of Robustness

In order to verify the reliability of the above conclusions, and considering the temporal continuity of the manufacturing industry, the manufacturing industry green total factor productivity lag phase I is included into the model, and the results are shown in Table 4.

Table 4. Benchmark regression robustness test

Variable	Benchmark regression
L.gtfp	0.179**
	(0.078)
digital	0.519***
	(0.035)
re	0.0237*
	(0.012)
ind	0.0758*
	(0.041)
mark	0.000962
	(0.002)
hc	0.00161
	(0.009)
en	0.0499*
	(0.027)
_cons	0.848***
	(0.099)
N	240

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Table 5. Test of the robustness of the mediation effects

Variable	Imitative innovation		Technology introduction		Independent innovation	
	model 1	model 2	model 3	model 4	model 5	model 6
	inno1	gtfp	inno2	gtfp	inno3	gtfp
L.gtfp		0.180**		0.143*		0.214***
		(0.078)		(0.077)		(0.076)
inno1		0.0253				
		(-0.0214)				
inno2				0.167***		
				(0.048)		
inno3						0.141***
						(0.033)
digital	-0.060	0.519***	0.399***	0.445***	0.724***	0.411***
	(0.087)	(0.035)	(0.045)	(0.040)	(0.054)	(0.042)
re	-0.002	0.0236*	0.0397**	0.018	0.008	0.0239**
	(0.035)	(0.012)	(0.018)	(0.012)	(0.022)	(0.012)
ind	-0.463***	0.0877**	0.114*	0.059	-0.018	0.0733*
	(0.118)	(0.043)	(0.061)	(0.041)	(0.074)	(0.040)
mark	-0.002	-0.001	0.003	-0.001	-0.002	-0.001
	(0.006)	(0.002)	(0.003)	(0.002)	(0.004)	(0.002)
hc	-0.023	-0.001	-0.011	0.002	0.002	-0.004
	(0.021)	(0.009)	(0.011)	(0.009)	(0.013)	(0.009)
en	-0.051	0.0509*	0.034	0.0520**	0.019	0.040
	(0.071)	(0.027)	(0.036)	(0.026)	(0.044)	(0.026)
_cons	0.213	0.838***	0.255**	0.829***	0.463***	0.761***
	(0.230)	(0.099)	(0.118)	(0.097)	(0.143)	(0.097)
N	270	240	270	240	270	240
Note: * * *, * *, * indicate significant at 1%, 5% and 10%, respectively						

The results showed that the return results of digital economy (digital) to manufacturing green total factor productivity (gtfp) remained significantly positive, and the regression coefficient of technology introduction (inno2) and independent innovation (inno3) was significantly positive for manufacturing green total factor productivity (gtfp).Except the coefficient and a few of variables in the level of significance, the symbol and significance were consistent with those in Table 5, and the main conclusions did not change.Therefore, the results of this study have a high reliability.

6. Conclusion and Policy Enlightenment

6.1. Research Conclusions

According to the above empirical results, the conclusion is that (1) digital economy has a significant positive effect on manufacturing productivity; (2) technology introduction and independent innovation can promote the positive effect of manufacturing; the digital economy in less developed areas; and the positive effect of digital economy in the less developed areas.In the (5) control variable, industrial structure has significant positive impact on high quality development of manufacturing industry; environmental regulation, human capital and energy structure have significant positive impact on high quality development of manufacturing industry.

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6.2. Policy Inspiration

First, we will comprehensively promote digital industrialization and industrial digitalization. The digital economy has significant regional differences in the High-quality development of the manufacturing industry. Different regions should take measures in line with local conditions and steadily promote coordinated and interconnected development between regions.The eastern region should vigorously improve the quality of the development of digital economy, increase the construction of new infrastructure such as research and development blockchain and 5G, artificial intelligence, broaden the scope of application of digital technology in manufacturing enterprises, accelerate the integration and penetration of information technology and industry, and accelerate the formation of digital industrialization. In the central and western region should use policy advantage and resources, increase the regional broadband, base station, pipeline, optical cable infrastructure construction, development and local industry corresponding digital technology development pilot, form a new model with regional industrial characteristics, new structure, fully release the digital economy to the manufacturing development dividend.

Second, we will improve our regional independent innovation capacity.In the era of digital economy, although imitation innovation and technology introduction can bring spillover effects and externalities, it can not bring long-term effects.Only by increasing the independent innovation and research and development capabilities of key digital technologies, and making leading achievements in the field of digital economy, can we truly realize the transformation from "Made in China" to "Intelligent Made in China".Facing the needs of leading breakthroughs in key areas and intelligent transformation in traditional fields, strengthen technological breakthroughs.Relying on the national key research and development plan and the "Core Fire Plan", we will strengthen the combination of industry, education and research, support the construction of a collaborative, efficient and open generic technology research and development platform, and promote the deep integration of the industrial chain, innovation chain, policy chain, talent chain and capital chain.In addition, independent innovation has extremely high requirements for talents. All regions should make advantage of regional educational advantages to cultivate compound high-end talents, formulate the construction of characteristic and advantageous disciplines of institutions of higher learning, increase subsidies for digital technology entrepreneurs, and encourage social members to actively participate in the activity of "mass innovation and innovation".

Third, we will vigorously foster innovation platforms.On the one hand, we will promote the construction of the manufacturing innovation center, promote the construction of industrial incubators, and adopt various forms such as network open incubation, industrial collaborative incubation, and internal enterprise incubation.On the other hand, speeding up the construction of a network service company integrating the digital economy and the real economy provides the integrated services of process optimization, business design, machine networking project implementation and system coordination for the digital transformation and upgrading of manufacturing enterprises.Accelerate the application of promotion and construction of the Internet of things platform, so as to guide large and small categories of manufacturing enterprises to the cloud platform, make full use of the massive amount of data, break through the industrial value chain, supply chain and innovation chain "circulation barrier" and "data island", promote the manufacturing optimization of resource allocation and total factor connection, promote manufacturing operation and innovation mode to sharing, efficient and collaborative transformation.

ISSN: 2688-9323

Acknowledgments

Anhui University of Finance and Economics Postgraduate Research and Innovation Fund Project "Digital Economy Drives the High-quality Development of Manufacturing Industry--An Empirical Study Based on the Perspective of Innovative Human Capital" (Project Approval Number: ACYC2020075).

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