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The Impact of the Digital Economy on Industry's Green Transformation

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Abstract: *In recent years, my country's economic development has changed from the pursuit of high speed to the purpose of high quality. Industry's green transformation is an urgent need for my country's economic growth. Based on the panel data of 287 prefecture-level cities from 2011 to 2019, this paper uses the entropy method to analyze the penetration rate of Internet usage, the input of relevant practitioners, the output changes of related industries, and the penetration rate of urban mobile phone consumption and inclusive digital finance. The five dimensions of the index construct the regional digital economy index and analyze the impact of the digital economy on the transformation of industrial greening. Empirical studies have found that the development of the digital economy can significantly reduce sulfur dioxide and nitrogen oxide emissions while reducing electricity consumption per unit of GDP. There is no significant effect on wastewater discharge and soot.*

Keywords: *industry's green transformation; digital economy; entropy method*

1. Introduction

At the 2019 China Digital Economy Expo, General Secretary Xi put forward important guiding opinions on the development of the digital economy. It is necessary to place the development of the digital economy in an important position, focus on promoting the development of the digital industry itself, and deepen the integration of the digital economy and the real economy.

Realizing the industry's green transformation is a prerequisite for promoting the high-quality development of the regional economy. In today's era, the digital economy is a new driving force for economic growth, and vigorously developing the digital economy is a significant prerequisite for realizing industrial greening.

The marginal contributions of this paper are as follows: First, there are many articles on the high-quality economic development of the digital economy, but there are still relatively few studies on the green transformation of the digital economy. Second. The sample of this paper is the panel data of 287 prefecture-level cities across the country from 2011 to 2019, and the data is rich to avoid chance. Third, this paper studies the impact of the digital economy on the green transformation of the industry through industrial structure and technological innovation based on the mechanism analysis of marginal effects, and the research is relatively comprehensive.

2. Literature review

2.1. Connotation of the digital economy

The concept of the digital economy can be traced back to "The Digital Economy: Prospects and Risks in the Era of Network Intelligence" in "Father of the Digital Economy" by Don Tapscott [1]. The significance and impact of the impact on the traditional economic and social model afterward. Tapscott emphasized that human beings will rapidly build an innovation network that combines wisdom, knowledgeability, and artistic creativity through new technologies and can make significant breakthroughs in the way of personal wealth value creation and the level of economic and social innovation development. Moulton [2] had also begun to generalize the digital economy into a new generation of the information technology industry and a new generation of e-commerce.

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2.2. Research on digital economy and industrial's green transformation

Deng Rongrong [3] believes that the vital essence of the transformation process of social green and the realization of sustainable economic development mode of environmental economics is to achieve a high degree of organic unity and coordination of the interests of the economic society and the environment. Liu Xinzhi[4] believes that developing the Chinese industrial digital economy can effectively integrate resources and promote the optimization of the division of labor and the deep integration of the network of production links in the traditional manufacturing industry, as well as the customization of large-scale production processes.

Therefore, the accelerated and healthy development of the digital economy will undoubtedly play a more and more critical role in promoting the safety, harmony, and balance of the urban environment and the earth's ecological space resources in my country and even the whole country.

On the one hand, the continuous and rapid development of the digital economy is also more conducive to governments of various countries to actively strengthen the environmental protection monitoring departments in multiple places through the analysis of water, gas, soil, noise, radiation, and pollution accidents and other vital nodes.

On the other hand, 5G, big cloud data, artificial intelligence network computing, and other new-generation large-scale digital service technologies at home and abroad are also accelerating the rapid interconnection and integration and collaborative service development supporting the real economy of Chinese enterprises. They effectively and rationally optimize and integrate various service management links of industry online and offline, front-end operations, and production and back-end management services. Therefore, the utilization rate of urban space energy resources can be improved, and the total amount of pollutants exceeding the standard and the discharge of production enterprises can be reduced.

3. Research design

3.1. Model construction

Build the following models for the research direct pass-through mechanism

$$Gp_{i,t} = \alpha_0 + \alpha_1 De_{i,t} + \alpha_2 X_{i,t} + \mu_i + \delta_t + \varepsilon_{i,t} \quad (1)$$

Formula (1) $Gp_{i,t}$ is the industrial's green transformation degree of the city i in period t, and $De_{i,t}$ is the indicator of the digital economy development level of the city i in period t, and the variable $X_{i,t}$ represents a series of control variables; μ_i represents the individual fixed effect of the city i that does not change with time, δ_t then Controls time fixed effects; $\varepsilon_{i,t}$ represents a random perturbation term.

3.2. Description of variables and measures

3.2.1. Measurement of industrial's green transformation

Many aspects jointly determine the level of industrial's green transformation. This paper starts from the industry's green production and considers the data's availability and completeness. The leading indicators are SO2 emissions per unit of GDP, nitrogen oxides emissions per unit of GDP, particulate soot emissions per unit of GDP, and wastewater emissions per unit of GDP. The empirical analysis is carried out separately as well as the electricity consumption per unit of GDP.

3.2.2. Digital economy level measurement (De)

Liu Jun[5] constructed a comprehensive index system for rational evaluation from three data dimensions: enterprise informatization management development, Internet application development research, and Internet digital asset transaction application development analysis. The development index system is the core of its measurement framework, and the idea of constructing the evaluation system framework of the urban digital credit trading platform is further added. At the same time, the statistical method of Huang Qunhui[6] was used for reference, and four important monitoring indicators

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were adopted, including the Internet usage penetration rate, the input of related practitioners, the output changes of related industries, and the urban mobile phone consumption penetration rate. At the same time, the China Digital Financial Inclusion Index is cited, and the index system has been jointly researched, hosted, and compiled by the former National Bureau of Statistics Information Center, Peking University Digital Finance Research Center, and other departments and the current leaders of the Ministry of Finance, Ant Financial Group, etc. Guo Feng thought.[7]

Through the entropy value method, the data of the above five indicators are standardized and then dimensionally reduced. The comprehensive development index of the digital economy is obtained, which is recorded as De.

3.2.3. Control variables

To more comprehensively analyze the spillover effect of the digital economy in the process of urban industry's green transformation, it is also necessary to set control variables that may have an impact on the industry's green transformation, as follows: per capita gross regional product (GDP), divided by gross regional product In terms of the total population of the region; fixed asset investment (FAI): expressed as the proportion of regional fixed asset investment in the regional GDP; foreign investment (FDI), defined as the ratio of the actual use of foreign capital to the provincial GDP; government fiscal expenditure (GOV), expressed in terms of government fiscal expenditure and GDP.

4. Empirical analysis

4.1. Benchmark regression results

Table 1 reports that after controlling for the control variables foreign investment, fixed asset investment, government expenditure, and per capita GDP, it is found that the digital economy has a significant negative correlation with sulfur dioxide emissions, nitrogen oxide emissions, and electricity consumption per unit of GDP, and wastewater discharge was negatively correlated but not significant.

Table 1: Correlation analysis of the impact of the digital economy on industrial's green transformation

Explanatory variables	SO2	NO	Smoke	Wastewater	EC
DE	-0.0818*** (.0199)	-0.0525054*** (0.0089447)	-0.0041153 (0.0071481)	-0.0235119 (0.0274123)	-0.2657564*** (0.0481337)
FDI	0.0332* (0.0212351)	-0.0153792* (0.009521)	0.0017212 (0.0076087)	-0.0410146 (0.0291786)	-0.0346937 (0.0512351)
FAI	-0.2549768*** (0.0290438)	-0.0888467*** (0.0130222)	-.0229194* (0.0104067)	-0.0422244 (0.0399085)	-0.5802863*** (0.0700758)
GOV	0 .2460753*** (0 .0710911)	0.1104974*** (0.0318746)	0.0053785 (0.0254726)	-0.1193338 (0.0976845)	0.7634316*** (0.1715255)
GDP	0.0322687* (0 .0197066)	0.0337347*** (0.0088357)	-0.002249 (0.007061)	-0.0759851** (0.0270783)	0.3914068*** (0.0475472)
CONS	0.152245 (2.102976)	-1.602116* (0.9428959)	0.5755883 (0.7535154)	12.37031*** (2.889649)	-32.10646*** (5.073972)
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Location fixed effect	Yes	Yes	Yes	Yes	Yes
R^2	0.509	0.621	0.521	0.379	0.603
Observations	287	287	287	287	287

4.2. Robustness test

In order to obtain a more robust regression result, this section adopts the principal component analysis method to analyze the digital economy index as a replacement variable for the digital economy index for the robustness test. The regression results of each explanatory variable by the principal component analysis index of digital finance and digital finance are shown in Table 2.

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Table 2: Robustness test of the impact of the digital economy on industrial's green transformation

Explanatory variables	SO2	NO	Smoke	Wastewater	EC
De1	-0.059892*** (0.016522)	-0.0340002*** (0.0074218)	0.0001079 (0.0059161)	-0.0053884 (0.0226892)	-0.1333177*** (0.0399843)

It can be found that the regression analysis using the principal component analysis method as the digital economy index still shows that the digital economy is significantly negative for sulfur dioxide, nitrogen oxides, and electricity consumption but not significant for soot emissions and wastewater emissions.

5. Conclusion and suggestions

5.1. Conclusion

Based on the panel data of 287 prefecture-level cities from 2011 to 2019, this paper analyzes the impact of the digital economy on the transformation of industrial greening. Empirical studies have found that the development of the digital economy can significantly reduce sulfur dioxide and nitrogen oxide emissions while reducing electricity consumption per unit of GDP. There is no significant effect on wastewater discharge and soot.

5.2. Suggestions

A green economy is one of the essential goals of my country's current economic development. Clear waters and lush mountains are invaluable assets and a necessary concept for our economic development. Improving the level of development of the digital economy can effectively help our industry undergo a green transformation, reduce exhaust emissions, and reduce energy consumption. Therefore, I feel that vigorously developing new Internet infrastructure and improving the level of the regional digital economy will help accelerate the green transformation of regional industries.

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