Analysis on the influence of digital economy on manufacturing transfer

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Abstract. Based on the panel data of 30 provinces in China from 2010 to 2020, the entropy method is used to measure the digital economy, and the fixed-effect model is used to explore the impact of digital economy on manufacturing transfer. The results show that: (1) The digital economy will have an inverted U-shaped impact on the manufacturing industry, that is, the digital economy will promote the transfer of manufacturing within a certain range, but after reaching a certain extent, it will inhibit the transfer of manufacturing; (2) An increase in the producer price index and a decline in the per capita road area will significantly promote the transfer of manufacturing; (3) The level of digital economy in Guangdong, Jiangsu and Zhejiang provinces is among the best.

Keywords: Digital economy, Manufacturing transfer, Entropy method, Fixed-effects.

1. Introduction

1.1. Background

In the 20th Congress report, there was a proposal to accelerate the development of the digital economy in China. This proposal emphasized the need to integrate the digital economy with the real economy, establish internationally competitive digital industry clusters, and expedite the construction of a digital China. As a result, top-level design documents such as the "Outline of the Digital Economy Development Strategy" and the "14th Five-Year Plan" have been issued to guide the development of the digital economy. These initiatives aim to actively promote the digitization of industries and facilitate the process of digital industrialization. It is evident that the digital economy plays a crucial role in facilitating the high-quality development of China's economy.

Additionally, China also attaches great importance to industrial transfer work. The optimization of industrial transfer is crucial for fostering coordinated regional development and expediting the establishment of a new development paradigm. In line with the objectives outlined in the 14th Five-Year Plan, China aims to streamline the layout of regional industrial chains, encourage the retention of pivotal segments within domestic borders, and bolster the capabilities of all regions to accommodate industrial transfers [1].

1.2. Definition of the digital economy

In 2016, the G20 adopted a comprehensive definition of the digital economy, referring to it as a set of economic activities that rely on digital knowledge and information as fundamental components of production [2]. The digital economy represents a new and distinct form of economic activity that emphasizes the critical role of digital knowledge and information as indispensable factors of production [3]. According to ChinaInfo100, the digital economy encompasses the collective information activities of an entire society, and it is a economy with digital information as the primary resource, relying on information network, and closely integrated with other fields through information

and communication technology, forming five types of digital economy: basic, convergence, efficiency, new generation, and welfare [4].

1.3. Definition of industrial transfer

Currently, there is no universally agreed-upon definition of industrial transfer academically, and Huang Tao points out that the reason lies in four aspects: industrial transfer is both a macro concept and a micro concept, it can be either a positive gradient transfer or a reverse gradient transfer, it can be caused by both endogenous and exogenous factors, and it is both a change in industrial scale and a change in competitive advantage [5].

1.4. Studies related to the influence effect of the digital economy

According to Chi Mingyuan and Shi Yannan, the digital economy incorporates digital elements into production, operation and circulation, which can not only optimize traditional industries, but also drive industrial structure upgrading [6]. Jiang Song and Sun Yuxin found that the relationship between the digital economy and the real economy follows an inverted "U" shape, and the impact on the eastern region exhibits "crowding out effect" [7]. Shen Yunhong and Huang Zhao divided the digital economy into three dimensions: digital infrastructure construction, development, innovation and research, and found through empirical research that all three factors can optimize the manufacturing industry structure [8]. Ma Zhongdong and Ning Chaoshan found that the digital economy plays a vital role in facilitating the enhancement of manufacturing quality by alleviating distortions in the allocation of labour and capital factors [9]. The non-linear impact of the digital economy on manufacturing competitiveness and the mediating effect [10].

The existing research literature in academia primarily focuses on the impact of the digital economy on industrial transformation and upgrading, as well as the optimization of industrial structure within the manufacturing sector. However, there are few studies that specifically analyzed the impact of digital economy on manufacturing transfer. Therefore, this study uses the entropy method to calculate the digital economy index using the panel data of 30 provinces in China spanning from 2011 to 2020, and adopts the fixed-effects model to explore the influence of digital economy on manufacturing transfer.

2. Model construction and description of its variables

2.1. Entropy method

In this study, the entropy method was used to assess the level of digital economy development in each province. The application of this method was referred to the study by Huang Qinghua et al [11]. The data were processed according to the entropy method. The weights of each indicator were assessed to measure the comprehensive digital economy index of each province:

$$\begin{cases} S_{it} = \sum_{j=1}^{n} W_j \times X_{itj}^{''}; \\ i = 1, 2 \cdots, 30; \\ t = 2011, 2012, \cdots, 2020; \\ j = 1, 2, \cdots, 14 \end{cases} \tag{1}$$

Where: S_{it} is the overall digital economy index for each province by year, W_j is the weight of the indicator, $X_{itj}^{''}$ is the standardized value, i denotes the province, t denotes the year and j denotes the indicator. The larger the index, the higher the level of digital economy development, and vice versa.

2.2. Fixed-effects model

To assess empirically whether the digital economy can have an impact on manufacturing transfer, the following panel data model is constructed:

$$T_{it} = a_0 + \beta S_{it} + \sum_{n=1}^{4} \gamma_n Z_{nit} + u_i + v_t + \varepsilon_{it} \quad (2)$$

Where T_{it} and S_{it} denote the level of manufacturing transfer and digital economy development in province i in year t respectively, Z_{nit} represent the series of control variables, β and γ represent the estimated coefficients of the variables, μ_i and ν_t denote the area and time fixed effects, respectively, and ε_{it} are random error terms.

2.3. Description of variables

(1) Explained variables

The manufacturing industry transfer (MIT) refers to the transformation of the industry and the optimization of industrial structure. Measured by the ratio of MVA to national MVA, it reflects the proportion of economic value produced by the manufacturing industries in their production process.

$$MIT = MVA_{ij} / MVA \quad (3)$$

i for province, j for year.

(2) Explanatory variables

Digital Economy (GEDI) is constructed by entropy methods, adopting the objective weighting entropy method of three-level index weighting to enhance the reliability of the results, and weighting to construct the index system. Level 2 indicators include digital infrastructure, digital innovation capability, digital coverage, digital industry development and government support. The detailed information are shown below in Table 1.

Table.1. Digital Economic Indicators

Target layer	Primary index	Secondary index	Tertiary index	direction
Evaluation Index System of Digital Economy	Digital economic indicators	Digital infrastructure equipment	Long-distance optical cable length	+
			Broadband access port	+
			R&D funding for industrial enterprises above the designated size	+
		Digital innovation capability	Number of high-tech enterprises	+
			Number of personnel in high-tech enterprises	+
		Digital coverage	Telephone penetration rate	+
			Number of digital TV users	+
			Internet access users	+
		Digital industry development	Number of digital publications issued	+
			The proportion of total telecom services to GDP	+
		Government support	R&D investment intensity	+
			Local finance expenditure on science and technology	+

(3) Control variables

Production price index (PPI). It is an index that reflects changes in the prices of inputs and final products in the industrial production sector and can measure the stability of national economic activities.

Salary level (WL). It is measured by the average wage of the employees in urban units, as it is the main indicator to reflect the wage level of the employees.

Road area (RA). This indicator is an important economic indicator that reflects the urban road ownership in the urban built-up area, and promotes the development of logistics, tourism, commerce and other aspects, thus improving the economic benefits of the city. This indicator measures the extent of urban development.

Labor Level (LL) refers to the average number of employees owned monthly or annually during the Reporting Period. It is used to measure the scale and development of an industry or an enterprise and reflects the people's social and economic characteristics and living conditions.

2.4. Data sources

This paper selects 30 provinces in the country from 2011 to 2020 as samples, establishes a panel database, and uses the entropy method in order to quantitatively measure the digital economic index. The original data are from China City Statistics Yearbook, China Science and Technology Statistics Yearbook, China Electronic Information Industry Statistics Yearbook and China Labor Conditions Yearbook, etc.

3. Regression results

3.1. Basic regression

Using the entropy method, we first calculated the development index of 30 provinces within our consideration. We find that Guangdong's digital economy is optimal, followed by Jiangsu and Zhejiang. Secondly, there is a positive correlation between manufacturing transfer and the development extent of the digital economy. As the core driving force, digital technology, with digital information as the main economic value-creating factor, is the most important driving force to stimulate the development of enterprises and achieve the effect of manufacturing industry transfer by enabling various industries and promoting their upgrading and transformation [15].

The regression results are shown below in Table 2. The results in column (1) of Table 2 indicates that for every unit added to a certain digital economic development index, the manufacturing transfer level in the region increases by 0.0301 units, which is significantly positive at the level of 1%. Section (2) is classified as the non-linear impact of the digital economy on manufacturing transfer. The impact on manufacturing transfer is prominent at a high level of 5%. Column (3) of Table 2 examines in detail the impact of digital economic development on manufacturing transfer through four control variables.The results show that the development level of digital economy is positively correlated with the transfer of manufacturing industry, and the impact coefficient is 0.0753, which is significant at the level of 10%.

Table.2. Regression Results of Digital Economy to Manufacturing Transfers

ED	MIT			2013-2020
	(1)	(2)	(3)	（4）
GEDI	0.0301***	0.0773**	0.0753**	0.0620**
	(0.0058)	(0.012)	(0.012)	(0.012)
GEDI2		-0.0803**	-0.0770**	-0.0575**
		(0.018)	(0.018)	(0.017)
PPI			0.0054***	0.0013***
			(0.005)	(0.005)
WL			-0.0016***	0.0019***
			(0.001)	(0.002)
RA			-0.0070***	-0.0018***
			(0.004)	(0.004)
LL			0.0265***	0.0207***
			(0.010)	(0.009)
cons	0.0270***	0.0223***	0.0124***	0.0168***
	(0.0015)	(0.002)	(0.007)	(0.006)
time	Yes	Yes	Yes	Yes
id	Yes	Yes	Yes	Yes
N	300	300	300	240

Pour: *, * *, * * * are significant at the levels of 10%, 5% and 1%, respectively, and the standard errors of each coefficient are shown in brackets.

3.2. Robustness test

For the robustness of the results, we changed the sample size to shorten the sample data to 2013-2020 for regression in our test. The results are shown above in Table 2(4). The positive and negative regression coefficients and their significance have not changed markedly, indicating robust results.

4. Conclusion

Based on the above regression results, we found that: 1. when the level of digital economy is low, it will promote the transfer of manufacturing, such as promoting the rational allocation of labor, capital. However, when digital economy becomes larger, it will inhibit the transfer of manufacturing, that is, the effect of the digital economy on the transfer of manufacturing is inverted U-shaped. 2. The coefficients of labor service level and average salary of employed persons were not significant; The rise of the production price index will significantly promote the transfer of manufacturing, that is, the increase in the production price index will lead to an increase in the cost of industrial enterprises, then enterprises will accelerate technological transformation and innovation to avoid rising costs; Urban roads are one of the traditional infrastructure, the decline in per capita road area means that the government for this aspect of infrastructure construction investment is reduced, that is, the government supports manufacturing transfer. 3. The top three provinces in the digital economy score in 2020 are Guangdong, Jiangsu and Zhejiang.

According to the analysis results, the following suggestions are put forward: 1. Strengthen the construction of digital economy infrastructure and promote the construction of digital infrastructure. 2. Drive digital transformation for your business. Enterprises should strengthen their own digital construction, improve the competitiveness and productivity of digital technology, and the government can encourage enterprises to accelerate digital transformation through subsidies and other policies, and encourage enterprises to carry out technological innovation. 3. Accelerate the development of digital talent. Talent is the main resource of competition, the development of digital economy requires

many talents to play their talents, support enterprises to cooperate with research institutes, universities, etc. to build talent training bases, and systematically carry out the teaching and practice of digital economy.

Although some conclusions have been drawn in this article, there are also shortcomings. This paper concludes that the role of digital economy on manufacturing transfer, but the mechanism of digital economy affecting manufacturing transfer is not concluded, and the specific ways and means are unclear. At the same time, the selected control variables are not significant and there is no way to explain them. Therefore, it is hoped that future literature can start from relevant aspects to solve these problems.

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