Research on the Influence of High-tech Industry Technology Innovation Investment Ability on High-quality Development--Empirical Analysis Based on Provincial Panel Data

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Abstract

Science and technology is the primary productive force, and also the inexhaustible driving force for high-quality development, so the research of technological innovation affecting high-quality development has become the focus of all sectors of society. Comprehensively improving the capacity for technological innovation is an important engine for high-quality development and an important guarantee for achieving sustainable economic development and improving the quality and efficiency of economic development. So this study on the basis of the existing literature, using the entropy right Topsis to 30 provinces of high quality development index and give the corresponding weight, and through the analysis of high technology industry technology innovation ability, build high technology industry technology innovation ability and high quality development model, analysis of the linear regression between the two, and through empirical study on the relationship between the two and influence mechanism. The evaluation of high technology industry technology innovation ability, how through high technology industry technology innovation ability to promote the development of high quality, is crucial, to explore high technology industry technology innovation ability to promote the development of high quality economic mechanism opened up a new perspective, to promote high technology industry technology innovation ability, accelerate the development of high quality provides a new way of thinking.

Keywords-*Technological innovation ability; high-quality development; entropy right Topsis; linear regression; empirical evidence; Demonstration*

1. Introduction

With the accelerating process of global economic integration, the competition between high-tech industries is increasingly fierce, and the core of the competition in high-tech industry lies in technological innovation. With the rapid development of China's economy and society, the existing economic development model no longer meets the current practical needs of China. In addition to innovative economic development, the development of the real economy is essential, among which the technological innovation of enterprises is an important breakthrough for high-quality economic development.

This paper takes the investment stage of technological innovation ability of high-tech industry as the entry point to discuss the influence relationship with high-quality development. When measuring the high-quality development level, the entropy right Topsis method is used to give weight to each index to ensure the objectivity of the measurement results. Through the linear regression test, the correlation between the technology innovation investment ability and high-quality development of high-tech industry is further proved.

For the research on the technological innovation ability of high-tech industry, foreign scholar A Coad (2008)[1] linked innovation to the sales growth of existing companies in four high-tech fields, and observed that innovation is crucial for a few "superstar" rapidly growing companies. N Aramburu (2009)[2] empirically tests the influence of different knowledge

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sharing mechanisms on enterprises 'innovation ability, and points out that knowledge sharing is a key issue to improve enterprises' innovation ability. V Chiesa (2011)[3] discusses the relationship between the introduction of high-tech innovation to the market and its commercial success or failure, pointing out that the diffusion process is continuous in the diffusion of social system innovation. Domestic scholar Hu Jihua (2010) [4]studied the status quo of the enterprise technology innovation ability, and proposed that the enterprise technology innovation ability mainly focuses on the promotion ability of the innovation subjects and meeting the needs of customers. Cao Xing (2013)[5] discussed the key factors for the formation of independent innovation capacity of strategic emerging industries, including: scientific and technological talents, innovation environment and cooperative innovation. Dai Shuchun (2015)[6] proposed that the development of the technological innovation ability of science and technology enterprises should be divided into three stages: formation, cultivation and promotion.

Due to the deepening role of high technology industry in the process of economic development, such as the main business income and total profit increase year by year, so China now pay more attention to high-tech industry, the total number of high-tech enterprises and high-tech industry employees basic growth trend, as shown in figure 1 and 2.

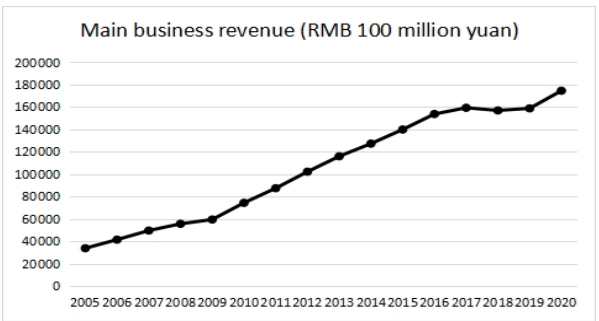

Figure 1 Main business revenue (RMB 100 million yuan)

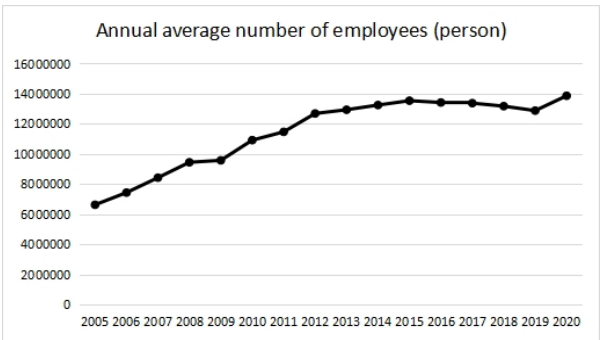

Figure 2 Annual average number of employees (person)

To sum up, high-tech industry is the source and driving force of high-quality economic development.

Foreign studies similar to China's "high-quality development" are mainly studies on the quality of economic growth. Mlachila M et al. (2016)[7] believe that developing countries have put forward a new growth quality index, namely QGJ, and that the main factors are: political, financial, institutional and foreign direct investment, and define the quality of economic development as a broad concept. Frolov et al. (2018)[8] proposed a scientific method for the quality of economic growth, which is based on the matrix method and combines the annual average rate and per capita development index. The domestic research on high-quality economic development is mainly conducted from the micro, medium and macro aspects. Huang Sujian et al. (2018)[9], Shibo (2018)[10] and other scholars believe that the high-quality economic development at the micro level is reflected in the high-quality individual development, and the high-quality individual development will ultimately promote the high-quality development at a higher level. That is to promote the overall development of high quality by increasing innovation investment and efficiency to complete the enterprise from scale to efficiency; the high quality development is industrial development quality and industrialization quality, and largely depends on the overall quality of the enterprise; the high quality development is the operation quality of national economy and the quality and efficiency of economic growth and development. Wang Yiming (2018)[11] believes that the essence of high-quality development is to build a matching institutional environment, which is embodied in improving macro-control while making continuous innovation.

After sorting out and reading the above literature, this paper summarizes the research conclusions on "high-tech industry technology innovation ability" and "high-quality economic development", and analyzes the insufficient research based on the conclusions, and thus obtains the direction of future research.

2. THEORETICAL LOGIC AND MECHANISM OF ACTION

Technological innovation refers to the innovation of production technology, including the development of new technologies, or the application and innovation of existing technologies. Science is the source of technology, technology is the source of industry. Technological innovation is based on the discovery of scientific truth, and industrial innovation is mainly based on technological innovation. It will then promote high-quality economic development. In order to further explore the theoretical logic and function mechanism of high-tech industry technology innovation investment ability to promote high-quality economic development, this paper constructs the path map of high-tech industry technology innovation ability to affect high-quality

economic development, as shown in Figure 1. The following assumptions are put forward: (1) the ability of technological innovation investment in high-tech industry directly affects the high-quality economic development. (2) The technological innovation investment capacity of the high-tech industry affects the high-quality economic development by affecting the industrial agglomeration. (3) The technological innovation investment ability of high-tech industry affects the high-quality economic development by affecting the talent agglomeration.

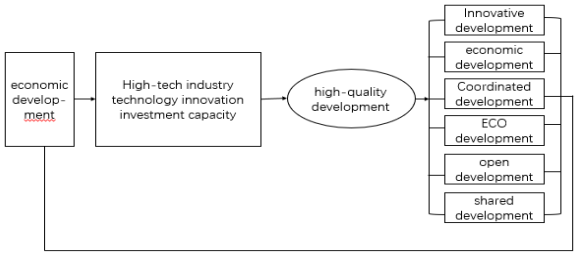

Figure 3 The theoretical framework of this research

3. Materials and Methods

3.1. Selection of indicators

3.1.1. explained variable

In most of the studies conducted by domestic scholars, Establish indicators for high-quality development, Mainly based on the five major development concepts, Combined with some foreign development indexes, For example, the EU's Composite Index for Sustainable Development (Sustainable Development Indicators, SDIs), the green growth index in the Netherlands, the new welfare index in Germany (National Welfare Index, NWI), the US New Economic Index (NewEconomy Index, NEI) and the United Nations Social Progress Index (Social Progress Index, SPI) wait a minute, Based on the above research, from the economic development, innovative development, coordinated development, green development, open development and shared development selected from six aspects of 27 indicators to build a high-quality development index system, This is shown in Table 1.

TABLE 1 High-quality development system

Target layer	The standard layer	Level 1 indicators	Secondary indicators	Indicator measure	unit	Indicator attribute
Based on the five major development concepts High-quality development Index（Development）	innovative development	Innovation investment	R & D funding input intensity	R & D Expenditure / GDP	%	+
			Number of R & D employees	R & D personnel full-time equivalent	man-year	+
		Innovative output	Per capita patent possession	Number of three domestic patents granted / total population	A / person	+
			Technology market turnover proportion	Technology market turnover / GDP	%	+
			The proportion of science and technology employees employed	Number of science and technology practitioners / number of employees	%	+
	economic development	commercial efficiency	economics of scale	Regional per capita GDP	Yuan	+
			productivity of labour	GDP / average number of employees	Yuan / person	+
			level of consumption	Total retail sales / GDP	%	+
			The level of government fiscal expenditure	Government fiscal expenditure / GDP	%	+
	harmonious development	Urbanization rate	——	Urbanization rate	%	+
		Industrial structure is advanced level	——	Industrial structure advanced index	-	+

		Reasonable level of industrial structure	——	Thil index measured by the proportion of employees and output value	-	-
		Coordination between urban and rural areas	Coordination between urban and rural incomes	Urban-rural income ratio	-	-
			Coordination level between urban and rural consumption	Urban-rural consumption level ratio	-	-
	green development	resource consumption	Energy consumption per unit of GDP	Total energy consumption (ton of standard coal) / domestic (regional) GDP (ten thousand yuan)	ton of standard coal / ten thousand yuan	-
			Electricity consumption per unit of GDP	Total electricity consumption / GDP	One hundred million KWH / 100 million yuan	-
		Pollution reduction	Industrial pollution control situation	Total investment in industrial pollution control was completed	100 million	+
			Household waste disposal situation	harmless disposal rate of household garbage	%	+
		Green environmental protection	Ecological improvement	land area covered with trees	%	+
			Urban greening	Green coverage rate of the built-up area	%	+
	Open development	——	Foreign trade dependence degree	Total imports and exports / GDP	%	+
			Scale of foreign investment	Total foreign direct investment	billions of dollars	+
			Scale of foreign-invested enterprises	The proportion of industrial enterprises in Hong Kong, Macao and Taiwan above designated size, and foreign-funded enterprises	%	+
	Shared development	Hard and fast facility level	medical level	Number of beds in health institutions per capita	-	+
		Soft facility level	educational level	Per capita education expenditure	-	+
			cultural standing	Per capita has the possession of public libraries	-	+
		——	Social security and employment level	Social Security and Employment expenditure / GDP	%	+

In order to eliminate the influence of the dimensions between the data, this paper first standardizes the original data of 30 provinces from 2010-2019, and then measures them with the entropy weight Topsis. The resulting index weights are shown in Table 2.

TABLE 2 High-quality development system

The weight results are calculated by the entropy method					
	nape	Information entropy value e	Information utility value d	weight coefficient w	
innovative development	R & D funding input intensity	0.912	0.088	3.47%	37.69%
	R & D personnel full-time equivalent	0.8962	0.1038	4.09%	
	Per capita patent possession	0.8209	0.1791	7.06%	
	Technology market turnover proportion	0.6832	0.3168	12.48%	
	The proportion of science and technology employees employed	0.7313	0.2687	10.59%	
economic development	economics of scale	0.9332	0.0668	2.63%	9.07%
	productivity of labour	0.9463	0.0537	2.12%	
	level of consumption	0.9765	0.0235	0.92%	
	The level of government fiscal expenditure	0.9137	0.0863	3.40%	
harmonious development	Urbanization rate	0.9393	0.0607	2.39%	10.55%
	Industrial structure advanced index	0.8732	0.1268	5.00%	
	Rationalization index	0.9791	0.0209	0.82%	
	Coordination between urban and rural incomes	0.971	0.029	1.14%	
	Coordination level between urban and rural consumption	0.9696	0.0304	1.20%	
green development	Energy consumption per unit of GDP	0.9816	0.0184	0.72%	8.41%
	Electricity consumption per unit of GDP	0.9891	0.0109	0.43%	
	Investment in industrial pollution control was completed	0.9235	0.0765	3.01%	
	armless disposal rate of household garbage	0.9712	0.0288	1.13%	
	land area covered with trees	0.9422	0.0578	2.28%	
	Green coverage rate of the built-up area	0.9787	0.0213	0.84%	
open development	Foreign trade dependence degree	0.8503	0.1497	5.90%	18.07%
	Scale of foreign investment	0.8295	0.1705	6.72%	
	Scale of foreign-invested enterprises	0.8831	0.1169	4.61%	
Shared development	medical level	0.942	0.058	2.29%	17.04%
	educational level	0.8669	0.1331	5.25%	
	cultural standing	0.8469	0.1531	6.03%	
	Social security and employment level	0.912	0.088	3.47%	

3.1.2. explained variable

Investment ability of technology innovation: This paper measures the internal expenditure of R & D funds of high-tech industry. Because the data is represented as traffic, it needs to be converted into stock by the perpetual inventory method. Depreciation rate before

the reference study 15%, the domestic research using Zhu Pingfang method, give PIc (consumer price index) 55% weight, PIi (fixed assets investment price index) 45% weight, and the international usually use PPI (factory price index) and GDP implied price index weighted average to represent R & D (spending price index), the weight of both indexes are 50%. In order to make the index more reasonable, this paper on the one hand refers to Zhu Pingfang's method, on the other hand, the weight of the two, that is, PIc52.5% weight, PIi47.5% weight.

3.2. Model building and data source

To test the direct influence of the technological innovation investment capacity of high-tech industry on high-quality development, the following model is designed:

$$HQ_{it}=\alpha HTT_{it}+\mu_{it} \quad (1)$$

Among them, HQ_{it} represents the high quality level in the t year of i province, and HTT_{it} represents the investment ability of high-tech industrial technology innovation in the t year of i province, which is the regression coefficient of the explanatory variable, it pseudo-random disturbance term.

In this paper, the relevant data of 30 provinces (municipalities and autonomous regions) from 2010 to 2019 were selected for analysis. Due to the data integrity problems, Hong Kong, Macao, Macao and Tibet are excluded. Other individual missing data were complemented by the mean method. The data are from the National Statistical Yearbook, China Statistical Yearbook of China High-tech Industry, China Science and Technology Statistical Yearbook, China Employment and Population Yearbook and so on.

4. Results & Discussion

4.1. descriptive statistics

TABLE 3 Descriptive statistical results of the linear regression

	sample number	minimum	maximum	average value	standard deviation
High-quality development	300	0.0884465	0.7041012	0. 91988	0.13051
Internal expenditure for high-tech industries	300	6.52	17.51	13.321	1.96854
Effective cases (in columns)	300				

Table 3 presents the descriptive statistical results of the variables used in this paper. Among them, the average high-quality economic development index is 0.2400, the maximum value is 0.7041, and the minimum value is 0.0884, indicating that there are great differences in the level of high-quality economic development among regions in China. In the statistics of internal expenditure, the average is 13.3218, the maximum is 17.51, and the minimum is 6.52. The large gap shows that there is also a big difference in the internal expenditure level of high-tech industries between regions in China.

4.2. Linear regression statistics

TABLE 4 linear regression coeffficient

coefficienta						
model		No standardized coefficients		Standardization coefficient	t	conspicuousness
		B	standard error	Beta		
1	(constant)	-0.259	0.043		-6.075	0.000
	Internal expenditure for high-tech industries	0.037	0.003	0.565	11.829	0.000

According to the linear regression statistics, the significance of the $p<0.05$, That is, the internal expenditure of high-tech industry funds has a significant impact on high-quality development.

5. Conclusions

Through empirical research, this paper proves that the influence of high-quality development is significant, and the relationship between the investment ability of high-tech industry technology innovation and high-quality development is positively correlated, but there is also uneven regional development, so the policy Suggestions in this paper is as follows: (1) should actively improve technology innovation ability, and reasonable allocation of resource input, and strengthen its direct influence on the development of high quality. (2) Grasp the trend of science and technology development, use technological innovation to improve the efficiency and quality of the industry, achieve a qualitative leap, and provide a solid foundation for high-quality development. (3) Formulate technological innovation and high-quality economic development strategies in line with the actual regional development according to local conditions. China's technological innovation capacity of high-tech industry and high-quality economic development in inter-regional development show different characteristics. The policy supply should fully consider the factors of regional economic development level, industrial structure reality, ecological environment and other factors, and implement differentiated policies in line with the development stage of regional development.

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