

Research on Evaluation of Industrial Investment Efficiency in Anhui Province

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ABSTRACT. Firstly, this paper analyses the basic situation of industrial investment in Anhui from the aspects of total industrial investment and growth rate, industrial investment structure, industrial technology reform investment and so on. Then, the efficiency of industrial investment in Anhui from 2014 to 2018 is evaluated by using the efficiency coefficient of industrial and the super-efficiency DEA model. The evaluation results show that the efficiency coefficient of industrial investment in Anhui is generally good, but the fluctuation of the efficiency coefficient of industrial investment is large and the regional differences are large. The value of the efficiency coefficient of industrial investment is generally on the rise, but the regional differentiation is obvious. Finally, the paper puts forward some countermeasures and suggestions on how to improve the efficiency of industrial investment.

KEYWORDS: industrial investment, efficiency evaluation, the efficiency coefficient method, super-efficiency DEA model

1. Introduction

In recent years, facing the complex and changeable development environment, Anhui resolutely carries out the "six stable" decision-making deployment of the central government, strengthens investment guidance, highlights project support, and maintains a good situation of industrial investment, which provides a strong support for the sustained and healthy development of the economy [1]. The driving force of economic development is reflected not only in the growth of investment scale, but also in the improvement of investment efficiency. To this end, Anhui has further promoted the technological transformation of industrial enterprises, and the investment in technological transformation has been accelerating, which provides strong support for the realization of high-quality industrial development. However, the efficiency of industrial investment still needs to be improved, and the efficiency of industrial investment in different regions is quite different. In order to further

improve the efficiency of industrial investment in Anhui Province, this paper, based on the analysis of the basic situation of industrial investment in Anhui Province, evaluates the efficiency of industrial investment in Anhui Province by using the method of industrial investment benefit coefficient and the super-efficiency DEA model, puts forward the existing problems of industrial investment, and puts forward some countermeasures and suggestions on how to improve the efficiency of industrial investment.

2. Analysis of the Basic Situation of Industrial Investment

This paper analyses the basic situation of industrial investment in Anhui from the aspects of total industrial investment and growth rate, industrial investment structure and investment in industrial technological transformation.

2.1 Rapid growth of total industrial investment

Since 2005, Anhui has continuously strengthened investment guidance, highlighted project support, made comprehensive efforts in policies and measures such as strong provinces and private economy, and achieved rapid growth in industrial investment [2]. Total industrial investment increased from 91.679 billion yuan in 2005 to 1615.349 billion yuan in 2018, an increase of 24.8% over the same period, and the growth rate was faster than that of national industrial investment in the same period. Detailed data are shown in Table 1.

Table 1 Total and Growth Rate of Industrial Investment in Anhui and the whole country

Unit of measurement: 100 million yuan, %

year	Total	Growth Rate	Total in China	Growth Rate
2005	916.79	46.11	37283.74	35.79
2006	1397.03	48.04	46890.21	25.55
2007	2149.21	53.17	59388.38	26.39
2008	2792.94	29.97	74761.38	25.99
2009	3656.21	33.11	93406.39	25.00
2010	5012.15	41.04	114437.17	22.32
2011	5714.22	10.60	128264.76	11.99
2012	6898.92	19.20	153592.48	19.67
2013	8134.80	18.6	181026.11	17.78
2014	9265.16	13.23	204515.00	12.45
2015	10568.76	14.10	219957.00	8.00
2016	11588.10	9.60	227892.00	3.61
2017	12943.50	12.70	232618.76	2.07
2018	16153.49	24.80	247738.98	6.50

2.2 Continuous optimization of industrial investment structure

In recent years, Anhui has steadfastly carried out the structural reform of supply side, vigorously promoted the implementation of innovation-driven development strategy, continuously optimized its industrial investment structure, and the contribution rate of manufacturing investment to industrial investment has been increasing [3].

First, manufacturing investment has become an important driving force for investment growth. The investment in manufacturing industry increased from 60.468 billion yuan in 2005 to 3443.948 billion yuan in 2018. The contribution rate of manufacturing investment to the growth of total investment increased from 46.72% in 2005 to 67.8% in 2018. Second, the contribution rate of manufacturing investment to industrial investment is further increased. The contribution rate of manufacturing investment to industrial investment increased from 51.90% in 2005 to 98.1% in 2018. In the past 10 years, the contribution rate has been in a fluctuating upward trend, but the contribution rate to industrial investment has further increased.

2.3 Rapid growth of investment in industrial technological transformation

In recent years, Anhui has redeployed and mobilized its industrial investment targets, key tasks and safeguards, implemented a new round of large-scale technological transformation of industrial enterprises with higher quality and level, and promoted the work of industrial technological transformation to a new level. From the perspective of investment in technological transformation of manufacturing industry, the investment in technological transformation in Anhui Province maintained a high growth in 2018. The total number of enterprise above designated size implementing technological reform in Anhui Province reached 9153. The investment in technological transformation increased by 34.6% year-on-year, ranking fourth in the country, increasing by 16.6 percentage points over the previous year, reaching a new high in the same period since 2012. Investment in technological transformation is 23.8% higher than that in industry and 22.8% higher than that in fixed assets, respectively[4]. Among them, the investment in technological transformation in manufacturing industry has accelerated, increasing by 36% compared with the previous year, which is 1.4 percentage points higher than the total investment in technological transformation, and the growth rate has increased by 17.7 percentage points compared with the previous year.

3. Analysis of Industrial Investment Efficiency

Promoting the steady and healthy development of industrial economy requires not only a certain investment scale as a guarantee, but also the continuous improvement of industrial investment efficiency. Next, the efficiency of industrial investment is evaluated from two aspects: the efficiency coefficient of industrial investment and the efficiency value of industrial investment.

3.1 Analysis of the efficiency Coefficient of Industrial Investment

The efficiency coefficient of industrial investment can be expressed by the ratio of the added value of industrial investment to the total amount of industrial investment[5]. Based on the added value of industrial investment and total industrial investment of 16 cities in Anhui Province, the efficiency coefficient of industrial investment of each city in Anhui Province from 2014 to 2018 is obtained, as shown in Table 2.

Table 2 The efficiency Coefficient of Industrial Investment of 16 cities in Anhui Province

Region	2014	2015	2016	2017	2018
Hefei	0.073	0.061	0.010	0.088	0.099
Huaibei	-0.007	-0.090	-0.068	0.066	0.003
Bozhou	0.051	0.058	0.008	0.066	0.055
Suzhou	0.044	0.046	0.022	0.048	0.046
Bengbu	0.195	0.134	0.061	0.090	0.003
Fuyang	0.246	0.173	0.082	0.126	0.121
Huainan	-0.236	-0.053	0.006	0.096	0.040
Chuzhou	0.088	0.073	0.016	0.104	0.068
Luan	0.088	-0.146	-0.013	0.069	0.080
Ma'anshan	0.026	-0.023	0.025	0.045	0.034
Wuhu	0.102	0.028	-0.019	0.065	0.058
Xuancheng	0.073	0.027	0.010	0.048	0.042
Tongling	0.011	0.138	-0.002	0.269	0.047
Chizhou	0.072	0.034	0.006	0.028	0.032
Anqing	0.123	-0.068	0.042	0.069	0.054
Huangshan	0.080	-0.029	0.020	0.107	0.096

From table 2, we could get as follows.

Firstly, the efficiency coefficient of industrial investment in Anhui is generally good. In the past five years, the efficiency coefficient of industrial investment in most cities in Anhui Province has been on the rise, and 9 of the 16 cities have been on the rise. It can be seen that the efficiency coefficient of industrial investment of more than half of the cities in Anhui shows an obvious upward trend, and the efficiency coefficient of industrial investment is better.

Secondly, the efficiency coefficient of industrial investment fluctuates greatly in Anhui. From 2014 to 2016, except Huainan City, the efficiency coefficient of industrial investment of 15 cities in Anhui Province showed a cliff-like decline. The efficiency coefficient of industrial investment of Huaipei, Luan, Wuhu and Tongling in 2016 fell below the negative value, and the efficiency of industrial investment showed a negative growth. From 2016 to 2017, the efficiency coefficients of industrial investment of 16 cities in the province showed a straight upward trend,

and those of Huaibei, Luan, Wuhu and Tongling changed from negative to positive. From 2017 to 2018, the efficiency coefficients of industrial investment of Hefei, Luan and Chizhou were higher than those of 2017, while the efficiency coefficients of industrial investment of the other 13 cities showed a downward trend.

Thirdly, the efficiency coefficient of industrial investment varies greatly in different regions in Anhui Province. Over the past five years, the average value of the efficiency coefficient of industrial investment has shown a marked downward trend in the three regions of northern Anhui, central Anhui and southern Anhui. The efficiency coefficient of industrial investment decreased from 0.049 to 0.045 in northern Anhui, from 0.083 to 0.082 in central Anhui, and from 0.07 to 0.052 in southern Anhui, which decreased by 0.004, 0.001 and 0.018, respectively. From the comparison of cities in different regions, the efficiency coefficients of industrial investment of Bengbu and Fuyang in northern Anhui Province showed a downward trend, while those of Wuhu, Xuancheng and Chizhou in southern Anhui Province showed a downward trend. The efficiency coefficients of industrial investment of three cities in central Anhui Province except Hefei showed a downward trend. The main reason is that the rapid development of Hefei city has a siphon effect on the dominant industries in the nearby cities.

3.2 Analysis of the Value of Industrial Investment Efficiency

Table 3 The Value of Industrial Investment Efficiency of 16 cities in Anhui Province

Region	2014	2015	2016	2017	2018
Hefei	0.758	0.701	0.738	0.771	0.835
Huaibei	0.751	0.660	0.864	0.944	0.875
Bozhou	0.497	0.422	0.500	0.489	0.446
Suzhou	0.369	0.384	0.463	0.422	0.432
Bengbu	0.577	0.571	0.622	0.645	0.628
Fuyang	0.821	0.846	0.948	1.084	1.192
Huainan	0.479	0.379	0.519	0.530	0.873
Chuzhou	0.459	0.521	0.548	0.669	0.568
Luan	0.532	0.546	0.659	0.586	0.726
Ma'anshan	0.456	0.421	0.446	0.460	0.375
Wuhu	0.595	0.614	0.634	0.596	0.643
Xuancheng	0.490	0.420	0.453	0.461	0.360
Tongling	1.298	0.871	0.880	0.931	0.936
Chizhou	0.317	0.316	0.379	0.404	0.335
Anqing	0.496	0.488	0.578	0.599	0.602
Huangshan	1.420	1.526	1.406	1.298	0.886

DEA data envelopment analysis (DEA) is the most effective non-parametric method for evaluating efficiency. Based on the concept of relative efficiency, it calculates and compares the relative efficiency of decision-making units by using

mathematical programming model, and evaluates the evaluation objects. It is suitable for the comprehensive evaluation of the effectiveness of decision-making units with multiple inputs and outputs. The CCR and BCC models in the traditional DEA model can no longer compare many decision-making units with efficiency value of 1 and easily ignore the relaxation variables, while the super-efficiency DEA model can effectively overcome the above shortcomings[6]. The super-efficiency DEA model is used to evaluate the efficiency of industrial investment in Anhui, in which the investment amount of industrial fixed assets is the input variable, and the industrial added value and main business income are the output variables. From 2014 to 2018, the efficiency of industrial investment in Anhui is listed in Table 3.

From table 3, we could get as follows:

First, the efficiency of industrial investment in Anhui cities is on the rise. From 2014 to 2018, the industrial investment efficiency of most cities in Anhui Province showed an overall upward trend, with 11 out of 16 cities showing an upward trend. In 2018, with the slowdown of national economic growth and the intensification of international trade frictions, there are still eight cities in Anhui, namely Hefei, Huaibei, Suzhou, Huainan, Lu'an, Wuhu, Tongling and Anqing, whose industrial investment efficiency value has increased against the trend.

Secondly, there are obvious regional differences in the efficiency value of industrial investment in Anhui. From 2014 to 2018, the efficiency of industrial investment in five of the six cities in northern Anhui showed an upward trend, that in three cities in central Anhui showed an upward trend, and that in only three of seven cities in southern Anhui showed an upward trend. In 2018, the industrial investment efficiency of three cities in northern Anhui showed a downward trend, only one city in central Anhui Province showed a downward trend, and four cities in southern Anhui Province showed a downward trend, accounting for half of the total number of cities whose efficiency value had declined. The main reason is that with the implementation of the five development concepts and the construction of the international cultural tourism demonstration zone in southern Anhui, the southern Anhui region pays more and more attention to the protection of ecological environment, vigorously develops tourism and service industries.

4. Conclusions and suggestions

4.1. Conclusions

1). The amount of industrial investment in Anhui Province has increased rapidly, the structure of industrial investment has been continuously optimized, and the investment in industrial technological transformation has increased rapidly. 2). The efficiency coefficient of industrial investment of each city in Anhui Province is generally better, the fluctuation of the efficiency coefficient of industrial investment is larger, and the regional difference of the efficiency coefficient of industrial investment is larger. 3). The value of Industrial investment efficiency of each city in

Anhui Province shows an overall upward trend, and the regional difference of the value of Industrial investment efficiency is obvious.

4.2. Suggestions

Based on the research conclusion, the paper puts forward some countermeasures and suggestions to improve the efficiency of industrial investment in Anhui Province. Firstly, we should strengthen policy guidance and optimize investment structure. Secondly, we should increase investment in science and technology to promote the transformation and upgrading of manufacturing industry. Thirdly, we should strengthen management mechanism to improve project quality and efficiency. Fourthly, we should coordinate regional development and narrow the investment gap.

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