Study on Effect of Higher Education to the Upgrading of Industrial Structure

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Abstract: Taking Hebei province of China as an example, This article analyses and discloses the correlation between higher education and industrial structure. By calculating the deviation of industrial structure and regression coefficient, it is shown that the level and structure of higher education will affect industrial structure and the development of higher education will promote the optimization and upgrading of industrial structure. On the base of above, the article at last proposes some suggestions to deepen higher education reform to promote industrial development.
Keywords: Industrial structure; Deviation; Regression; Education reform

1 Introduction

Since entering the new century, our economy has achieved relatively fast growth, especially in the "Eleventh Five-Year" period. But there is still economic imbalance in each province. The unreasonable industrial structure is one of the most important factors which restricts the economy development. Therefore improving and adjusting industrial structure are very important. The experience from other countries has shown that the industrial structure adjustment can bring a series of changes on the employment structure and such new society reform will certainly cause the corresponding adjustment in educational structure[1], model and personnel training.Furthermore, the situation of education and employment structure will also affect industrial structure.

The problem to disclose the relationship of higher education and industrial structure is paying much attention in academic field. He Wanning(2003) proposed that the type structure, overall arrangement structure, hierarchical structure and discipline structure of higher education should match the economic structure, industrial structure, technological structure and composition of trained personnel; and we should enable the development of higher education to offer the support of intelligence and talent for adjustment, optimization of Guangdong's industrial structure, contributing to the primary realization of modernization in Guangdong as the first province. Li Yongdong (2006) studied the relationship between Sichuan's industrial structure and that of higher education in the province. He pointed out that the technology and the talanted person are main factors of affecting industrial promotion and economic development. And the development of higher education is the key measure to promote the development of technology and personnel training. Zhou Jianan(2006) drew the conclusion in his paper that that industrial upgrading is of most relevant to the tertiary industry while employment of the society is on the contrast end, thus to speed up the development of the tertiary industrial is crucial to the industrial upgrading of our country and it is, consequently, a most important step to enlarge employment in the tertiary industry for the purpose of industrial upgrading of our country.

This paper, taking Hebei province as an example, analyses the relationship between industrial structure and higher education, Its aim is to achieve the result that the development of higher education can promote the upgrading of industrial structure. The remainder of the paper is laid out as follows. Section 2 is situation of industrial structure in Hebei province. Section 3 is the analysis of structure deviation and section 4 is the analysis of regression. Section5 presents the conclusion and proposal.

2 Research Method, Results and Analysis

2.1 Industrial situation in Hebei province

Industrial structure is the proportional relationship of factors of production in various businesses, industries and sectors. Economic situation in Heibei province changes with each passing day and it places an important role in the whole country. The industrial structure in Hebei province has been adjusted accordingly. Since 1980s, the ratio of primary industry to GDP has dropped gradually, the ratio of secondary industry has developed gently, and the ratio of tertiary industry has risen year by year, which is shown in the figure 1.

In Figure 1, the blue line is the ratio of the primary industry to GDP, the yellow line is the ratio of the tertiary industry to GDP and the purple line is the ratio of the secondary industry to GDP. Figure 1

indicates that the industrial structure of Hebei province has made great strides. From 1978 to 1987 and the industrial structure presented "2-1-3" model. The ratio of the output of secondary industry to GDP is the biggest, and the ratio of the output of tertiary industry is the smallest. From 1988 to 2008, Tertiary industry developed rapidly and its ratio to GDP surpassed the primary industry. So the industrial structure presented"2-3-1" trend.
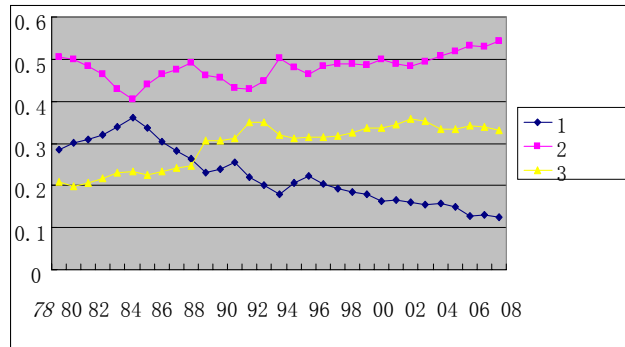

Figure 1   The ratio of the three industry to GDP

But in general, the industrial structure in Hebei province is still in its infancy. According to the study of Channer and other economists, the industrial structure should be 15.4%, 43.4%, 41.2% as long as GDP per capita surpasses 2,000 US dollars(1980, US dollar)[2] . As the ratio of Hebei province is 12.6%、54.2%、33.2% in 2008，Hebei's industrial structure has to be adjusted and promoted. We should especially develop the secondary and tertiary industry to upgrade industry. As we all know, technology innovation is the most important way to upgrade industry and the higher education is the most important means to train specialized personnel. We must pay more attention to the higher education.

2.2 Deviation of industrial structure

The industry structure and the employment structure do not always synchronize their steps. Industrial structure always changes faster than the employment structure, because there are some other factors affecting employment structure besides industrial structure, such as systems and education. [3] Usurually we use deviation of industry to express such relationship. The formula is as follows:

$$P = C/L - 1$$

In the formula, P is the deviation of industry, C is the ratio of industry structure, L is the ratio of employment structure. If P=0, it means the industrial structure and employment structure are coordinated; the farther P is from zero, the bigger the deviation is.

We can see from table 1 that since 1998, deviation of primary industry has been negative and the absolute value has risen from 0.62 to 0.68, which indicated the industrial structure in the primary industry and the employment structure are very uncoordinated. The deviation has been positive in secondary industry, which indicated the second industry can accept more employment theoretically. The structure deviation in the tertiary industry has dropped from 0.39 to 0.15, which indicated the industrial structure and the employment structure has been improved and the tertiary industry has the strong accepting ability for the labor force.

Table 1   Deveation of industrial structure in Hebei

year	Primary industry	Secondary industry	Tertiary industry
1998	-0.62	0.77	0.39
1999	-0.65	0.85	0.40
2000	-0.67	0.90	0.39
2001	-0.67	0.88	0.39
2002	-0.68	0.84	0.41
2003	-0.69	0.90	0.36
2004	-0.66	0.80	0.29
2005	-0.66	0.77	0.24
2006	-0.70	0.77	0.23
2007	-0.67	0.71	0.19
2008	-0.68	0.73	0.15

In fact, along with the industrialization development, the secondary industry did not absorb labour force fully. The surplus rural labor force was detained in the countryside or flowed to the low-level tertiary industry, and most high-educated labor force flew to the high-level tertiary industry. As a result, the labor force quality of primary industry is very low and high-educated human capital is very scarce in the second industry. Such level and disposition of human capital seriously restricted Hebei province's industrial structure promotion. So we should deepen educational reform and   make good use of Hebei's human resources to   promote human capital level and enhance the employment ability. [4]

2.3　Analysis of linear regression

In recent years, the relation of the higher education and the economic development has become closer. The higher education provides talented people for the society every year form the aspects of quantity, quality, structure and specification, which plays great role in the adjustment of industrial structure. [5] So it is very important to analyze the relationship between the higher education and the economic development. Table 2 gives the value-added of the three industries and the growth of university graduates in Hebei province.

In the table, g is the GDP growth, is Value-added of the primary industry, v2 is value-added of the secondary industry, v3 is Value-added of the tertiary industry and u is the growth of university graduates.

Table 2　The value-added of the three industry and the graduates' growth

Year	g	V1	V2	V3	u
1991	175.74	9.00	72.39	94.35	644
1992	206.43	20.19	113.24	73.00	-19
1993	412.34	44.60	274.77	92.97	-1257
1994	496.65	150.23	205.20	141.22	5361
1995	662.03	179.43	269.65	212.95	8897
1996	603.45	69.60	341.84	192.01	5449
1997	500.81	60.82	269.77	170.22	397
1998	302.23	28.84	149.95	123.44	-1672
1999	258.18	15.37	104.26	138.55	-956
2000	529.77	18.58	326.37	184.82	1649
2001	472.80	89.27	181.67	201.86	-25384
2002	501.52	43.02	215.06	243.44	47039
2003	903.01	107.21	505.87	289.94	44652
2004	1556.34	269.52	884.17	402.65	35586
2005	1618.48	169.50	930.77	518.21	40065
2006	1419.65	41.26	882.51	578.40	24353
2007	2193.74	342.91	1126.79	724.04	20627
2008	2479.11	229.88	1535.62	713.61	43142

Using the data in table 2, we can analyse, by calculating the correlation coefficient and regression coefficient, the relationship between industrial structure and the higher education in Hebei province.

Table 3　Correlation coefficient

	Primary industry	Secondary industry	Tertiary industry	GDP
Correlation coefficient	0.4495	0.6551	0.6355	0.6474

We can see that the correlation coefficient between growth of university graduates and GDP is 0.6474, which is positive. The correlation coefficient between the growth of university graduates and the value-added of the three industries are 0.4495, 0.6551 and 0.6355.   So, it is obvious that there exists linear regression relationship among these factors. Regression equation is as follows:

$$Y_0 = \alpha_0 + \beta_0 X + \mu \qquad (1)$$

$$Y_1 = \alpha_1 + \beta_1 X + \mu_1 \qquad (2)$$

$$Y_2 = \alpha_2 + \beta_2 X + \mu_2 \qquad (3)$$

$$Y_3 = \alpha_3 + \beta_3 X + \mu_3 \qquad (4)$$

In the equation, Y0 is GDP, Y1 is value-added in primary industry, Y2 is value-added in secondary industry, Y3 is value-added in tertiary industry. The result of regression analysis is in table 4.

Table 4   Regression result

	Primary industry	Secondary industry	Tertiary industry	GDP
Regression coefficient	0.0021	0.0133	0.0065	0.0218

Analyzing the correlation coefficient, coefficient of determination, F test and T test, the regression results are tenable. As can be expected, university graduates' growth can truly affect industrial development, especially the secondary and tertiary industry. There are two reasons. The first one is the demand of the secondary and the tertiary industry for technology is higher than the primary industry. The second one is the university graduates are inclined to seek jobs in the secondary and tertiary industry for thinking of the job stability and its wage. However, the results can be seen from the regression that the elasticity of absolute value of each factor are less than 1.This shows that the promotion of education to industrial development is not doing enough. So it needs further development for higher education to promote the optimization and upgrading of industrial structure in Hebei province.

3 Conclusion and Recommendations

This study reveals that the higher education is in-depth power which can promote the optimization of the industrial structure. The higher education development may provide the high level human resource for the three industries to promote industrial upgrading. However there are many problems in the higher education in Hebei province, such as the insufficiency of the capital quantity, the unreasonable structure, the unbalance of the disposition and the efficiency of the use of the high level personnel resource. So reform of higher education system is essential.

So here are some advices:

Firstly, we should recognize the function of the higher education and enlarge multilateral investment system, including the government, the enterprise, the society and the family, so as to finance educational expenditure[6].

Secondly, Considering from the industrial structure demand, higher education structure should be optimized in various aspects, such as hierarchical structure of the personnel training, the structure of subject and specialty, the course construction which is related to the pillar industry in Hebei province.

Thirdly, we should carry out higher education quality projects and strengthen teaching management to improve the teaching quality. Two things must be done. One is promoting teaching reform by innovating personnel training pattern and curriculum system, The other is enhancing the construction of talented undergraduate cultivation base.[7].

Finally, another needs to be paid attention to is the technology in novation. Universities, research institutions and enterprises should form the resource-sharing platform and cooperate with each other. We should accelerate the transform of scientific achievements and enhance industry development.

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