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Article

A quantitative assessment model of the fit between local undergraduate colleges' major settings and regional industries based on regression analysis

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Abstract: This study integrates the coupled coordination degree model, relative development degree analysis, and the Cobb-Douglas production function regression model, which are used to quantitatively assess the fit between undergraduate colleges and universities' major structure and industry structure. Using 25 applied undergraduate colleges and universities in Area A as a sample, the empirical analysis is conducted for the period of 2018-2024.The overall coordination between the majors and industries of colleges and universities in Area A has steadily improved, with the degree of coordination increasing from 0.673 to 0.819, reaching the level of "highly coordinated". However, the coordination between specific categorized disciplines and industries is not fully coordinated; agronomy and agriculture are precisely matched, with a coordination degree of 0.634 in 2024, but the synergy between science and technology and industry is seriously out of sync, with almost all of the seven years in a state of "low coordination", which is an obvious shortcoming of industrial upgrading. Regression analysis further reveals its internal driving mechanism, every 1% increase in industrial output value can drive the percentage of students in science and engineering to increase by 0.463%, and the service industry is the core of the development of economics and management majors. The study not only diagnoses the effectiveness and problems of the synergy between the two, but also quantifies the industrial-economic contribution of the professional setting, which provides very powerful support for the region to formulate precise education-economic synergistic development policies.

Keywords: college major setting; industrial structure; Cobb-Douglas production function; coupling coordination degree; fit degree; regression analysis

1. Introduction

At present, the country is facing the challenge of economic development mode and industrial structure adjustment, need to change the development mode, upgrade the industrial structure, to vigorously promote the development and growth of modern high-tech industries [1-2]. Therefore, the development of social economy needs the help of talents, based on this purpose colleges and universities in the professional settings should be more adapted to the needs of society, in the face of the actual situation of industrial development of the professional settings to supplement, replacement of the adjustment, to achieve the sustainable development of the social economy, this move undoubtedly has a very significant guiding significance [3-5].

The purpose of institutions of higher education is to cultivate high-quality, highly educated people, and students in different professional fields of study in order to be needed by enterprises to show their strength and value. Therefore, to serve the regional industrial economic and social development is the essential attribute of higher education, to make the economic development can be better and stronger, it is necessary to match with the development of local industry, which has become the industry's consensus [6-8]. Colleges and universities to strengthen professional relevance, accelerate professional adjustment and research efforts in the regional industrial development of industrial restructuring, enterprise transformation and upgrading in the footsteps of the university can play a more effective role in the center of education and talent, so that the professional setup with the structure of the regional industry organically combined, one side to promote the development of the other side, the two complement each other, and grow together [9-12].

However, a number of studies have found that local undergraduate colleges and universities have homogenization of professional settings, and some of the majors are seriously disconnected from the local industry, while the current focus of industrial development requires students to become composite application talents, mastering multi-disciplinary professional knowledge and technology, such as management + multi-disciplinary technology [13-16]. In addition, the rapid pace of industrial development requires college majors to have the ability to synchronize and dynamically adapt to the industry to continuously deliver professionals [17]. And due to the differences in regional development and the demand for professional settings, it is urgent to construct a classification assessment standard and quantitative assessment model of the degree of fit between the professional settings of local undergraduate colleges and the regional industries, which can provide help for professional optimization.

The study is committed to constructing a quantitative assessment model of fit based on regression analysis to measure the level of synergy between professional setting and industrial development. The article first combs through the intrinsic interaction between local higher education and regional industrial development, pointing out that the industrial structure not only determines the type and level of talent demand, but also needs to use signaling to guide colleges and universities to adjust its specialty layout. On this basis, the synergistic theory is introduced, and the education system and the economic system are viewed as an associated whole. In order to judge whether the professional structure matches or mismatches with the industrial structure from a macroscopic point of view, the degree of misalignment between the two is measured. In order to portray the strength and quality of the interaction between these two in a more refined way, the study also constructed a coupling coordination degree model. This model can effectively distinguish whether the systems are coupled at a low level or coordinated at a high level, so as to avoid the misjudgment that may be brought about by relying only on a single coupling indicator. With the goal of revealing the actual contribution of professional settings to regional economic development, the article innovatively introduces the Cobb-Douglas production function in economics into the study and constructs a regression model. The model takes the human capital of sub-industries as the core variable, and uses the number of college enrollment and employment respectively to represent the supply of talents in different industries. By calculating the elasticity coefficients of human resources to economic output in each industry, it allows the study to assess the actual benefits brought by specialization in a more detailed way, starting from the source of growth.

2. Quantitative model of the fit between the professional settings of local universities and the development of regional industries

2.1. Interaction between local higher education and regional industrial development

2.1.1. Mechanism of interaction between industrial and professional structures

The relationship between regional industrial structure and the specialized structure of higher education is essentially the relationship between economy and education, and the academic community often adopts system theory to analyze the interaction mechanism between the two. According to system theory, education and economy are two subsystems within the social system, and there is an interaction relationship. The development of education is constrained by economic development, which is manifested in the fact that the regional industrial structure determines the structure of higher education disciplines and specialties; the development of education also plays a counteraction to economic development, which is manifested in the fact that the structure of higher education disciplines and specialties has an impact on the regional industrial structure through the intermediary of human capital. On the basis of systematics, system coupling theory and synergism theory, which emphasize the dynamic relationship among the elements of the system, have been developed. According to the system coupling theory, the coupling effect of higher education professional structure and industrial structure is reflected in the fact that the industrial structure determines the demand for talents, and higher education cultivates and delivers various kinds of human resources for the industrial sector. The adjustment and upgrading of industrial structure sends adjustment signals to the unbalanced state of demand and supply of talents, and higher education constantly adjusts the structure of disciplines and specialties to improve the degree of “toughness” with the industrial structure and reach the coupling state. Under the benign coupling state, the movement of each element within the system will tend to be in order and form a coordinated relationship. The article analyzes the connotation of synergistic development between higher education and industrial clusters based on the perspective of social system theory, and considers that synergistic development includes structural synergy, functional synergy and institutional synergy.

2.1.2. Mechanisms for interaction between the industrial level and the talent level

Different stages of industrial development require different levels of talent. Industrial restructuring and upgrading is manifested in the process and results of industrialization. The article puts forward the talent structure corresponding to different stages of industrial development on the basis of the theory of industrialization stage, and makes it clear that the process of industrial high-polarization needs to be supported by the high-polarization talent structure, and when the regional industry is in the transition from labor-intensive and capital-intensive to technology-intensive and knowledge-intensive, it will generate a strong demand for senior technical talents and innovative talents. The core of senior technical talents is the middle and senior technical talents who can carry out technical application and management of capital resources with high technical content. The core of innovative talents is the development-oriented talents who can drive industrial development with innovation and make products tend to be highly sophisticated and high value-added.

The level of talents required at different periods of industrial development is also different. The study refines the talent demand corresponding to different periods in the life cycle of an industry, and proposes that the supply of undergraduate applied talents should be strengthened for industries tending to decline or mature, and the supply of undergraduate research talents (academic) should be strengthened for emerging high-tech industries.

The stage and period of industrial development together determine the level of talents needed, which are cultivated by different types of colleges and universities. According to the classification of academic and applied higher education institutions, China's higher education in general is divided into two major types: academic colleges and applied colleges and universities, and applied higher education institutions can be further divided into three categories: applied research, applied technology and applied skills.

To sum up, the industrial structure determines the type of talents needed, which in turn determines the types of disciplines and specialties of higher education, and the state of industrial development, i.e., the stage and period of development, determines the level of talents needed, i.e., the level of higher education personnel training. The synergistic development of regional higher education and local industry is essentially to match the type and level of talents cultivated by higher education with the development status of local industry.

2.2. Analysis of the synergy between undergraduate major settings and industrial development

After clarifying the interaction mechanism between local higher education and regional industrial development, this section will introduce the synergistic theory to systematically and scientifically analyze the synergistic relationship between undergraduate college major setting and industrial development.

2.2.1. Synergistic Theory

Synergism belongs to the theory of system science, which holds that various subsystems or elements acting within an organization, through communication, coordination and mutual cooperation, promote the formation of a stable structure in equilibrium, facilitate the transformation of the system from disorder to order, and achieve the maximization of the overall effectiveness and benefits. The theory was initially applied to natural sciences, and then extended to other fields such as economics, management, education, etc., to quantify and assess the synergistic effect between multiple subsystems. Local applied colleges and universities provide talents with specialized knowledge for regional economic and social development, and there is a demand for talents for regional economic development and social construction. From the perspective of educational economics, the two are essentially supply and demand relationships, involving the educational system on the supply side and the economic system on the demand side. Therefore, the synergism theory can be used to explore the synergism between the educational system and the economic system involved in the setting of undergraduate majors in colleges and universities and the development of local industries.

2.2.2. Analysis of synergy between professional settings and industrial development

The division of regional industries is divided into primary industry (agriculture), secondary industry (industry), and tertiary industry (service industry) from a macroscopic point of view; from a mesoscopic point of view, it can be divided into general industry and dominant industry, traditional industry and emerging industry. In order to comprehensively analyze the match between college undergraduate majors and industrial structure and the synergy between major settings and industrial development, this study mainly analyzes the synergy between college undergraduate major settings and local industrial development from the degree of mismatch between major structure and regional tertiary industry structure.

In order to analyze the relative rationality of undergraduate college major structure, we first understand the synergy between majors and industries from a macro perspective, and use the misalignment degree to portray the degree of synergy between the two. The misalignment degree is defined as follows:

$$M - I = \left| M_i - I_i \right|, i = 1, 2, 3 \tag{1}$$

Where M_i denotes the ratio of the i th industry to the output value of the third industry, and I_i denotes the ratio of the number of majors related to the i th industry to the number of all majors. From a macroscopic point of view, the smaller the degree of misalignment is, the better the synergy between professional and industrial structure is.

2.3. Analysis of the degree of coordination between the structure of undergraduate majors and industrial coupling

After analyzing the synergy between undergraduate college major setting and industrial development, a coupling coordination degree model will be established next to quantitatively assess the degree of coordination between college major structure and industrial structure.

2.3.1. Coupling coordination degree modeling

This study intends to use the coupling analysis method to quantitatively analyze the coupling state between the professional structure and industrial structure of local undergraduate colleges and universities, and use the coupling degree and the coupling coordination degree to analyze the interaction between these two factors, the coupling degree can measure the degree of mutual influence between the two elements, and the coupling coordination degree is the impact of the coordinated development level between the two on the overall development.

According to the following formula on the coupling degree and coordination to quantitatively analyze the coupling state between local undergraduate colleges and universities' professional settings and economic structure, the two systems are constructed respectively with the development index X, Y. And the coupling degree C is used to measure the degree of association between the two systems. According to the existing research and combined with the actuality of this study, the coupling degree formula is constructed as follows:

$$C = \left[\frac{\left(4X_i Y_j\right)}{\left(X_i + Y_j\right)^2} \right]^{\frac{1}{2}} \tag{2}$$

Coupling degree D is to reflect the higher education professional structure and the local economic structure of the association, but the coupling degree is only a measure of the association of the two systems, does not represent a high degree of coordination of the development of the two systems, for example, the development level of the two systems are very low, but close to the value of the formula will still get a high degree of coupling, and therefore the introduction of another indicator to measure the coordination of the two systems:

$$D = \sqrt{CT} \tag{3}$$

$$T = \alpha X_i + \beta Y_j \tag{4}$$

α and β are coefficients to be determined, and because $\alpha + \beta = 1$, the structure of higher education specialization and the structure of the local industry are of equal importance in this paper, both α and β are set to 0.5, substituting for Eq:

$$D = \left\{ \left[\frac{\left(4X_iY_j\right)}{\left(X_i + Y_j\right)^2} \right]^{\frac{1}{2}} \left(\frac{X_i + Y_j}{2} \right) \right\}^{\frac{1}{2}} \tag{5}$$

$$D = \left(X_iY_j\right)^{\frac{1}{4}}$$

2.3.2. Evaluation of the degree of coupling coordination

Coupling degree and coordination is an important index to measure whether the two systems develop in a coordinated way. Low coupling degree in this study means that the higher education professional structure lags behind or ahead of the development of local industrial structure, and low coupling coordination degree refers to the low coordination of the interaction between the higher education professional structure and the local industrial structure, and low coupling coordination degree means that the development level of both the higher education professional structure X and the local industrial structure Y is very low, and so is the coordination of their interaction. On the contrary, high coupling coordination degree means that both higher education specialized structure X and local industrial structure Y have a high level of development and their interaction coordination is also high.

For the division of coupling degree and coupling coordination degree, combined with the actual situation of the coupling coordination degree of local higher education professional structure and local industrial structure, the coupling degree and coordination evaluation criteria divided in this study are shown in Table 1.

Table 1. Evaluation criteria for coupling and coordination

Coupling coordination degree	Range of values	Stage
Value of coupling degree	$0 < C \le 0.3$	Low-level coupling
	$0.3 < C \le 0.5$	Competing stage
	$0.5 < C \le 0.8$	Accommodation stage
	$0.8 < C \le 1$	High-level coupling
Value of coordination degree	$0 < D \le 0.2$	I: Extremely uncoordinated
	$0.2 < D \le 0.4$	II: Low degree of coordination
	$0.4 < D \le 0.6$	III: Moderate coordination
	$0.6 < D \le 0.8$	IV: High coordination
	$0.8 < D \le 1$	V: High degree of coordination

2.4. Professional-Industry Synergy Model Based on Cobb-Douglas Production Function

In order to further reveal the actual contribution of professional settings to regional economic development, this section introduces the Cobb-Douglas production function, constructs an econometric model of professional-industry synergy, and analyzes the impact of professional structure on industrial growth from the perspective of human capital.

2.4.1. Cobb-Douglas production function

The Cobb-Douglas production function is about the production function created in the context of the study of the relationship between inputs and outputs, and is an improvement on the general form of the production function, introducing the element of technological resources. The function, in its simple form, has some properties of interest to economists, examines the relationship between labor inputs and capital inputs and outputs, has a clear economic significance, and its unique data characteristics make the conclusions of the computational analysis more accurate, and thus is widely used.

The Cobb-Douglas production function is of the form

$$Y = f(K, L) = \Lambda K^{\alpha} L^{\beta} e^{u} (0 \bullet \alpha \bullet 1, 0 \bullet \beta \bullet l) \tag{6}$$

Where: Y is the value of output, A is the level of technological progress, K is the input of physical capital, L is the input of human capital, α, β is the elasticity coefficient, u is the disturbance term.

From the model shown in equation (6), it is seen that the main factors determining the level of economic development are the number of invested human capital, fixed assets and the level of comprehensive technology (including the level of business management, the introduction of advanced technology, etc.). According to the combination of α, β, it has three types:

(1) $\alpha + \beta > 1$, known as increasing returns, suggests that it is advantageous to increase output by expanding the scale of production.

(2) $\alpha + \beta < 1$, known as diminishing returns, suggests that increasing output by expanding the scale of production is not beneficial.

(3) $\alpha + \beta = 1$, known as the constant-return type, suggests that production efficiency does not increase with the expansion of the scale of production, and that only an increase in the level of technology will improve economic efficiency.

2.4.2. Empirical analysis model of GDP growth

Considering that economic growth is related to the contribution of industry, the structure of the 19 major categories of professions was organized according to the structure of the three major industries, i.e., agriculture and as the human capital of the industry, and the following model was developed based on the Cobb-Douglas production function.

$$Y = f(K, L) = \Lambda K^{\alpha} h_1^{\beta} h_2{}^{x} h_3^{\delta} e^{u} \tag{7}$$

In order to eliminate possible heteroskedasticity, equation (7) was log-linearized to obtain:

$$\ln Y = \ln \Lambda + \alpha \ln K + \beta \ln h_1 + x \ln h_2 + \delta \ln h_3 + u \tag{8}$$

Where: h_j is human capital by industry, i.e., h_1, h_2, and h_3 are human capital by primary, secondary, and tertiary industries, respectively, Y is the output value of the local area, Λ is the level of technology (a constant), and u is a perturbation term. α, β, x, δ are the output elasticity coefficients of each factor of physical capital, human capital input in primary industry, human capital input in secondary industry, human capital input in tertiary industry, etc., respectively.

Considering the need of the object analyzed in this paper, the following 2 models are adopted here according to the above modeling ideas:

Model 1:

$$\ln Y = \ln \Lambda + \alpha \ln K + \beta \ln h_1 + x \ln h_2 + \delta \ln h_3 + u \tag{9}$$

Where: h_1, h_2, and h_3 are undergraduate enrollments in local undergraduate institutions of higher education collapsed by primary, secondary, and tertiary industries, respectively.

Model 2:

$$\ln Y = \ln \Lambda + \alpha \ln K + \beta \ln h_4 + x \ln h_5 + \delta \ln h_6 + u \tag{10}$$

Where: h_4, h_5, and h_6 are the number of undergraduate employment in local undergraduate institutions of higher education in the primary, secondary, and tertiary sectors, respectively.

3. Empirical research on the coupling coordination and development trend of professional structure and industrial demand

Twenty-five applied undergraduate colleges and universities in place A are selected as the research object, and are divided into three economic circles of provincial capital, coastal and southwest according to the regional development layout of place A. Among the 25 colleges and universities, there are 15 in the economic circle of the provincial capital, 7 in the economic circle of the coastal area, and 3 in the economic circle of the southwest. Next, the empirical research on the time and space differentiation characteristics of the data related to the academic specialty structure of the 25 colleges and universities and the data related to the regional industrial knots will be carried out in the seven years from 2018 to 2024.

3.1. Analysis of the degree of coupling coordination

In terms of coupling coordination degree analysis, the discipline structure X of applied undergraduate colleges and universities is divided into agricultural disciplines, science and engineering disciplines, humanities and social sciences, and medical disciplines, and the regional industry structure Y is divided into primary industry (agriculture), secondary industry (industry), and tertiary industry (service industry).

3.1.1. Time-varying characteristics

Now with regard to the perspective of time-varying characteristics, the analysis of the coupling coordination degree between the overall discipline structure and industrial structure, agronomy and primary industry (agriculture), science and engineering and secondary industry (industry), humanities, social sciences and medicine and tertiary industry (service industry) is launched, and the coupling coordination degree between the specialty structure and the industrial structure of undergraduate colleges and universities in place A from 2018-2024 is shown in Table 2. Meanwhile, in order to show more clearly the changes in the degree of coordination between the professional setting and the industrial structure of place A over time in 2018-2024, the trend graph of the changes between the two is also plotted as shown in Figure 1.

Table 2. Coordination between disciplinary and industrial structure(2018-2024)

		2018	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Professional structure and industrial structure	C	0.845	0.762	0.831	0.857	0.872	0.879	0.891
	D	0.673	0.706	0.647	0.716	0.774	0.786	0.819
	Stage	IV	IV	IV	IV	IV	IV	V
Agricultural Sciences and Agriculture	C	0.523	0.551	0.573	0.602	0.618	0.629	0.641
	D	0.453	0.478	0.528	0.576	0.596	0.607	0.634
	Stage	III	III	III	III	III	IV	IV
Science and engineering disciplines and industry	C	0.245	0.231	0.218	0.236	0.258	0.297	0.315
	D	0.288	0.253	0.226	0.248	0.274	0.321	0.342
	Stage	II	II	II	II	II	II	II
Humanities, social sciences, medicine and service industries	C	0.412	0.385	0.356	0.332	0.335	0.341	0.368
	D	0.448	0.395	0.344	0.314	0.317	0.325	0.361
	Stage	III	II	II	II	II	II	II

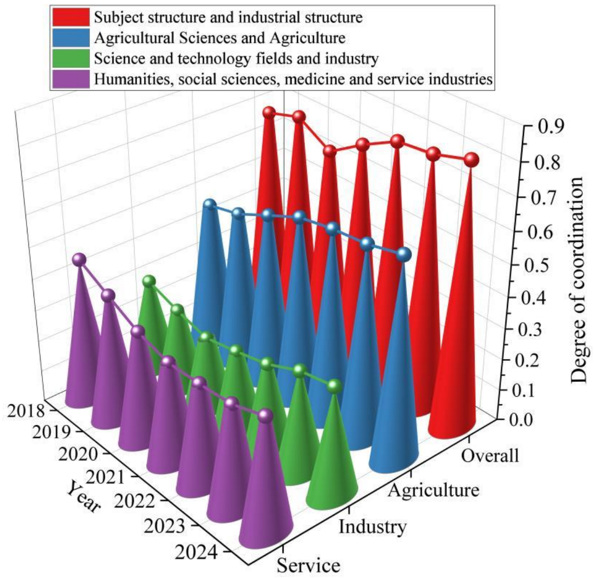

Figure 1. Trend of the coordination between professional and industrial structure

It can be seen that the overall coordination between the disciplinary structure and industrial structure of undergraduate colleges and universities in A shows a positive growth trend of steady increase. The degree of coordination D continues to grow from 0.673 in 2018 to 0.819 in 2024, shifting from the stage of “IV: high coordination” to the stage of “V: high coordination”. It shows that the specialty layout of colleges and universities in place A is basically in line with the general direction of the industrial development of the region, and this matching degree becomes better and better in seven years.

However, the coupling and coordination degree between the three types of disciplines and three industries of applied colleges and universities in place A is low, and none of them has reached the state of coordinated development. The coupling and coordination degree between agricultural majors and the primary industry (agriculture) is the highest, rising from 0.453 to 0.634, and the stage also transitions from “III: moderate coordination” to “IV: higher coordination”. This indicates that in the field of agriculture, the training of talents in colleges and universities meets the needs of the industry, and the degree of fit is getting higher and higher. However, the match between science and technology majors and the secondary industry (industry) has remained at the stage of “II: low coordination” for the past seven years, with the degree of coordination fluctuating between 0.226 and 0.342. This indicates that there is an obvious lack of coordination between the supply of scientific and technical talents and the industrial demand in the industrial industry in Place A. There is also a low-coordination relationship between humanities, social sciences and medicine majors and the service industry, with the degree of coordination between the two declining from 0.448 in 2018, and remaining at the level of “II: low coordination” in the following years until 2024, when it rebounded slightly to 0.361.

3.1.2. Characterization of spatial differentiation

Now on the perspective of spatial differentiation characteristics, the three major economic circles of provincial capitals, coasts and southwest of A are analyzed individually for the degree of coupling and coordination between disciplinary structure and industrial structure, and the trend of the degree of change in the degree of coupling and coordination between the specialized structure of the applied colleges and universities and the industrial structure of the three major economic circles are shown in Fig. 2~Fig. 4, respectively.

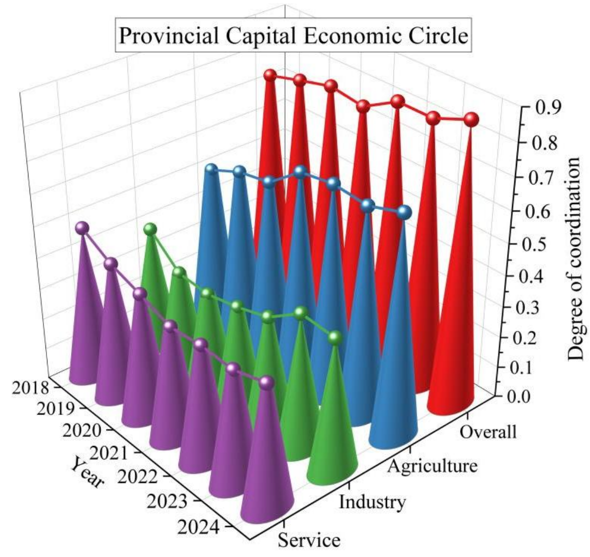

Figure 2. Coupling coordination degree of provincial capital economic circle

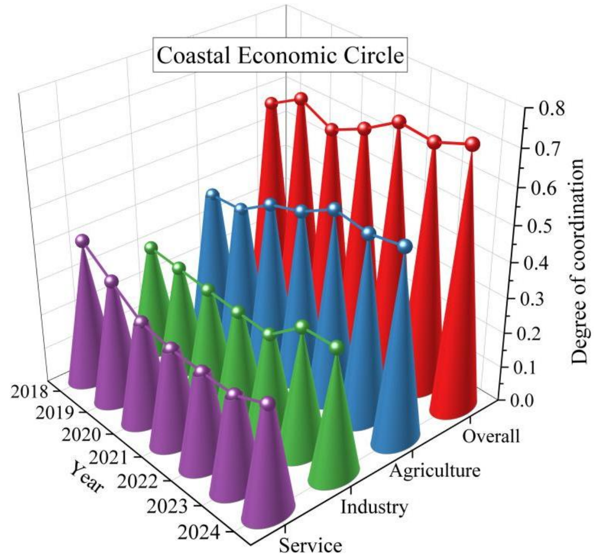

Figure 3. Coupling coordination degree of coastal economic circles

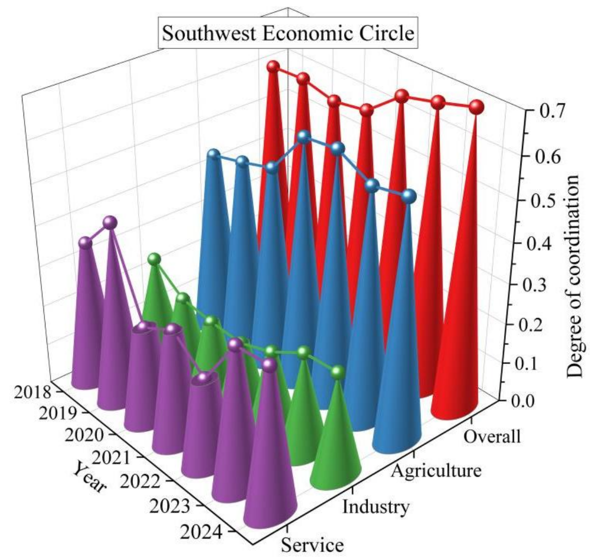

Figure 4. Coupling and coordination degree of the Southwest Economic Circle

The coupling coordination degree of undergraduate college major structure and industrial structure develops differently among the economic circles. In terms of the overall aspect, the comprehensive coordination degree of the three economic circles shows a growing trend, but the coupling coordination degree of the three types of disciplines and three types of industries is more different. Specifically, in the provincial capital economic circle, as the center of economic development area, its undergraduate college professional settings of the supply of talent and regional industrial demand between the degree of fit is undoubtedly the highest, from 0.732 all the way up to 0.877, is the only one of all regions to enter the "V: highly coordinated" stage. The Coastal Economic Circle has the second highest degree of coordination, and the Southwest Economic Circle has the lowest degree of overall coordination.

In terms of the match between agronomy and agriculture, the degree of coordination of the three regions basically continues to grow. Among them, the progress of the Provincial Capital Economic Circle (from 0.503 to 0.695) and the Southwest Economic Circle (from 0.437 to 0.584) is particularly obvious, reflecting that these two regions are getting better and better coordinated in terms of the outputs and ratios in the field of agriculture.

Between science and technology and industry, the degree of harmonization of the three regions has been hovering in the "low degree of harmonization" range of 0.2-0.4 all year round. Especially in the Southwest Economic Circle, the degree of coordination will even be as low as 0.168 in 2021, which may be related to the backwardness of its regional economy and the poor development of industry, and the talents in science and technology cultivated by colleges and universities in this region tend not to participate in the employment of engineering.

In terms of the match between humanities and social sciences medicine and the service industry, the coordination degree of the provincial capital economic circle fluctuates but always maintains at a relatively high level, indicating that in the central economic development zone, the undergraduate colleges and universities are basically appropriate between the cultivation of talents in the service industry and the huge market demand. In contrast, the coordinated development of the coastal and southwestern economic zones is completely unbalanced, with the degree of coordination once dropping to 0.262, which is in the stage of "low degree of coordination".

3.2. Analysis of the relative degree of development

The relative degree of development between the structure of disciplines and specialties of 25 applied colleges and universities in place A and the structure of regional industries is shown in Figure 5.

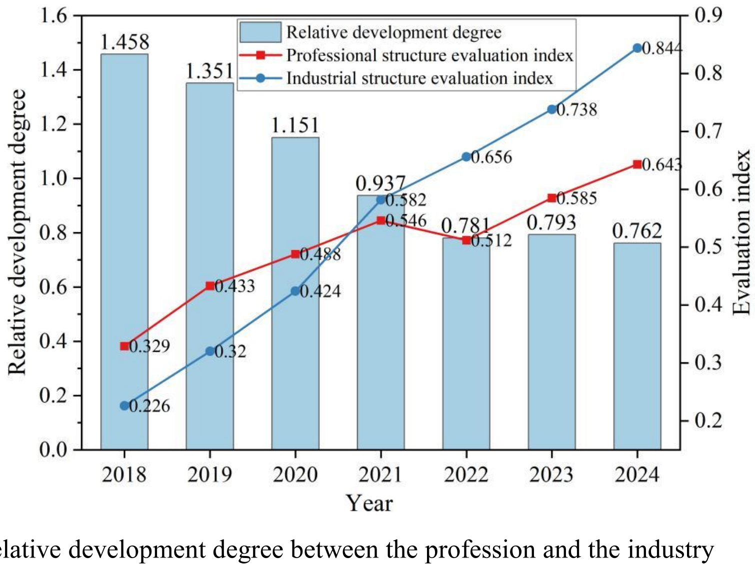

Figure 5. The relative development degree between the profession and the industry

It can be seen that the relative development between undergraduate colleges and industries in the seven years of 2018-2024 in Place A shows an industry-driven and education-following trend. In 2018-2020, the evaluation index of academic specialty structure is higher than the evaluation index of industrial structure, which makes its relative development reach a high level of 1.458, 1.351 and 1.151 respectively. This reflects that in the first three years, undergraduate colleges and universities were, to a certain extent, ahead of the scale of the industry at that time in their professional settings and talent reserves. However, with the subsequent high-speed development of the A-land industry, its industrial structure evaluation index continues to climb, and even reached a height of 0.844 in 2024, while at this time, the rate of talent reserve of undergraduate college disciplines and specialties is obviously insufficient, and even in 2022 there was a decline in the phenomenon of not being able to catch up with the development of the industrial structure, so that the relative development index of the two declined, and as of 2024, the relative degree of development was only 0.762.

3.3. Analysis of the industrial fit of each university specialty

The previous two subsections depict the development picture of the coupling and coordination between the overall majors and industries of the 25 colleges and universities in A. In order to have a clearer understanding of the relationship between the majors offered by the 25 colleges and universities and the industry's degree of fit, we now draw the degree of fit and its type of fit of the colleges and universities from the level of the micro point of view by selecting the special data of each college and university in the last three years from 2022-2024 as shown in Table 3. (I: very poor fit; II: low fit; III: medium fit; IV: higher fit: V: high fit)

Table 3. The compatibility degree and the types among 25 universities

Number	2022		2023		2024	
	Compatibility	**Type**	**Compatibility**	**Type**	**Compatibility**	**Type**
1	0.883	V	0.902	V	0.942	V
2	0.539	III	0.613	IV	0.765	IV
3	0.781	IV	0.767	IV	0.797	IV
4	0.994	V	0.958	V	0.964	V
5	0.872	V	0.878	V	0.879	V
6	0.677	IV	0.716	IV	0.747	IV
7	0.828	V	0.816	V	0.802	V
8	0.639	IV	0.646	IV	0.682	IV
9	0.868	V	0.893	V	0.899	V
10	0.767	IV	0.766	IV	0.757	IV
11	0.974	V	0.951	V	0.935	V
12	0.658	IV	0.659	IV	0.773	IV
13	0.895	V	0.899	V	0.922	V
14	0.561	III	0.597	III	0.685	IV
15	0.673	IV	0.695	IV	0.709	IV
16	0.645	IV	0.673	IV	0.787	IV
17	0.779	IV	0.799	IV	0.801	V
18	0.884	V	0.868	V	0.857	V
19	0.846	V	0.851	V	0.889	V
20	0.586	III	0.588	III	0.665	IV
21	0.837	V	0.852	V	0.863	V
22	0.732	IV	0.745	IV	0.742	IV
23	0.621	IV	0.642	IV	0.677	IV
24	0.937	V	0.971	V	0.976	V
25	0.875	V	0.911	V	0.950	V

Most of the universities have a good fit with the industry, showing a positive trend of continuous optimization. The majority of these 25 universities have already reached the level of “high fit (IV)” or “high fit (V)”. 12 universities have a fit of 0.8 or above in 2024, and number 2 has a fit of 0.539 in 2022, which is only a moderate fit. 0.539 in 2022, which is only a moderate fit, and then jumps to 0.765 in 2024, reaching the standard of IV: higher fit. Although there are still some colleges and universities that have a decline in fit, they still remain at a high level of fit, and overall the colleges and universities are generally on a positive development trend.

4. Regression analysis of professional structure and industrial structure of undergraduate colleges and universities

Chapter 3: Coordination degree, relative development degree and performance of each school's fit degree and other perspectives, clearly maps out the matching status between undergraduate colleges and universities and industries in A. Next, with the help of correlation and regression analyses, the cause and effect between academic majors and industrial structure are explored in depth, so as to prescribe scientific prescriptions for the precise optimization of major settings.

4.1. Correlation analysis between the structure of academic specialties and industrial structure

Firstly, the data analysis of professional structure and industrial structure is carried out to clarify the intrinsic relationship between the two, which provides the basis for the regression analysis in the later part of the paper.

4.1.1. Data analysis

Now the disciplines continue to be subdivided into four major categories: economic management, agricultural sciences, science and technology, and humanities, social sciences and medicine, and each of the major categories contains one or more categories of disciplines, and the trend of the percentage change in the four major categories of disciplines in the period from 2018 to 2024 is shown in Table 4.

Table 4. The trend of changes in the proportion of the four major disciplines

		2018	2019	2020	2021	2022	2023	2024
Economics and Management	Economics and Management	21.16	23.08	25.72	24.36	27.13	28.27	30.08
	Economics	11.74	11.54	14.46	12.73	13.82	14.25	16.16
	Management	9.42	11.54	11.26	11.63	13.31	14.02	13.92
Agricultural		3.72	3.41	3.53	3.25	2.87	2.46	2.11
Science and Industry	Science and Industry	41.21	39.59	36.33	35.74	38.89	39.16	41.38
	Science	11.92	9.38	13.03	11.42	10.43	13.14	15.28
	Industry	29.29	30.21	23.3	24.32	28.46	26.02	26.10
Humanities, Social Sciences and Medicine	Humanities, Social Sciences and Medicine	33.91	33.92	34.42	36.65	31.11	30.11	26.43
	Humanities	3.01	2.86	2.72	2.56	2.22	2.01	1.66
	Arts	3.36	3.68	4.16	3.95	4.53	4.72	4.78
	Education	7.17	8.01	8.14	8.65	9.21	9.16	9.31
	Law	8.04	7.56	8.96	7.33	7.02	6.44	5.97
	Medical	12.33	11.81	10.44	14.16	8.13	7.78	4.71

The share of economic management majors increased from 21.16% to 30.08%, making it the subject category with the largest increase, with more and more students choosing to further their studies in economic management majors. The share of agricultural science majors decreased, shrinking from 3.72% to 2.11%, indicating that fewer and fewer students are choosing to major in agricultural studies, which may be related to their low social popularity. Although the science and engineering majors have always been the part with the highest share, consistently above 35% and 41.38% in 2024, their internal structure of the share of science and engineering sciences has been fluctuating. The proportion of humanities, social sciences and medicine has decreased from 33.91% to 26.43%, specifically categorized, the proportion of majors in arts and education is getting higher, but the proportion of humanities, law and medicine is getting lower and lower, especially medicine, which has a subject share of 12.33% in 2018 but plummets to 4.71% in 2024, which may be related to the pressure of attending the medical specialty, the and the frequent occurrence of medical accidents in recent years, the prospect of medical development is not ideal.

Taking 2024 as an example, its specific distribution of disciplines is shown in Figure 6.

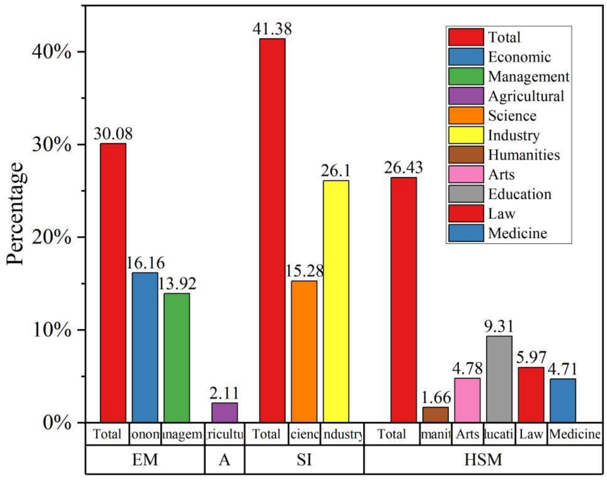

Figure 6. The specific distribution of disciplines in the year 2024

As can be seen from Figure 6, the current layout of majors is a pattern dominated by “science and engineering (41.38%)” and “economics and management (30.08%)”, which together account for more than 70% of the total. This reflects that the talent supply of applied undergraduate colleges in A focuses on industrial and economic management development. The proportion of humanities, social sciences and medical disciplines is 26.43%, while that of agricultural sciences is only 2.11%, which is an unbalanced proportion of the professional structure.

4.1.2. Correlation coefficient analysis

According to the above Pearson correlation analysis between the percentage of each discipline and the percentage of output value of the three industries, the correlation coefficients between the structure of each discipline and the change of output value of the three industries can be derived as shown in Figure 7.

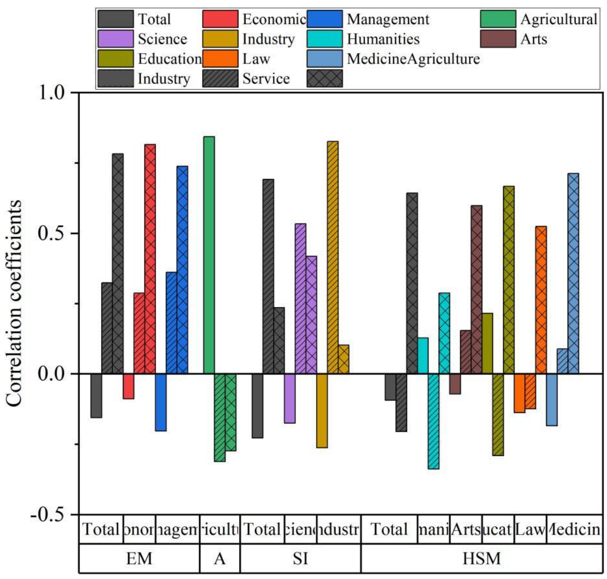

Figure 7. Correlation coefficients between the structure of disciplines and industries

Figure 7 clearly shows that the relationship between different disciplines and the three major industries of universities in A is “affinity differentiated”. On the whole, each academic discipline has the strongest resonance with its most directly corresponding industry. Economics and management majors are most closely related to the tertiary industry (service industry), with a correlation coefficient of 0.7 or above. The correlation of economic majors even reaches 0.815. In terms of supporting the real industry, science and engineering majors, especially engineering, show solid synergy with the secondary industry (industry), with a correlation coefficient of 0.826. Agricultural science majors, on the other hand, unsurprisingly, show a high degree of specialization bound to the primary industry (agriculture), with a correlation coefficient of 0.843, which is the highest of all the pairs. This reflects that the setting of agricultural science majors has a very precise orientation to the agricultural industry. At the same time its weak negative correlation with the secondary and tertiary industries precisely shows that it is less affected by the fluctuations of other industries. Finally, humanities and social sciences and medicine as a whole maintain a medium-strength positive correlation with the tertiary industry, with a correlation coefficient of 0.643. Medical and education majors have the strongest correlation with the service industry, with 0.713 and 0.667, respectively, while the correlation of art and law is a little lower, and humanities is the lowest, with 0.287, which reflects that graduates from these disciplines have more diversified employment paths, and not all of them flow into the the service sector. All in all, the appeal data confirms that the professional structure of colleges and universities in A does respond to industrial demand, but the strength and precision of the response varies from discipline to discipline.

4.2. Regression analysis of disciplinary specialty structure and industrial structure

Let the ratio of the number of students enrolled in the four major disciplinary categories of engineering and natural sciences, economics and management, humanities and social sciences, and agricultural sciences be Y1, Y2, Y3, and Y4, respectively, and let the ratio of the output value of the first, second, and third industries be X1, X2, and X3, respectively.Regression is conducted with the change of the ratio of the number of students enrolled in each discipline as the dependent variable and the change of the ratio of the output value of the three industries as the independent variable in the period from 2018 to 2024. Analysis.

4.2.1. Regression analysis of the economic management category with the three major industries

The stepwise regression method was used to regression analysis of the proportion of the number of students enrolled in economic management disciplines and the proportion of the output value of the three industries, and the results of the regression analysis are shown in Table 5.

Table 5. Regression analysis of economic management and 3 industries

Variables Entered	**Secondary industry (Industry) The tertiary industry (Service)**				
Variables removed	Primary industry (Agriculture)				
R Square	0.923				
Adjusted R Square	0.901				
F	52.392				
Sig.	0.002				
	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	20.404	6.576	-	3.689	0.003
Industry	1.585	0.126	0.895	9.183	0.000
Service	-0.801	0.113	0.336	2.823	0.038

The results of the analysis show that the primary industry is removed from the model and the secondary and tertiary industries are entered into the regression model in the broad category of economic and management disciplines. The goodness of fit of the model reaches 0.923 and the adjusted goodness of fit is 0.901, which is a good fit. The probability of significance of the F-test of the regression equation and the t-test of the regression coefficients are less than the given significance level of 0.05, which indicates that the change in the share of the number of students enrolled in the discipline of Economics and Management is significantly influenced by the change in the share of the value of output in the industrial and service sectors, and is less correlated with the development of agriculture. Therefore, the following equation is derived:

y1=20.404+1.585x2+0.801x3

In the equation, Y1 represents the share of students enrolled in economic management disciplines, X2 represents the share of industrial output, and X3 represents the share of service sector output. This equation shows that the change in the proportion of students enrolled in economic management disciplines has a positive correlation with the share of output value of both industry and service workers, and the correlation with industrial development is somewhat higher.

4.2.2. Regression analysis of the agricultural science category with the three major industries

The results of the regression analysis of the share of the number of students enrolled in agricultural sciences and the share of the output value of the three industries are shown in Table 6.

Table 6. Regression analysis of agriculture and 3 industries

Variables Entered	**Primary industry (Agriculture)**				
Variables removed	Secondary industry (Industry) The tertiary industry (Service)				
R Square	0.987				
Adjusted R Square	0.964				
F	128.415				
Sig.	0.000				
	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	1.842	0.453		4.066	0.002
Agriculture	0.318	0.038	0.912	8.356	0

The regression analysis process for the agricultural sciences category eliminates the secondary and tertiary sectors, and only the primary sector (agriculture) enters the equation. It reveals its exclusive dependence on the primary industry agriculture. The explanatory power of this model is quite strong, with an R-squared value of 0.964, implying that changes in the share of agricultural output can explain up to 96.4% of the fluctuations in the share of the number of students enrolled in the agricultural sciences category. The final regression equation obtained for the agricultural science category is:

Y2 = 1.842 + 0.318X1

This equation tells us that for every 1 percentage point increase in the share of agricultural output, there is a corresponding increase of about 0.318 percentage points in the share of students in agricultural science classes.

4.2.3. Regression analysis between science and engineering and the three major industries

The results of the regression analysis of the share of the number of students enrolled in science and engineering categories and the share of the three industrial outputs are shown in Table 7.

Table 7. Regression analysis of science and industry and 3 industries

Variables Entered	**Secondary industry (Industry)**				
Variables removed	Primary industry (Agriculture) The tertiary industry (Service)				
R Square	0.851				
Adjusted R Square	0.834				
F	49.127				
Sig.	0.000				
	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	22.715	4.892		4.644	0.001
Industry	0.463	0.066	0.845	7.009	0.000

For science and engineering, the regression model accurately captures its core linkages with secondary industry industries. The R-squared value of the model is 0.851, which is a good fit, and the entire model and regression coefficients pass the significance test.

The resulting regression equation is:

Y3 = 22.715 + 0.463X2

For every 1% increase in the share of industrial output, there is a subsequent increase of 0.463% in the share of science and engineering students. This coefficient is relatively high among all disciplines, highlighting the strong pulling force of industrial development on the demand for S&E talents, which likewise explains why in the coupling coordination analysis, the size of S&E is still large despite the low degree of coordination, which is more like a relationship of large volume but insufficient matching precision.

4.2.4. Regression Analysis of Humanities and Medical Sciences and the Three Major Industries

The results of the regression analysis of the proportion of the number of students enrolled in humanities and social sciences and medicine and the proportion of the output value of the three industries are shown in Table 8.

Table 8. Regression analysis of humanities, social, medicine and 3 industries

Variables Entered	**Primary industry (Agriculture) The tertiary industry (Service)**				
Variables removed	Secondary industry (Industry)				
R Square	0.916				
Adjusted R Square	0.885				
F	27.392				
Sig.	0.000				
	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	25.637	5.124		5.004	0.000
Agriculture	-0.294	0.108	-0.185	-2.722	0.021
Service	0.572	0.095	0.781	6.021	0.000

The regression model for the Humanities, Social Sciences and Medicine category is more complex, with the primary and tertiary industries entering the equation after the regression analysis, while the secondary industry is excluded. The R-square value of the model is as high as 0.916, and the explanatory power of the model is very strong.

The final regression equation is:

Y4 = 25.637-0.294X1 + 0.572X3

For the Humanities and Social Sciences and Medicine categories, Services is the core driver, showing a positive value of positive pull, with a 1% increase in its share of output leading to a 0.572% increase in the share of students in this category, with a standardized coefficient of Beta = 0.781. Agriculture, on the other hand, shows a weak directional pull, with an increase in its share of output leading instead to a small decrease in the share of students in this category of 0.294%.

5. Conclusion

Based on the coupling coordination degree model and regression analysis model, the study quantitatively diagnoses the fit between the major settings of undergraduate colleges and universities in A and the development of regional industries.

The data show that although the overall degree of coordination between majors and industries has increased from 0.673 to 0.819 in seven years, realizing the leap from “high coordination” to “high coordination”, there are serious structural contradictions within. Agricultural majors and agriculture have good synergy, with an average degree of coordination of 0.554, which belongs to “medium coordination", while the degree of coordination between science and technology and the secondary industry is always low, with an average of 0.279.

There is a development speed difference between education supply and industrial demand, and the relative development degree of the two has dropped from 1.458 to 0.762, and the pace of professional restructuring of colleges and universities obviously cannot keep up with industrial upgrading.

Regression analysis confirms that the sensitivity of different disciplines to industrial changes varies greatly, and every 1% growth in industrial output can directly pull the growth of science and technology student size by 0.463%, while the service industry is the main driving force for the training of talents in economics and management and humanities and social sciences.

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