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Article

Research on the assessment model of vocational education employment matching degree based on multiple regression analysis

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Abstract: At present, vocational education pays more attention to the comprehensive quality education of the educated, and it has become the consensus of higher vocational colleges and universities to fully improve the degree of students' employment matching. This paper proposes a vocational education employment matching degree assessment model based on entropy weight method and fuzzy comprehensive evaluation, and introduces the multiple linear regression model to analyze the specific factors affecting the vocational education employment matching degree. Firstly, the index system of vocational education employment matching degree assessment is established, the entropy weight method is used to solve the index weights, and the fuzzy comprehensive evaluation model is combined to realize the assessment of vocational education employment matching degree. Then, using the data of graduates from 50 vocational colleges and universities in China as support, we constructed benchmark regression and threshold regression models to explore the path of vocational education employment matching degree improvement. It is found that the fuzzy comprehensive evaluation model can realize the accurate assessment of vocational education employment matching degree, the level of students' employability has a significant positive effect on vocational education employment matching degree, and the promotion effect on vocational education employment matching degree is stronger when the level of regional economic development is lower than 16.21%. Therefore, vocational education needs to optimize the design of students' employment guidance courses, reasonably promote the reformative development of regional economy, and then promote the improvement of vocational education employment matching degree and enhance the quality of vocational education talent cultivation.

Keywords: vocational education; entropy weight method; fuzzy comprehensive evaluation; threshold regression; employment matching degree

1. Introduction

Vocational education refers to the education that cultivates high-quality workers of various types, levels and specialties that meet the needs of national and local economic and social development [1]. With the rapid development of social economy, the demand for high-quality and high-skilled talents in all walks of life is increasing, and vocational education, as an important way to cultivate vocational skilled talents, is also increasingly being emphasized by society [2-3]. Data show that the employment rate of higher vocational graduates in 2019 is only 73.9%, rising to 92% in 2023, but the professional matching rate is low, and there is a large gap in the number and quality of employment positions, which leads to a higher departure rate of vocational education graduates in a shorter period of years than that of general college graduates, which seriously affects the career development of students and vocational education, and even leads to the delay of industrial upgrading [4-8]. It reveals that the problem of matching the education system of vocational education with the job market still exists.

The key factors in the study of the matching problem between vocational education and the job market are mainly the following. First, changes in industrial structure and demand are key factors in the matching problem between vocational education and the job market, for specific industries and enterprises, the trend of industry development and changes in demand are key, however, vocational education curriculum and faculty fail to make timely adjustments in accordance with market demand [9-12]. Second, social policies and regulations have an obvious guiding role for both vocational education and the job market, and the formulation and implementation of scientific policies and regulations can better promote the effective matching of vocational education and the job market, but the updating mode of the vocational education system is slow [13-16]. Thirdly, the improvement of students' own quality and the accumulation of professional knowledge is also the key to the problem of matching vocational education and the job market. The current education model of vocational education is relatively single, focusing on the teaching of theoretical knowledge and neglecting the cultivation of practical skills, which leads to the lack of practical experience of students and difficulty in adapting to the needs of the work, thus affecting the employability of students [17-20]. Therefore, it is necessary to establish a vocational education employment matching degree assessment model to help the precise transmission between education-talent-industry.

Literature [21] constructed an intelligent system that can be used to monitor the needs of hiring firms and automate the matching of this information with educational standards and curricula, which allows estimating the match between different hiring needs and educational programs in the job market. Literature [22] used a multinomial logistic regression model to assess the match between students and the job market four years after graduation under different specialized programs, noting that there was a cross-sectional mismatch for students with a degree, but that students with vocational skills were less likely to be in that situation. Literature [23] assessed the match between film and animation professional education in higher vocational colleges and industry demand by using big data analysis techniques based on the dimensions of school-enterprise cooperation, student internship practice, animation culture, and project-based teaching. Literature [24] used grey correlation analysis to assess the degree of coupling and coordination between secondary vocational school curriculum and industry, and emphasized that dynamic changes in the demand for talents in the primary and tertiary industries require schools to make corresponding curriculum adjustments. Literature [25] combined the multi-layer fusion information extraction model and employment matching algorithm to calculate the similarity between job requirements and students' overall ability scores based on professional knowledge and healthcare job requirements, and assessed the match between the job market and students' professional education effects.

Multiple regression analysis is a statistical method used to explore the extent to which an independent variable affects a dependent variable. It analyzes the relationship between multiple independent variables and a dependent variable by developing a mathematical model to predict changes in the dependent variable [26]. Literature [27] evaluated the effectiveness of higher vocational and technical courses with the help of multiple regression analysis, which included a variety of variables such as students' characteristic data, length of study, participation, number of tests, number of out-of-class assignments, etc., and identified the important factors affecting the effectiveness of teaching and learning. Therefore, a multivariate mathematical model can be established through multiple regression analysis, so as to explore the association between variables such as professional knowledge, practical skills, vocational literacy, market demand, and industrial upgrading in the match between vocational education and the job market, and to effectively assess the match between the two.

Aiming at the problem that the current assessment of vocational education and employment matching degree is not precise enough and the influencing factors are not clear enough, the article proposes an assessment model combining entropy weighting method and fuzzy comprehensive evaluation, and introduces multivariate linear regression to explore the influencing factors. This study provides a new sociological research method for the innovative assessment of the degree of employment matching in vocational education, and analyzes the degree of influence on the degree of employment matching from the aspects of students' employability and the level of regional economic development, which provides decision-making support for the improvement of the degree of employment matching in vocational education.

2. Vocational Education Employment Matching Assessment Model

After years of rapid growth, China's social economy has entered a medium- to high-speed growth stage, and China is transitioning from a “manufacturing power” to a “manufacturing power”, and technical talents will increasingly occupy a dominant position in the market. Higher vocational colleges and universities are the places to cultivate high-quality technical and skilled talents for the society, and

the full employment of students in higher vocational colleges and universities is a systematic project that involves students, schools, families, governments, enterprises and the society in many aspects. However, employment problems such as long employment time, low employment matching degree and low employment satisfaction are prominent, and how to promote the development of students' employment matching degree in vocational education has become one of the key concerns and researches in the society nowadays.

2.1. Indicator System for Evaluating Employment Matching

2.1.1. Definition of Job Match

Employment matching, also known as matching of ability and post or matching of learning and utilization, refers to the matching of individuals with jobs in accordance with the principle of making the best use of talents, and is a perfect fit between the job requirements and the skills, knowledge and abilities of the inaugurated person and the requirements of the job. It is a reasonable match between jobs and people to achieve adequate allocation of human resources and make people fit their jobs.

Factors affecting the matching of employed people and jobs include the skills required for a specific job and the professional knowledge, comprehensive ability, experience level, personal qualities and so on that should be possessed. Most studies only focus on the impact of education and job matching on employment quality, but education job matching is not a good measure of learning and utilization matching, as education level, skills and the type of vocational education received all have an impact on education job matching. Studies have shown that the correlation between education-work matching and job-matching is not obvious, and it is more realistic to study the impact of matching of study majors and jobs on employment, in addition to education level. Only by realizing job matching can vocational education be promoted to maximize output, and the creativity and productivity of talents will promote the development of local industries as well as stimulate the vitality of innovation [28].

2.1.2. Construction of the assessment indicator system

In order to accurately realize the assessment of vocational education employment matching degree, this paper establishes the vocational education employment matching degree assessment index system from eight dimensions, including job stability, labor remuneration, social security, labor-management relations harmony, employment opportunities, job matching degree, employment policy system and regional macroeconomic level, and its specific content is shown in Table 1.

Table 1. Employment matching index system

Criterion layer	Index layer	Code
Job stability	Temporary employment rate of graduates	JS1
	The ratio of labor contracts with a term <3	JS2
	Labor protection investment of the employing unit	JS3
	The stress level related to work	JS4
Labor remuneration	Average monthly income	LR1
	Salary satisfaction	LR2
	Under income rate	LR3
Social security	The coverage rate of old-age insurance	SS1
	Work-related injury insurance	SS2
	Medical insurance	SS3
	Maternity insurance	SS4
	Unemployment insurance	SS5
The harmony of labor-management relations	Trade union participation rate	HL1
	The signing rate of labor contracts	HL2
	Employee participation rate	HL3
	The incidence rate of labor disputes	HL4
Employment opportunities	Graduate employment rate	EO1
	The ratio of supply to demand for graduates	EO2
	Underemployment rate	EO3
Job matching degree	The degree of alignment with career expectations	JM1
	Competency satisfaction	JM2
	The rate of professional relevance	JM3
Employment policy system	Employment system	EP1
	Employment structure	EP2
	Employment services	EP3
	Employment policy	EP4
Regional macroeconomic level	Total domestic production value	RM1
	Proportion of industrial structure	RM2
	Output value of high-tech industries	RM3
	Per capita consumption level	RM4
	Per capita disposable income	RM5

2.2. Comprehensive assessment model for job matching

2.2.1. Methodology for calculating indicator weights

The entropy weighting method is widely used in various assessments by calculating the weights of each factor. The principle is that the greater the entropy, the greater the information and the greater the uncertainty; conversely, the smaller the entropy, the smaller the uncertainty. Therefore, the principle of entropy can be used to judge the uncertainty and randomness of a factor by the entropy weight method [29]. The specific steps are as follows:

(1) Construction of original evaluation matrix

Assuming that there are h ... evaluation metrics and t evaluators, then x_{mn} is the rating of the mth

expert on the nth evaluation metric. Then the original matrix can be expressed as:

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1h} \\ x_{21} & x_{22} & \cdots & x_{2h} \\ \cdots & \cdots & \cdots & \cdots \\ x_{t1} & x_{t2} & \cdots & x_{th} \end{bmatrix} \tag{1}$$

where $m = 1, 2, \ldots t, n = 1, 2, \ldots h$.

(2) Normalization of the original matrix

Since different indicators represent different meanings, some values are better the larger the better, and some values are better the smaller the better. Therefore, when using the entropy weighting method to assign weights to the indicators, it is necessary to apply different calculation formulas according to different types of indicators. If the larger an indicator is the better the actual meaning it represents, it is standardized using the positive indicator standardization formula:

$$r_{mn} = \left(x_{mn} - \min x_{mn}\right) \div \left(\max x_{mn} - \min x_{mn}\right) \tag{2}$$

If the smaller an indicator is the better the actual meaning it represents, it is normalized using the reverse indicator normalization formula:

$$r_{mn} = \left(\max x_{mn} - x_{mn}\right) \div \left(\max x_{mn} - \min x_{mn}\right) \tag{3}$$

(3) Calculate the weight of the nth evaluation indicator under the mth expert:

$$p_{mn} = \frac{r_{mn}}{\sum_{n=1}^{t} r_{mn}} \tag{4}$$

(4) Calculate the entropy value of the indicator:

$$H_m = \frac{-\sum_{n=1}^{t} p_{mn} \ln p_{mn}}{\ln t} \tag{5}$$

where $m = 1, 2, \cdots t$. where $p_{mn} = \frac{r_{mn}}{\sum_{n=1}^{t} r_{mn}}$, and when $p0 = 0$, let $p_{mn} \ln p_{mn} = 0$.

(5) Calculate the weights:

The indicator difference coefficient $Dm = 1 - Hm$ for the m th factor, and the formula for the weight of the n th evaluation indicator is:

$$W_m = \frac{1 - H_m}{\sum_{m=1}^{h} \left(1 - H_m\right)} = \frac{1 - H_m}{h - \sum_{m=1}^{h} H_m} \tag{6}$$

2.2.2. Fuzzy integrated evaluation model

The fuzzy comprehensive evaluation method is suitable for solving the problem of unclear boundaries and difficult data, which can effectively transform qualitative evaluation into quantitative evaluation, thus producing clear and explicit evaluation results [30]. Its application steps are as follows:

(1) Establish the factor set of the evaluation target

Usually the evaluated target is affected by multiple factors, assuming that the influencing factors are m, then the factor set $U = \left\{U_1, U_2 \ldots, Um\right\}$.

(2) Establishment of the set of rubrics of the evaluated object

In the process of evaluating the evaluated object, multiple evaluation results will be formed, then all the evaluation results constitute the rubric set, rubric set $V = \left\{V_1, V_2, V_3, \ldots, Vn\right\}$, this set of rubrics is

used to obtain quantitative evaluation results by means of score assignment.

(3) Determination of evaluation index weights

Usually, the determination of indicator weights can be synthesized by one or more methods, and this paper adopts the entropy weight method.

(4) Determine the degree of affiliation to establish a fuzzy relationship matrix

From the perspective of a single factor, if R is set as the degree of affiliation of the evaluation object to each evaluation factor, then the degree of affiliation of the evaluation object to each evaluation factor U can be determined and expressed in terms of R, then:

$$R = \begin{bmatrix} r_{11} & r_{12} & r_{13} & r_{14} \\ r_{21} & r_{22} & r_{23} & r_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ r_{m1} & r_{m2} & r_{m3} & r_{mn} \end{bmatrix} \tag{7}$$

$$r_{ij} = \frac{c_{ij}}{\sum_{i=1}^{m} c_{ij}}$$

Where r_{ij} denotes the affiliation of a certain evaluated object to the rubric V_i from the evaluation factor Ui, and Cij denotes the number of people who have been evaluated for the jth evaluation result of the ith factor V_j.

(5) Comprehensive evaluation value of multiple indicators. Then:

$$Q = R \cdot V \tag{8}$$

Where Q denotes the evaluation value matrix, R denotes the fuzzy relationship matrix, and V denotes the set of rubrics.

Firstly, the evaluation value of secondary indicators is calculated, i.e:

$$Q_{ij} = R_{ij} \cdot \begin{bmatrix} V_1 \\ V_2 \\ V_3 \\ \vdots \\ V_n \end{bmatrix} \tag{9}$$

Secondly, the evaluation value of the first level indicator is calculated, i.e:

$$Q_i = W_{ij} \cdot Q_{ij} = W_{ij} \cdot R_{ij} \cdot \begin{bmatrix} V_1 \\ V_2 \\ V_3 \\ \vdots \\ V_n \end{bmatrix} \tag{10}$$

Finally, the composite evaluation value is calculated, i.e:

$$\overline{Q_i} = W_i \cdot Q_i \tag{11}$$

3. Vocational Education Employment Matching Degree Influence Model

Employment is one of the most concerned issues in higher vocational colleges and universities. Higher vocational colleges and universities students training method originally tends to practical skills, so students must have a clear understanding of the serious attitude of the post and the use of skills in the environment. At present, many students tend to have a serious lack of knowledge about these

contents before graduation. This chapter is aimed at modeling the influencing factors of vocational education employment matching degree to provide support for exploring the improvement path of employment matching degree.

3.1. Data sources and multiple regressions

3.1.1. Research data sources

The data in this paper comes from the results of a survey on the matching of majors and employment of graduates from 50 vocational colleges and universities in China, which targeted graduates from 50 vocational colleges and universities from the class of 2020 to the class of 2024. The online questionnaire survey was conducted by inviting and sending questionnaire links to QQ groups of grades and classes established by former students, and the data collection was carried out and completed from May to August 2025, with a total of 1,042 valid questionnaires. The reliability and validity tests of the questionnaire were all qualified, and the data can truly reflect the development level of vocational education employment matching degree. In addition, some of the employment data and economic data come from the China Statistical Yearbook, and the article predicts and fills in some of the missing data by means of the exponential smoothing method, so as to ensure the completeness of the data.

3.1.2. Multiple regression methods

Regression is a statistical way to study and analyze the interactions between variables. By defining the name of the method according to the number of variables involved, e.g., the study of the relationship between two variables is called simple correlation and simple regression, and if there are more than two variables, it is called multiple regression. Multiple linear regression focuses on the study of quantitative linkages between multiple factors and portraying these linkages in some mathematical form so as to determine the effect of a change in one or a number of factors (independent variables) on another factor (dependent variable) [31].

If there is some correlation between the variables $x_1, x_2, \cdots, x_p$ and the randomness variable y, then it generally means that each time $x_1, x_2, \cdots, x_p$ takes on a fixed value, there is a probability distribution of y that matches it. The probability model for a random variable y and the associated variables $x_1, x_2, \cdots, x_p$ is:

$$y = f\left(x_1, x_2, \cdots, x_p\right) + \text{ò} \tag{12}$$

When the regression function in the probabilistic model Eq. (12) is linear, then there is:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_p x_p + \text{ò} \tag{13}$$

where $\beta_0, \beta_1, \beta_2, \cdots, \beta_p$ are uncertain parameters, often called regression coefficients. For an uncertain variable $\beta_i (i = 0, 1, 2, \cdots, p)$, the degree of "linearity" is based on the uncertain variable. The linear nature of the regression explanatory variables is not intrinsic; the explanatory variables can also be nonlinear, in which case they are transformed to linear by substitution of variables.

Classical linear regression models, when estimating the parameters of the model, are generally subject to a number of important assumptions:

(1) The explanatory variables $x_1, x_2, \cdots, x_p$ are non-random variables and the observations $x_{i1}, x_{i2}, \cdots, x_{ip}$ are constants.

(2) The assumptions of equal variance and uncorrelation are:

$$\left\{\begin{array}{ll} E\left(\text{ò}_i\right) = 0, & i = 1, 2, \cdots, n \\ \operatorname{cov}\left(\text{蚪}_i, \text{蚪}_j\right) = \begin{cases} \sigma^2 & i = j, \\ 0 & i \neq j, \end{cases} & i, j = 1, 2, \cdots, n \end{array}\right\} \tag{14}$$

We call this condition the Gauss-Markov condition, notated G-M condition. In this case, certain key

properties concerning the least squares estimation of the regression coefficients and the variance estimation of the error term can be obtained, e.g., the least squares estimation of the regression coefficients is a linear unbiased estimation of the minimum variance of the regression coefficients, etc.

(3) The normal distribution is assumed to be:

$$\begin{cases} \text{ò}_i \sim N\left(0,\sigma^2\right), \\ \text{蝌}_1,\text{}_2,\cdots,\text{}_n \text{ Independent of each other,} \end{cases} \tag{15}$$

Under this condition, more conclusions about the least squares estimation of the regression coefficients and the estimation of σ^2 can be obtained, e.g., that each of them is an unbiased estimate of the regression coefficients and the minimum variance of σ^2, etc., and that tests of the significance of regressions and the estimation of intervals can be carried out as well.

(4) The general requirement of $n > p$, i.e., the number of sample sizes should be larger than the number of explanatory variables, in order to facilitate the mathematical processing and obtain more accurate results.

3.2. Model Design and Variable Description

3.2.1. Modeling

In order to verify the linear relationship between students' employment level and vocational education employment matching, the basic linear model is set up for testing. According to the multiple linear regression model, the model is set:

$$JY_{it} = \alpha_0 + \alpha_1 EL_{it} + \sum \alpha_i Controls_{it} + \Phi_t + \varepsilon_{it} \tag{16}$$

In the model, JY_{it} denotes the vocational education employment matching degree, EL_{it} denotes the student employment level, subscript i denotes the regions, and t denotes the year. controls denotes all control variables, and the control variables include the foreign trade level (FTL), the strength of governmental support (GS), and the strength of employment investment (EDI), human capital level (HCL). Φ_t is the time fixed effect, α_0 is the constant term, and ε_{it} is the residual term.

This paper also takes into account that the regional economic development level may have a threshold effect on the relationship between students' employment level and vocational education employment matching, and constructs a static threshold model expressed as with the regional economic development level (RED) as the threshold variable:

$$JY_{it} = \beta_1 \ln EL_{it} I\left(RED_{it} \bullet q_1\right) + \beta_2 EL_{it} I\left(RED_{it} > q_1\right) + \Phi X_{it} + \mu_i + e_{it} \tag{17}$$

In this model, subscript i denotes the regions, t represents the year, the relevant variables are the same as in the previous model, RED_{it} is the threshold variable, $I(\cdot)$ is the indicator function, q1 represents the variable thresholds, X_{it} is the set of control variables, μ_i is the individual fixed effects, and e_{it} is the residual term.

3.2.2. Description of variables

(1) Explained variable: vocational education employment matching degree

Vocational Education Employment Matching Degree (JY) is used as a standard to indicate the development level of vocational education employment matching degree by using the results solved by the fuzzy comprehensive evaluation model in the previous section.

(2) Explanatory variable: students' employability level

As for the level of students' employability (EL), integrating the relevant measurement indicators of students' employability level in existing studies and data availability, this paper determines the level of students' employability from three perspectives: students' professional level, students' technical ability, and students' vocational performance. The three indicators are first standardized in the calculation process, and on this basis, principal component analysis is used to synthesize them into one indicator to represent the level of student employability.

(3) Threshold variable: regional economic development level

For the regional economic development level (RED), this paper adopts the gross regional product to reflect the degree of development and economic status of a region. The regional economy is closely related to the employment level, and if the two do not match, it may lead to a lower degree of employment matching, and not be able to sustain the injection of talent vitality into the regional economy.

(4) Control Variables

Based on the current information about employment, and considering the researched problem and the form of employment, this paper mainly chooses the four variables of foreign trade level (FTL), government support (GS), employment investment (EDI), and human capital level (HCL). Its data were standardized in the application process, so as to ensure the consistency of the data in the analysis process.

4. Empirical Analysis of Vocational Education Employment Matching Degree

Vocational education in all countries of the world has gone through four major transmutation processes, namely, knowledge-based, ability-based, personality-based and quality-based, in accordance with the requirements of social development and talent cultivation, indicating the return of education from a “tool” to a “person”, and the need for a comprehensive understanding of the functions of vocational education. Function. During the period of economic restructuring and industrial transformation and upgrading, higher requirements are put forward for the comprehensive quality of workers, which urgently requires higher vocational colleges and universities to investigate and analyze the data of the region they are located in, and consider the employment quality of graduates in a multi-dimensional way. In order to pay more attention to the vocational ability and career development of students and cultivate high-quality technical and skilled talents with comprehensive development.

4.1. Comprehensive assessment of job matching

4.1.1. Determination of indicator weights

Based on the research data selected in the previous section and relying on the specific steps of entropy weighting method to solve the weights of indicators, the weight distribution of vocational education employment matching degree evaluation indicators is obtained as shown in Fig. 1.

For the weight distribution of vocational education employment matching degree evaluation indexes, the weight share of job matching degree (JM), employment opportunity (EO), and employment policy and institutional construction (EP) rank in the top three, with the values of 14.29%, 13.58% and 13.16% respectively. This indicates that in emphasizing the process of vocational education employment matching, it is necessary to pay active attention to the matching between students and jobs in order to effectively enhance the vocational education employment matching. It is also necessary to further expand employment opportunities and establish a sound institutional mechanism for employment policies in order to help promote the in-depth integration of students and the job market, thereby promoting the effective convergence of vocational education employment matching degree and enterprise demand. Among the secondary indicators, the weight values of ability satisfaction (JM2) and career expectation match (JM1) are over 0.05, while the weight values of salary satisfaction (LR2), graduate supply/demand ratio (EO2), graduate employment rate (EO1), and specialty matching rate (JM3) are all greater than 0.04. This indicates that in the process of improving the degree of employment matching in vocational education, it is necessary to deeply recognize the role of the above indicators in promoting the degree of employment matching in order to effectively promote the high-quality development of students' employability. In addition, the weight value of each indicator under social security (SS) is relatively low, which is manifested in the fact that the employment process does not fully satisfy the protection of employed people, which may lead to the emergence of a lower degree of employment matching.

Therefore, vocational education, as an important position for talent cultivation, wants to effectively improve the degree of employment matching, it is necessary to further improve the supporting role of some low-weight indicators on the basis of ensuring key indicators, and ensure the coordination and balance of all dimensions, in order to effectively promote the high-quality development of vocational education.

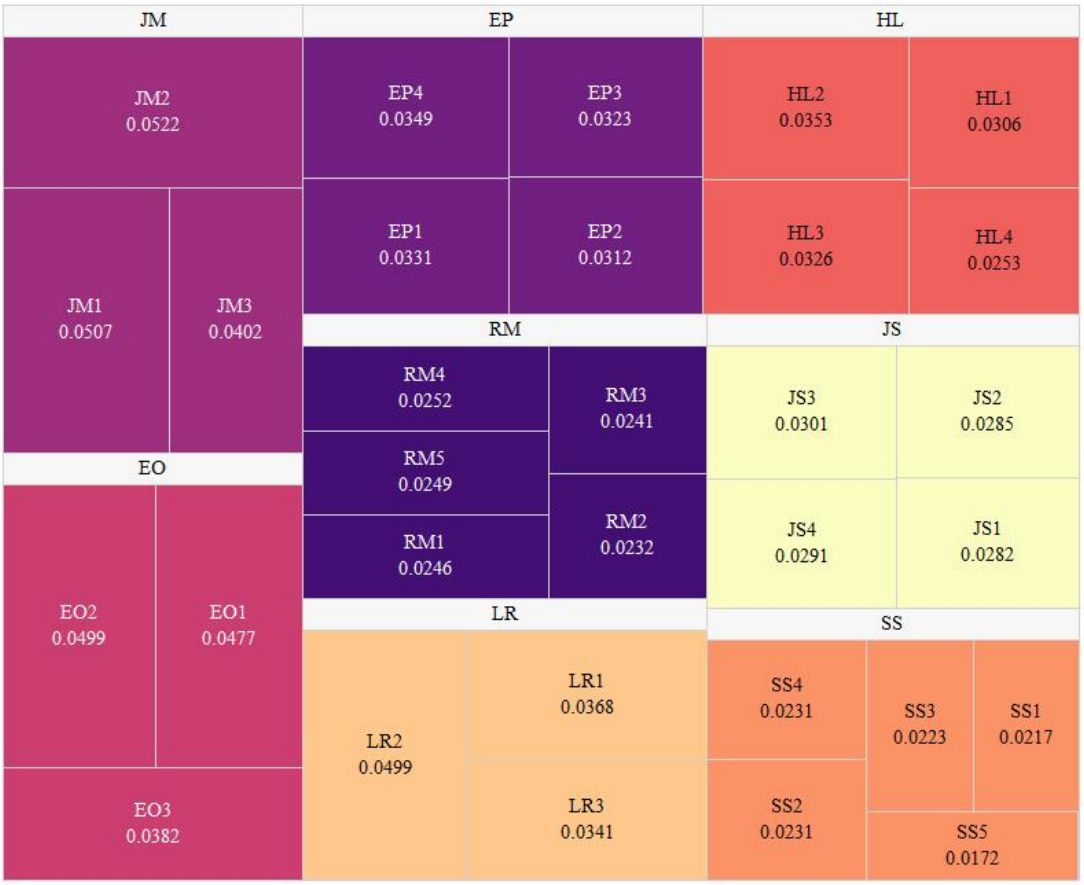

Figure 1. Index weight distribution tree diagram

4.1.2. Comprehensive evaluation results

In order to further illustrate the development of job matching in vocational education, College S was selected from 50 vocational institutions for comprehensive evaluation. This study was conducted on the graduates and employers of College S. 80 questionnaires targeting employers were distributed and 75 valid questionnaires were returned, with a recovery rate of 93.75%. A total of 200 questionnaires were distributed for alumni and 2024 graduates, and 185 valid questionnaires were recovered with a recovery rate of 92.5%. The questionnaire was divided into three parts, i.e., the evaluation of S College by employers, the evaluation of S College graduates by employers, and the evaluation of employment work by S College graduates.

Based on the calculation steps of fuzzy comprehensive evaluation, the comprehensive evaluation of the degree of matching of vocational education and employment in College S is carried out as follows:

(1) Determine the evaluation affiliation matrix of the secondary indicators, taking job stability (JS) as an example:

$$R_{JS} = \begin{bmatrix} 0.428 & 0.345 & 0.196 & 0.031 \\ 0.357 & 0.516 & 0.103 & 0.024 \\ 0.251 & 0.672 & 0.056 & 0.022 \\ 0.463 & 0.346 & 0.089 & 0.012 \end{bmatrix} \tag{18}$$

Based on the weights of the indicators given in the previous section $W_{JS} = [0.2429, 0.2462, 0.2598, 0.2511]$, the fuzzy evaluation result of the work stability is obtained as:

$$B_{JS} = R_{JS} \circ W_{JS} = [0.373, 0.489, 0.116, 0.022] \tag{19}$$

(2) Setting the set of rubrics, in this paper, we set the vocational education and employment matching grade as four levels, i.e. excellent, good, moderate and poor, then $V = [V_1, V_2, V_3, V_4]$. The

values are taken as 2, 4, 6 and 8, respectively.

(3) Following the process of evaluating the fuzzy evaluation results of the secondary indicator Job Stability (JS), the evaluation affiliation matrix of the vocational education employment matching degree is obtained as:

$$R = \begin{bmatrix} 0.373 & 0.489 & 0.116 & 0.022 \\ 0.516 & 0.321 & 0.163 & 0.000 \\ 0.427 & 0.495 & 0.067 & 0.011 \\ 0.303 & 0.512 & 0.128 & 0.067 \\ 0.298 & 0.487 & 0.215 & 0.000 \\ 0.315 & 0.643 & 0.042 & 0.000 \\ 0.428 & 0.446 & 0.104 & 0.026 \\ 0.365 & 0.427 & 0.143 & 0.065 \end{bmatrix} \tag{20}$$

Combined with the weight $W = \begin{bmatrix} 0.1159, 0.1208, 0.1074, 0.1239, \\ 0.1358, 0.1429, 0.1316, 0.1217 \end{bmatrix}$ of the first-level indicators, the fuzzy evaluation result of the vocational education employment matching degree is obtained as:

$$B = W \circ R = [0.375, 0.480, 0.122, 0.023] \tag{21}$$

(4) Based on the value of the rubric set designed in step (2), the comprehensive evaluation result of College S is obtained as:

$$\begin{aligned} Q = B \circ V &= [0.375, 0.480, 0.122, 0.023] \circ \begin{bmatrix} 8 \\ 6 \\ 4 \\ 2 \end{bmatrix} \\ &= 0.375 * 8 + 0.480 * 6 + 0.122 * 4 + 0.023 * 2 \\ &= 6.414 \end{aligned} \tag{22}$$

According to the principle of maximum affiliation and the score of fuzzy comprehensive evaluation results, it can be seen that the level of vocational education and employment matching of College S is good, and its comprehensive score is 6.414. It shows that the employment of graduates of College S is carried out more smoothly, the overall quality is higher, and both colleges, students and enterprises are more satisfied with all aspects. This coincides with the employment situation of the graduates of College S in the real situation and the evaluation of all aspects of society. This shows that the evaluation index system and assessment model of vocational education employment matching degree designed in this paper are reasonable and can provide a more objective and comprehensive evaluation of vocational education employment matching degree.

4.2. Benchmark regression results and analysis

4.2.1. Benchmark regression results

Before conducting the regression analysis, this paper uses the Hausman test to determine what type of regression model to use. Table 2 shows the results of Hausman test, in the table ***, **, * indicate that it is significant at the confidence level of 1%, 5%, 10%, respectively, RE is the random effect model, FE is the fixed effect model, the standard error is in parentheses, the same as in the following text.The results of the Hausman test show that the empirical model rejects the original hypothesis of the random effect at the confidence level of 5%, and therefore this paper chooses fixed effect model estimation.

Table 2. Hausman's test results

Variable	RE	FE
EL	0.229(0.198)	0.085(0.251)
FTL	0.935***(0.167)	0.831*** (0.159)
GS	0.025(0.143)	0.003(0.023)
EDI	0.007(0.018)	0.000(0.014)
HCL	0.275***(0.042)	0.258***(0.037)
Constant	0.008(0.176)	0.282(0.263)
Hausman	15.728	
P-value	0.011	

Based on the fixed effect model selected from the results of Hausman test, the article here uses stepwise regression method to analyze the regression results, and the results are shown in Table 3. It can be seen that the coefficient of the impact of the level of student employability on vocational education employment matching is positive and significant, indicating that the development of the level of student employability significantly promotes the improvement of vocational education employment matching. In model (1) without adding control variables, the estimated coefficient of the level of student employability on vocational education employment matching is 0.067, and in model (5) with added control variables, the estimated coefficient of the level of student employability decreases to 0.062. Although the impact of the level of student employability on vocational education employment matching decreases with the addition of control variables, the overall significant impacts are unchanged that all show a strong influence at the 1% level. The reason why the level of student employability can improve the degree of vocational education employment matching is that, on the one hand, the development of student employability helps to eliminate the information asymmetry in the labor market and promotes the cross-regional dissemination of employment information. On the other hand, the level of student employability helps to promote the advanced industrial structure, making the industrial structure match the overall student employment market.

Table 3. The result of Benchmark regression

Variable	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
EL	0.067*** (0.015)	0.061*** (0.012)	0.053*** (0.018)	0.048*** (0.018)	0.062*** (0.018)
FTL	-	0.005*** (0.007)	0.007*** (0.002)	0.007*** (0.002)	0.007** (0.002)
GS	-	-	0.213** (0.081)	0.221** (0.084)	0.232*** (0.089)
EDI	-	-	-	0.006 (0.005)	0.008 (0.009)
HCL	-	-	-	-	0.073** (0.037)
(Con_)	0.681*** (0.043)	0.662*** (0.041)	0.615*** (0.053)	0.582*** (0.049)	0.612*** (0.057)
R^2	0.431	0.478	0.515	0.518	0.523

4.2.2. Robustness Tests

In order to analyze the robustness of the benchmark regression results in this paper, this paper launches a robustness test on the model, and Table 4 shows the results of the robustness test.

(1) Linear panel model is used. Although the multivariate linear regression model has a higher degree of suitability for the study in this paper, the linear panel model can solve the accompanying parameter problems that cannot be solved by the multivariate linear regression model through the within-group transformation or difference transformation. Based on this, this paper uses linear panel models for robustness testing. As can be seen from the models (1) and (2) in the table, the coefficients of the level of student employability are significantly integer, indicating that the level of student employability significantly enhances the job matching degree of vocational education, which is

consistent with the results of the benchmark regression.

(2) Using Cloglog survival model. In order to further verify the reliability of the findings of the benchmark study, this paper constructs the student employment time Cloglog survival analysis model for empirical research. As can be seen from the models (3) and (4) in the table, the coefficients of the core explanatory variables are also significantly integer, indicating that the level of students' employability significantly improves the degree of employment matching in vocational education, which is consistent with the results of the benchmark regression.

(3) "Vocational school employment rate" is used as the explanatory variable. For students entering the job market for the first time, whether or not they can continue to exist is an important factor in measuring the quality of their employment. Therefore, a dummy variable for "employment rate of vocational schools" (ER) was created as an explanatory variable. From the models (5) and (6) in the table, it can be found that the coefficients of the core explanatory variables are significantly positive, indicating that the level of students' employability can effectively improve the employment rate of vocational colleges and universities, i.e., to enhance the effect of talent cultivation in vocational colleges and universities, which is in line with the core conclusions of this paper.

(4) Excluding the influence of outliers. In order to exclude the interference of outliers in the sample on the benchmark regression, this paper shrinks the indicator of students' employability level at the 1% and 99% percentile. The regression results after shrinking are shown in models (7) and (8) in the table. After excluding the influence of outliers, the direction and significance of the sign of the coefficients of the core explanatory variables are basically consistent with the benchmark regression.

Table 4. Robustness test result

Variable	Panel OLS		The Cloglog survival model	
	Model (1)	**Model (2)**	**Model (3)**	**Model (4)**
EL	0.018**(0.021)	0.012**(0.015)	0.074***(0.093)	0.091***(0.065)
Control	NO	YES	NO	YES
Time effect	YES	YES	YES	YES
Individual effect	YES	YES	YES	YES
Variable	Substitution dependent variable		Abnormal value effect	
	Model (5)	Model (6)	Model (7)	Model (8)
EL	0.061***(0.072)	0.037***(0.064)	0.115***(0.149)	0.108***(0.127)
Control	NO	YES	NO	YES
Time effect	YES	YES	YES	YES
Individual effect	YES	YES	YES	YES

4.2.3. Threshold regression results

In order to verify the influence effect of regional economic development level on the level of students' employability to promote vocational education and employment matching, this paper carries out the threshold effect model analysis to test the spillover of regional economic development level. Based on the threshold regression model established in the previous section, the threshold effect test results are obtained as shown in Figure 2, and the threshold regression results are shown in Table 5.

The core explanatory variable of the model regression is the lag 1 period of the regional economic development level, because the regional economic development is a cumulative process, and the short-term regional economic development level does not have an immediate effect on the degree of employment matching, i.e., the threshold effect of the regional economic development level has a certain lag. Although the level of students' employment ability can significantly promote the improvement of employment matching degree, there will be a certain time lag effect when the level of regional economic development is regressed as a threshold variable, so the lagged term of the level of regional economic development is chosen as the core explanatory variable. As can be seen from the data in the table, when the level of regional economic development exceeds 16.21%, the spillover coefficient on the degree of employment matching in vocational education is 0.048. While the spillover coefficient on employment matching is 0.059 when the regional economic development level is lower than 16.21%, the promotion effect is further strengthened, and the threshold effect of the regional economic development level can be seen in combination with Figure 2. It can be seen that in the

process of the cumulative development of the regional economic development level, the impact on the degree of employment matching is continuously strengthened. the F statistic of the Wald test corresponds to a probability value infinitely close to 0, indicating that the two coefficients are significantly different, which suggests that there is indeed an obvious threshold characteristic of the spillover effect of the regional economic development level.

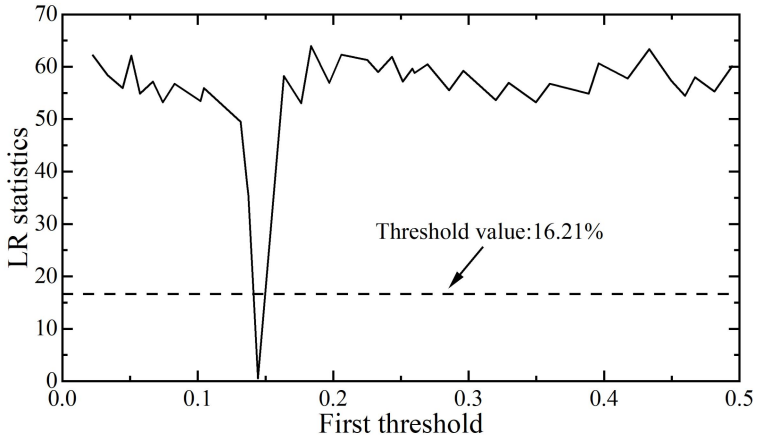

Figure 2. Threshold effect test results

Table 5. Threshold effect regression

Variable	Beta	t	P	95% CI
LnRED≤16.21%	0.059	4.283	0.002	[-0.716, -0.108]
LnRED>16.21%	0.048	3.179	0.001	[0.692, 3.157]
Control	YES	YES	YES	YES
(Cons_)	0.236	0.095	0.938	[1.607, 5.981]

5. Conclusion

The purpose of exploring the comprehensive assessment of vocational education employment matching degree and analyzing the influencing factors is to further solve the problems of low employment matching degree and poor employability in vocational education. The article establishes the evaluation index system of employment matching degree from multiple dimensions and establishes a fuzzy comprehensive assessment model. Multiple linear regression model and threshold regression model are then introduced to further explore the relevant factors affecting the improvement of employment matching degree. The study shows that the employment matching degree evaluation index system can comprehensively cover the data demand of employment matching degree, and the comprehensive assessment results are in line with the reality. There is significance at the 1% level between the level of students' employability and the degree of employment matching, i.e., for every 1 percentage point increase in the level of students' employability, the degree of employment matching can be improved by 0.062 percentage points. There is a single threshold effect of regional economic development level between the level of students' employability and the degree of employment matching, i.e., the value of the threshold variable is 16.21%, and the level of regional economic development increases the degree of employment matching more when it is lower than the threshold value.

Therefore, in order to further promote the improvement of employment matching degree in vocational education, it is necessary to fully coordinate the market economy, optimize the education of students' employment guidance, and promote the high-quality development of the regional economic level while promoting the improvement of students' employment ability level, so as to provide inexhaustible impetus for the improvement of employment matching degree in vocational education.

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