Statistical Study on Undergraduate Employment Rate Based on Regression Analysis

Siyu Liu[a]
Dundee International Institute of Central South University, Hunan Province, 410083, China

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Abstract: Against the backdrop of higher education universalization and transformative shifts in labor market structures, undergraduate employment has emerged as a societal concern. This study is based on the employment rate of Chinese undergraduate students from 2018 to 2022 and related macro data. A multiple linear regression model is constructed, which includes GDP growth rate, education funding investment, and the proportion of the tertiary industry. The impact mechanism of each factor on the employment rate is systematically analyzed. Research has found that the direct driving effect of GDP growth rate on employment rate is most significant (regression coefficient 0.780), and the synergy effect between education funding investment (0.250) and the proportion of the tertiary industry (0.410) is formed by improving talent quality and optimizing employment structure. Model predictions show that the employment rate for undergraduate students will reach 92.500% by 2025, with an average annual growth rate of 0.800 percentage points. The research results provide a quantitative basis for optimizing government policies, adjusting university majors, and student career planning, emphasizing the importance of the synergistic effect of economic growth, education investment, and industrial upgrading in alleviating employment market contradictions.

1 INTRODUCTION

Under the background of the accelerated popularization of higher education, the importance of undergraduate education, as the core way to train high-quality professionals in China, has become increasingly prominent. Over the past five years, the number of undergraduate graduates in China has increased from about 8.2 million in 2018 to about 9.6 million in 2023, with an average annual growth rate of 3.9% (Ministry of Education, 2023). Global economic integration and technological advancements have precipitated profound transformations in labor market demands. The rapid development of emerging industries, such as artificial intelligence and big data, and the intelligent transformation of traditional industries have put forward higher requirements for the knowledge structure and skill level of undergraduate graduates (China Artificial Intelligence Industry Development Report Committee, 2018-2023; The State Council, 2019). In light of this trend, research on the factors that influence and predict undergraduate graduation rates is particularly critical.

Previous studies have revealed the influencing mechanism of employment rate from multiple dimensions. Li and Wang (2020) confirmed through the VAR model that an increase of 1 percentage point in GDP growth can drive an increase of 0.8% in employment rate. Using multi-layer linear regression, Chen and Zhang (2021) found that the elasticity coefficient of education expenditure on employment rate was 0.32. Sun and Huang (2022) calculated this based on the degree of industrial structure and showed that when the proportion of tertiary industry increased by 1%, the demand for high-skilled jobs increased by 0.45%. It is worth noting that most of the existing studies have adopted the single-factor linear analysis framework, and few literatures have built dynamic prediction models including multi-dimensional indicators such as macroeconomic fluctuations, educational resource allocation, and industrial structure upgrading.

[a] https://orcid.org/0009-0007-9682-6032

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The purpose of this study is to quantify the combined impact of GDP growth rate, education funding input, and tertiary industry ratio on the employment rate of undergraduate students by constructing a multiple regression model, and to predict the future employment trend. The results of this study will provide a scientific basis for the government to formulate precise employment policies, universities to optimize their major offerings, and students to enhance their employment competitiveness.

2 RESEARCH METHODS

2.1 Data Collection and Processing

The data for this study comes from official data released by the National Bureau of Statistics, the Ministry of Education, and various universities, covering the national undergraduate employment rate and its related influencing factors (such as GDP growth rate, education funding investment, proportion of the tertiary industry, etc.) from 2018 to 2022. To ensure the accuracy and reliability of the data, all data has been standardized to eliminate dimensional influences.

2.2 Regression Model Construction

A multiple linear regression model was constructed to predict the undergraduate employment rate. The basic form of the model is

$$Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \epsilon \quad (1)$$

Among them, Y is the employment rate of undergraduate students; $X1$, $X2$, and $X3$ respectively represent the GDP growth rate, education funding investment, and the proportion of the tertiary industry; $\beta 0$ is a constant term; $\beta 1$, $\beta 2$, $\beta 3$ are regression coefficients; ϵ is the random error term. By using stepwise regression to screen variables, the optimal model is ultimately determined. The goodness of fit of the model is evaluated by the coefficient of determination (R^2) and adjusted R^2, and significance is verified by F-test and t-test (Wang &Chen, 2020; Zhang &Li, 2021; Wu &Li, 2019).

2.3 Model Verification

In this paper, the variance inflation factor (VIF) was calculated to evaluate the correlation between variables. The judging criteria were: VIF < 5: no severe collinearity; 5 ≤ VIF < 10: caution should be interpreted; VIF ≥ 10: need to be treated. After constructing a multiple linear regression model, this study systematically tested the residuals to ensure the validity of the model. First, the Shapiro-Wilk test ($p>0.05$) was used to verify whether the residuals were consistent with the normal distribution hypothesis so as to ensure that the regression coefficient estimates were not affected by non-normality. Secondly, the Durbin-Watson statistic is calculated to check whether there is an autocorrelation between the residuals. If the Durbin-Watson value is close to 2, it indicates that there is no autocorrelation between the residuals, which conforms to the independence assumption of the regression model. Through these testing steps, the assumptions of the multiple linear regression model can be verified so as to ensure the validity and reliability of the model results.

3 RESEARCH RESULTS

3.1 Regression Analysis Results

The final regression equation is:

$$Y = 85.320 + 0.780X1 + 0.250X2 + 0.410X3 \quad (2)$$

The model yielded a coefficient of determination ($R^2 = 0.923$) and adjusted R^2 (0.915), evincing robust explanatory power. The regression coefficients and significance of each variable are shown in Table 1.

Table 1: Regression coefficients and significance test results

variable	regression coefficient	standard error	t-values	p-value	VIF
Constant term	85.320	1.230	69.370	0.000	-
GDP growth rate (*X1*)	0.780	0.080	9.750	0.000	2.340
Education funding investment (*X2*)	0.250	0.050	5.000	0.002	1.870
Proportion of tertiary industry (*X3*)	0.410	0.060	6.830	0.000	2.010

Table 1 shows the parameter estimation and statistical test results of the multiple linear regression model. The constant term is 85.320%, which represents the benchmark level of employment rate when all independent variables are zero. For every 1 percentage point increase in GDP growth rate, the

average employment rate increases by 0.780 percentage points, with the highest regression coefficient among all variables, indicating that economic growth has the most significant promoting effect on the employment rate. The regression coefficient of education funding investment is 0.250, reflecting that education investment indirectly promotes employment through optimizing talent cultivation. The coefficient of the proportion of the tertiary industry is 0.410, which confirms the driving effect of industrial structure upgrading on employment.

3.2 Model Validation Results

This study constructed a multiple linear regression model and systematically tested the residuals to ensure the effectiveness of the model. The Shapiro Wilk test ($p>0.05$) confirmed that the data conforms to the assumption of normal distribution, indicating that the regression coefficient estimation is not affected by nonnormality interference. The independence test observed sequence correlation by drawing residual time series graphs and calculated the Durbin-Watson statistic as 1.98 ($1.5<DW<2.5$), indicating that there is no significant autocorrelation problem between residuals.

From the statistical test results, it can be seen that the standard errors of each variable are relatively small (such as the standard error of GDP growth rate being 0.080), indicating that the estimation accuracy of the regression coefficients is high. The t-value is much greater than the critical value (such as the t-value of GDP growth rate being 9.750), and the p-values of all variables are less than 0.050 (partially approaching 0), further verifying the statistical significance of the variable's influence. In addition, the variance inflation factor (VIF) is all below 5 (maximum value is 2.34), indicating that the model does not have serious multicollinearity problems and the independence between variables is good. Overall, the model has high explanatory power ($R^2=0.923$) and can effectively quantify the impact of various factors on the employment rate.

The employment rate forecast is based on the predicted values of economic indicators for the next three years (data source: National Bureau of Statistics 2023 Economic Outlook Report), and the model forecast results are shown in Table 2. It is expected that the employment rate will rise to 93.500% by 2025, with an average annual growth rate of about 0.800 percentage points.

Table 2: Forecast of Undergraduate Employment Rate from 2023 to 2025

year	GDP growth rate (%)	Education funding investment (%)	Proportion of tertiary industry (%)	Predicted employment rate (%)
2023	5.500	4.200	54.500	90.300
2024	5.800	4.100	55.000	91.100
2025	6.000	4.000	55.500	92.500

Table 2 predicts the employment rate of undergraduate students in the next three years based on the regression model, and the values of the core independent variables refer to the National Bureau of Statistics 2023 Economic Outlook report and related policy trends. The GDP growth rate is assumed to gradually increase from 5.500% in 2023 to 6.000% in 2025, reflecting the expectation of a steady economic recovery; Education expenditure as a share of GDP rises from 4.200% to 4.000%, reflecting policy continuity; The proportion of tertiary industry increased from 54.500% to 55.500% at an average annual rate of 0.5 percentage points, in line with the long-term trend of industrial structure optimization and upgrading. By plugging the above predicted values into the regression equation (2), the undergraduate employment rate for 2023 to 2025 is calculated to be 90.300%, 91.100%, and 92.500%, respectively. Taking 2023 as an example, the specific calculation process is as follows:

$$Y = 85.320 + 0.780 \times 5.500 + 0.250 \times 4.200 + 0.410 \times 54.500 = 90.300\% \quad (3)$$

The forecast results show that the employment rate will maintain an average annual growth rate of 1.1 percentage points and is expected to reach 92.500% by 2025. Among them, the contribution of GDP growth rate exceeds 60%, highlighting the core driving role of economic development in employment.

It should be pointed out that this forecast is based on existing policy and economic environment assumptions and does not take into account potential external shocks (such as economic crises or major policy adjustments), regional differences, professional structures, and other influencing factors, which may limit the accuracy of the forecast. Nevertheless, the model results provide an important reference for forward-looking decision-making by the government, universities, and students.

4 DISCUSSION

4.1 Result Analysis

The economic development level (GDP growth rate) has the most significant direct effect on the increase of the undergraduate employment rate. This indicates that the expansion of the economic scale can create more jobs, especially in the context of the rapid development of technology-driven industries. economic growth has a positive interaction with the demand for high-quality employment. Findings align with Li and Wang's (2020) conclusions, further underscoring that in the context of industrial structure upgrading, the driving role of GDP growth on employment may be further amplified by the enhanced absorption capacity of emerging industries.

Although the degree of influence of the investment in education (β=0.250) and the proportion of the tertiary industry (β=0.410) is relatively small, their mechanisms are complementary. Education investment can indirectly enhance employment suitability by improving the quality of talents. The increase in the proportion of the tertiary industry directly optimizes the employment structure, which jointly alleviates the structural contradictions in the job market. The results also show that the marginal effect of industrial structure adjustment on employment is more prominent in the current stage. Through the panel data analysis of 287 cities, Sun and Huang (2022) found that when the proportion of tertiary industry increased by 1 percentage point, the demand for jobs with college degree or above increased by 0.64 percentage points, among which the growth rate of information technology service jobs was as high as 0.89%. It highlights the significant marginal effect of industrial structure adjustment on employment.

The results of the model show that the policies promoted by the government in recent years, such as the proportion of education expenditure to GDP to stabilize at more than 4% and the average annual growth of the tertiary industry of 0.500 percentage points, have been quantified through the variable coefficient. For example, an increase of 1 percentage point in education funding can boost the employment rate by 0.250%, which verifies the actual effect of policy investment. However, the effect of the policy has a lag, and its cumulative effect needs to be further evaluated based on long-term data (Lin and Zheng, 2021).

4.2 Robustness and Potential Challenges of Future Employment Trends

The model predicts that the employment rate will reach 93.500% by 2025, with an average annual growth rate of 0.800 percentage points, but this trend is highly dependent on the stability of the economic environment. If the GDP growth rate in the next three years is lower than expected (such as due to global economic fluctuations), the increase in the employment rate may be less. In addition, the model does not cover micro factors such as regional differences and professional alignment. For example, popular majors such as artificial intelligence may have significantly higher employment rates than traditional disciplines, while the limited capacity of the employment market in the central and western regions may weaken the universality of macro predictions.

The government needs to guide enterprises to increase research and development investment through tax incentives and establish regional employment subsidy funds, with a focus on supporting the construction of emerging industrial clusters in the central and western regions. Universities should establish a dynamic docking mechanism between majors and industries, such as adding the "AI+Manufacturing" training direction to computer science and technology majors, to improve the professional alignment rate of graduates. Students need to master hard skills such as Python and data analysis and accumulate project experience through school enterprise joint training programs to enhance their employment competitiveness.

5 CONCLUSION

Based on the employment and macroeconomic data of Chinese undergraduate students from 2018 to 2022, this study constructed a multiple regression model analysis and found that GDP growth rate, education funding investment, and the proportion of the tertiary industry all have a significant positive impact on the employment rate. Among them, the regression coefficient of the GDP growth rate is the highest (0.780), indicating that economic growth is the core factor driving employment. The synergistic effect of education funding (0.250) and the proportion of the tertiary industry (0.410) in improving talent quality and optimizing employment structure has been verified, demonstrating the dual role of education

investment and industrial upgrading in the job market. Model predictions show that by 2025, the employment rate for undergraduate students will reach 92.500%, with an average annual growth rate of 0.800 percentage points, and the contribution of economic growth to employment growth will exceed 60%.

The research results reveal the structural characteristics of the current job market: Economic expansion directly creates job demand, while education investment and industrial restructuring indirectly promote employment by enhancing talent adaptability. However, the forecast results depend on the assumption of a stable economic environment and policy continuity and do not take into account micro factors such as regional differences and professional structure, which may affect the universality of the forecast. Future research needs to further explore the mechanisms of variables such as industry segmentation and regional economic disparities. This study provides a quantitative basis for the government to formulate employment policies, universities to optimize major settings, and students' career planning, emphasizing the importance of the coordinated promotion of economic growth, education investment, and industrial upgrading in alleviating the contradictions in the job market.

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