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AN EMPIRICAL ANALYSIS OF THE INDUSTRIAL STRUCTURE AND EMPLOYMENT STRUCTURE IN JIANGSU PROVINCE

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Abstract: Based on the development context of Jiangsu Province, this study uses data from 2002 to 2020 to examine the interaction between industrial structure and employment structure. It analyzes the output value and employment share of the three industries in Jiangsu, calculates their structural deviations, and explores the causal relationships between industrial and employment structures. Additionally, it identifies problems in their development and proposes optimization suggestions. The results indicate that there is no causal relationship between output value and employment in the primary industry. Increased labor productivity has reduced labor demand, making it difficult to reallocate surplus labor. In the secondary industry, output growth far exceeds employment growth, indicating no causal relationship, but there remains significant employment potential. The tertiary industry shows a unidirectional causal relationship where increased output value promotes employment. This industry has a strong capacity to absorb labor and significant development potential.
Keywords: Industrial structure; Employment structure; Grey relational analysis; Granger causality test

1 INTRODUCTION

Since the reform and opening-up policy, Jiangsu Province's economy has grown rapidly, achieving remarkable accomplishments. In 2013, its GDP was 217 times that of 1978, with an average growth rate of 17.14%. However, Jiangsu still faces issues related to both the quantity and quality of its labor force, and the inconsistency in the adjustment and upgrading of its industrial and employment structures has led to wasted labor resources and difficulties in overcoming traditional employment concepts. During the "13th Five-Year Plan" period, Jiangsu continued to adjust the structure of its three major industries. The proportion of the tertiary industry increased, while the proportions of the primary and secondary industries decreased, although the secondary industry still dominates. Compared to economically leading provinces like Guangdong and Shandong, Jiangsu's industrial structure remains biased towards the secondary industry. In comparison with Beijing and Shanghai, Jiangsu has higher proportions of the primary and secondary industries but lags in the development of the tertiary industry. In terms of employment, during the "13th Five-Year Plan" period, the employment proportions of the primary and secondary industries in Jiangsu decreased, while the tertiary industry's proportion continued to rise. By the end of 2020, they accounted for 13.8%, 39.7%, and 46.5% respectively. The growth momentum of traditional service industries weakened, and the growth rate of industrial added value slowed. Reasonable adjustments to the industrial and employment structures are crucial for future economic development and labor allocation.

Many scholars have studied the relationship between industrial structure and employment structure. Xiao Ma, Hongjuan Li, and Xiuli Sang analyzed the correlation between industrial structure and employment structure in Yunnan Province. Their research found that the primary industry can absorb a certain amount of labor but does not significantly increase its output value. Increased employment in the secondary industry notably promotes its output growth, while the output and employment in the tertiary industry reach equilibrium in the short term[1]. Wenqian Luo studied the dynamic relationship between industrial structure and employment structure, revealing that industrial structural adjustments have a lagged effect on employment structure[2]. The primary industry temporarily enhances its employment absorption capacity in the short term but diminishes in the long term, whereas the absorption capacity of the secondary and tertiary industries weakens in the short term but strengthens in the long term.

Other scholars have researched the factors influencing the coordination between industrial structure and employment structure. Yan He, Changyao Zhang, Zibao Sun used gray relational analysis to analyze industry and employment data, measuring the factors causing deviations between industrial structure and employment structure[3]. Their study found that urbanization levels can promote short-term adjustment of industrial structure in Tibet, while over the long term, industrial and employment structures tend to become more coordinated. Xingji Diao employed SVR and gray prediction models to explore factors influencing the coordination between industrial structure and employment structure in Hunan Province[4]. The results identified four major influencing factors: regional economic development level, quality of regional workforce, degree of government intervention, and level of technological development.

Some scholars have analyzed industrial and employment structures using methods such as structural deviation. Lijuan Wu and Ke Zhu examined the main difficulties faced by Guangxi in adjusting its industrial structure and proposed pathways for improvement[5]. Their study suggests that the primary industry should explore new advantages and promote the external transfer of surplus labor. The secondary and tertiary industries, which dominate economic development, should accelerate industrial upgrading. Qing Wen analyzed the coordination between industrial and employment structures using structural deviation and overall coordination degrees, concluding that both are at a low level, indicating significant potential for improvement[6]. Xinhao Qin compared indicators such as structural deviation, correlation coefficients, and employment elasticity, finding weak correlation in the primary industry's coordination with employment, a mismatch between jobs and talent in the secondary industry, and significant potential for labor absorption in the tertiary industry[7]. Fenglin Liu studied the structural deviation and coordination between industrial and employment structures in He tian, finding that the primary industry has improved economically, rural surplus labor is shifting to the tertiary industry, while the secondary industry is stagnant, and the tertiary industry significantly drives economic growth and labor absorption[8]. Yadi Ren analyzed the coupling effect between industrial and employment structures in the Beijing-Tianjin-Hebei region using economic data and indicators like structural deviation[9]. Shu-xi Yan quantitatively examined the relationship between industrial and employment structures in Yulin, using correlation analysis and structural deviation for the primary and secondary industries, providing recommendations while noting the lack of analysis for the tertiary industry[10].

Based on the above literature, most existing studies mainly conduct structural deviation analysis of industrial and employment structures. This paper, however, conducts research from two aspects. Firstly, it refers to previous studies and selects the following indicators to analyze the relationship between industrial structure and employment structure: employment elasticity, structural deviation, and gray relational analysis. Secondly, it uses the Granger causality test to conduct a dynamic analysis of the relationship between industrial structure and employment structure and provides relevant recommendations based on the changes in their relationship.

2 ANALYSIS OF THE RELATIONSHIP BETWEEN INDUSTRIAL STRUCTURE AND EMPLOYMENT STRUCTURE IN JIANGSU PROVINCE

2.1 Analysis of Employment Elasticity

Employment elasticity refers to the ratio of employment growth rate to economic growth rate. It is generally used to describe the capacity of economic growth to absorb labor resources. When the elasticity coefficient is greater than zero, it indicates that the industry promotes employment, and the capacity of economic growth to drive employment is determined by the magnitude of the elasticity. The larger this value, the stronger the ability to absorb labor. When the elasticity coefficient is less than zero, it indicates that the industry has a crowding-out effect on employment. The larger the absolute value of the elasticity coefficient, the stronger the crowding-out effect. If economic growth is positive and employment growth is negative, this situation is called a crowding-out effect. If economic growth is negative and employment growth is positive, this situation is called an absorption effect. The formula for employment elasticity is as follows:

$$\text{Employment elasticity } = \frac{\text{Employment growth rate}}{\text{GDP growth rate}} \tag{1}$$

By substituting the data from 2002 to 2020 into the formula, it can be seen that the employment elasticity coefficients of the primary industry are all negative. This is due to the increase in labor productivity in Jiangsu Province, which has led to a decrease in demand for labor. The secondary industry had positive elasticity coefficients from 2003 to 2014, indicating that economic growth drove employment growth. This was caused by the initial low technology levels, which required more labor. During these nine years, economic growth had a driving effect on employment, with an average driving capacity of 0.17. However, from 2015 to 2020, the elasticity coefficients of the secondary industry were all negative. This was due to technological innovation and increased labor productivity, leading to a reduction in the required labor force. The tertiary industry had positive elasticity coefficients from 2003 to 2020, indicating that economic growth significantly drove employment growth. It is evident that since its inception, the tertiary industry has consistently had a driving effect on employment.

Overall, the employment elasticity of the primary industry has always been negative, indicating that the primary industry's ability to absorb labor is weak and it does not promote employment. The employment elasticity of the secondary industry was greater than zero before 2014, indicating that the development of the secondary industry could increase labor, with a strong ability to absorb labor. However, from 2015 to 2020, the employment elasticity of the secondary industry was less than zero, indicating a weak ability to absorb labor. The employment elasticity of the tertiary industry has always been greater than zero and relatively stable, indicating that the development of the tertiary industry can increase employment and has a strong ability to absorb labor.

2.2 Structural Deviation Degree Analysis

In this article, the structural deviation degree used is the difference between the ratio of the added value proportion to the employment proportion of each industry . Structural deviation degree is used to determine whether the industrial structure and employment structure are coordinated, which can influence the arrangement of the three industries and employment numbers in Jiangsu Province. The judgment criteria are as follows: if the structural deviation degree tends to zero, it indicates that the two are in a balanced state; if the structural deviation degree is greater than zero, it indicates that the employment proportion is smaller than the industry value-added proportion, suggesting that there is significant employment potential in this industry; if the structural deviation degree is less than zero, it indicates that the employment proportion is greater than the industry value-added proportion, implying that there is pressure to transfer labor out of this industry, meaning there is surplus labor. A structural deviation degree with an absolute value greater than zero indicates an imbalance between the two, and the larger the absolute value, the more likely structural unemployment may occur in future development. Therefore, we will use the structural deviation degree to determine whether the industrial structure and employment structure of the three industries in Jiangsu Province are coordinated. The formula for structural deviation degree is as follows:

$$\text{Structural Deviation Degree} = \frac{\text{Proportion of Industry Value Added}}{\text{Proportion of Industry Employment}}\text{-1)} \tag{2}$$

By processing the relevant data from Jiangsu Province from 2002 to 2020 and substituting it into the above formula, we can observe the following: The structural deviation degree of the primary industry was consistently less than zero from 2002 to 2020, hovering around -0.7. This indicates that the value-added proportion of this industry lags behind its employment proportion. In other words, over these 18 years, there has been pressure to transfer labor out of the primary industry, resulting in a significant surplus of labor. The structural deviation degree of the secondary industry has always been greater than zero. Between 2004 and 2014, the deviation hovered between 0.1 and 0.2. During this period, both the value added and the number of employed persons in the secondary industry increased, indicating that the secondary industry's capacity to absorb labor was moderate. From 2015 to 2020, the structural deviation tended towards 0.1, suggesting that there is still potential for employment growth in the secondary industry. For the tertiary industry, the structural deviation degree gradually approached zero between 2002 and 2016, indicating that economic growth in the tertiary industry had a strong positive impact on employment, achieving a coordinated development between industrial structure and employment structure. However, between 2016 and 2020, the structural deviation ranged from 0.1 to 0.2, suggesting that there is still considerable potential for employment growth in the tertiary industry.

Based on the analysis of the structural deviation degree results, it can be concluded that, compared to the secondary and tertiary industries, the primary industry is more likely to experience structural unemployment. The proportion of employment and the value-added proportion in the primary industry are both declining, but the proportion of employment is decreasing much faster than the value-added proportion. Meanwhile, the value added in the secondary industry has been consistently increasing, and although the value added in the primary industry is also increasing, it is doing so at a much slower rate. This indicates that labor productivity in the primary industry is relatively low. The imbalance in development suggests that there will be unemployed workers in the primary industry.

2.3 Grey Relational Analysis of Employment Structure and Industrial Structure

Grey relational analysis is a quantitative method used to describe and compare the development trends of a system. Grey relational degree serves as a measure of the degree of correlation between factors. In this study, data from Jiangsu Province on industrial structure and employment structure from 2002 to 2020 are selected for relational analysis. Let X_0 represent the sum of absolute deviations of various industries, X_1 represent employment in the primary industry, X_2 represent employment in the secondary industry, and X_3 represent employment in the tertiary industry. The modeling steps are as follows:

Step 1: Define the analysis sequences: Establish the reference sequence as X_0, where $X_0(t)$ represents the deviation degree in year t, with t denoting the year. Set the comparison sequences as X_1, X_2, and X_3, where $X_1(t)$ represents the employment in the primary industry in year t, $X_2(t)$ represents the employment in the secondary industry in year t, and $X_3(t)$ represents the employment in the tertiary industry in year t, with t representing the respective year.

Step 2: To begin with the data, it's necessary to normalize the variables, as the data in each column may vary in scale, making direct comparison difficult or impractical. In this study, the method employed is initial value normalization. This involves dividing each column of data by its first value to derive new normalized data. Specifically, the formula for initial value normalization of the reference column is as follows:

$$X_0 * (t) = \frac{X_0(t)}{X_0(1)} \tag{3}$$

The formula for initial value normalization of the comparison columns is:

$$Xi(t) = \frac{Xi(t)}{Xi(1)} \tag{4}$$

Here, where iii represents the primary, secondary, and tertiary industries (i = 1, 2, 3).

Step 3: Calculate the correlation coefficient. First, calculate the difference sequence, where the absolute difference between the mother sequence and the child sequence at different times is:

$$\Delta_i(t) = X_i(t) - X_0 * (t) \tag{5}$$

In which, when t takes a certain moment, Δmax and Δmin are respectively the maximum and minimum values, and the formula for calculating the correlation coefficient is:

$$\xi_i(t) = \frac{\min(\Delta_i(\min)) + \rho \max(\Delta_i(\max))}{|\ X_0(t) - X_i(t)\ | + \rho \max(\Delta_i(\max))} \tag{6}$$

Here, the resolution parameter ρ is a constant, with values ranging between 0 and 1. In this study, ρ is equal to 0.5

Step 4: Calculate the correlation degree.

Because the correlation coefficient is the comparison of the correlation degree values between the comparison sequence and the reference sequence at each moment, and it has more than one number, so the correlation values are averaged as the final correlation degree.

Step 5: Correlation degree ranking.

Using MATLAB to process Jiangsu Province's data on the three major industries from 2002 to 2020, the results are shown in the table below.

Table 1 A List of Grey Relational Degrees for the Three Industries

Item	The primary industry	The second industry	the third industry
Grey relational degree	0.8335	0.6511	0.6080

Based on Table 1, it can be concluded that the correlation between employment numbers and industrial structure is greatest for the primary industry, followed by the secondary industry, and then the tertiary industry. Further comparison reveals:

The employment correlation of the primary industry is the highest among the industrial structure adjustments, indicating that over the 18 years, the employment dynamics in Jiangsu Province's primary industry have played the most significant role in industrial upgrading. Its grey relational degree of 0.8335 indicates a high correlation. Analyzing the period from 2002 to 2020, the proportion of the primary industry's value added showed a declining trend overall, decreasing from 10.47% to 4.42%, a drop of 6.05 percentage points. Concurrently, during this period, the employment proportion in the industry also exhibited a declining trend, decreasing from 39% to 13.8%, a decline of 25.2 percentage points. This decrease is nearly four times that of the decline in the value added proportion, indicating that the primary industry, facing saturated employment, has been transferring employment to the secondary and tertiary industries.

The correlation coefficient between employment in the secondary industry and industrial structure is 0.6511, indicating a moderate correlation, suggesting that employment in the secondary industry plays a certain role in industrial upgrading. Based on the data above, we understand that Jiangsu Province's proportion of value added in the secondary industry has generally declined, decreasing by 9.78 percentage points. However, during the same period, the employment proportion in the industry increased by 7.2%. This indicates that despite absorbing some labor, the industrial structure has not changed significantly or has even declined, highlighting the need for adjustments in Jiangsu Province's secondary industry to enhance value added.

Although employment in the tertiary industry exhibits the weakest correlation among the three sectors, it still shows a relatively high correlation coefficient, indicating that employment in the tertiary industry also plays a positive role in industrial upgrading. The value added in the tertiary industry has consistently increased from 2002 to 2020, growing by 24.17%. Simultaneously, the employment proportion in this industry has also increased by 18%. This demonstrates that the tertiary industry, after absorbing labor, significantly enhances industrial value added, making a notable contribution to the Gross Domestic Product (GDP).

Based on the analysis of employment elasticity, structural deviation, and grey relational degree, the following conclusions can be drawn: The primary industry exhibits a displacement effect on employment, indicating surplus labor. Its employment situation significantly affects industrial upgrading, continuously shifting labor towards the secondary and tertiary industries as its employment numbers saturate. Employment in the secondary industry plays a moderate role in industrial upgrading by absorbing labor. However, despite absorbing labor, the industrial structure has not changed significantly and may even have declined. The tertiary industry's economic growth drives employment growth with strong labor absorption capabilities. After absorbing labor, it enhances industrial value added, making the largest impact on economic development.

3 EMPIRICAL ANALYSIS OF INDUSTRIAL STRUCTURE AND EMPLOYMENT STRUCTURE

3.1 Introduction of Variables and Models

The paper selects the value added of the three industries (denoted as G1, G2, G3) and the employment numbers in these industries (denoted as J1, J2, J3) in Jiangsu Province from 2002 to 2020 as variables. To mitigate the impact of heteroscedasticity, the data are logarithmically transformed, represented as LNG1, LNG2, LNG3, LNJ1, LNJ2, LNJ3.

The paper further analyzes the relationship between industrial structure and employment structure using the Granger causality test, and conducts tests for stationarity and cointegration of the data. The Granger test method is primarily used to analyze causal relationships between variables. In the context of time series, the Granger causality between two economic variables X and Y is defined as: if, with the inclusion of past information of both X and Y, the prediction of X based solely on the past information of Y is significantly better than predicting X without considering Y, then X is considered to be a Granger cause of Y. When conducting the Granger causality test, the first consideration is whether the time series are stationary, as non-stationary series may lead to spurious regression issues. Therefore, before performing the Granger causality test, it is essential to test the stationarity of each indicator's time series using the Augmented Dickey-Fuller (ADF) test.

The Granger causality test assumes that all predictive information about Y and X is contained within their respective time series. The test requires estimating the following regressions:

$$Y_t = \sum \alpha_i X_{t-i} + \Sigma \beta_j Y_{t-j} + u_{1t} \tag{7}$$

$$X_t = \sum \lambda_i X_{t-i} + \Sigma \delta_j Y_{t-j} + u_{2t} \tag{8}$$

Assuming that the white noises u1t and u2t are uncorrelated. Equation (7) posits that the current Y is related to itself and to the past values of X, and Equation (8) assumes a similar scenario.

For Equation (7), the null hypothesis is: $H0: \alpha_1=\alpha_2=\alpha_3=\ldots=\alpha_q=0$

For Equation (8), the null hypothesis is: $H0: \delta_1=\delta_2=\delta_3=\ldots=\delta_s=0$

Discuss in four scenarios:

The first scenario is that X causes changes in Y, indicating a unidirectional causal relationship from X to Y. If the coefficients of lagged X in Equation (7) are significantly different from zero and the coefficients of lagged Y in Equation (8) are not significant, then X is considered to cause changes in Y.

The second scenario is that Y causes changes in X, indicating a unidirectional causal relationship from Y to X. If the coefficients of lagged Y in Equation (8) are significantly different from zero and the coefficients of lagged X in Equation (7) are not significant, then Y is considered to cause changes in X.

The third scenario is that X and Y mutually cause each other's changes, indicating bidirectional causality. If the coefficients of lagged Y in Equation (8) and the coefficients of lagged X in Equation (7) are both significantly different from zero, then X and Y are considered to have bidirectional causality.

The fourth scenario is that X and Y are independent or there is no causal relationship between them. If the coefficients of lagged Y in Equation (8) and the coefficients of lagged X in Equation (7) are both not significant, then X and Y are considered to have no causal relationship between them.

3.2 Data Stationarity Test

Based on the data of Jiangsu Province's primary, secondary, and tertiary industry output and employment from 2002 to 2020, the correlation coefficients between the structure of the three industries and employment structure were computed using EViews. The results are shown in Table 2.

Table 2 The Correlation Coefficients between the Output and Employment Numbers of the Industries

Item	LNJ1	LNJ2	LNJ3
LNG1	-0.98	0.87	0.97
LNG2	-0.99	0.91	0.98
LNG3	-0.99	0.86	0.98

From the table, it can be seen that Jiangsu Province's industrial output is negatively correlated with the primary industry and has some correlation with the secondary and tertiary industries. While these variables indeed exhibit correlation, it does not imply consistency or causality among them. Therefore, Granger causality tests are necessary to determine causality. Next, this paper conducts tests for stationarity, cointegration, and causality on the sequences to further elucidate the relationship between Jiangsu Province's industrial structure and employment structure.

Since non-stationary sequences can result in spurious regression, this study uses the Augmented Dickey-Fuller (ADF) test to assess stationarity. If the sequences are non-stationary, they will be differenced to achieve stationarity before conducting Granger causality tests. The ADF test results obtained using EViews are shown in Table 3.

Table 3 The Correlation Coefficient between Industrial Output and Employment Numbers

Item	LNG1	LNG2	LNG3	LNJ1	LNJ2	LNJ3
Prob.	0.0823	0.000	0.0068	0.0242	0.5118	0.7552

The unit root tests indicate that the time series LNG1, LNJ2, and LNJ3 are non-stationary at the 5% critical value level. Therefore, next steps involve differencing these series. First-order (or second-order) differencing is applied to achieve stationarity. The results of the differencing are shown in Tables 4 and 5.

Table 4 The first-Order Difference of Industrial Output and Employment Numbers

Item	D(LNG1)	D(LNG2)	D(LNG3)	D(LNJ1)	D(LNJ2)	D(LNJ3)
Prob.	0.2778	0.454	0.0161	0.0390	0.9959	0.5453

Table 5 The Second-Order Difference of Industrial Output and Employment Numbers

Item	D(LNG1,2)	D(LNG2,2)	D(LNG3,2)	D(LNJ1,2)	D(LNJ2,2)	D(LNJ3,2)
Prob.	0.0012	0.0045	0.0020	0.0053	0.0079	0.0121

Therefore, based on the first-order differencing results in Table 4, LNJ1 is stationary at the 5% critical value level. Additionally, from the second-order differencing results in Table 5, LNG1 and LNJ3 are stationary at the 5% critical value level. Thus, LNJ1 is first-order stationary, while LNG1 and LNJ3 are second-order stationary.

3.3 Analysis of the Relationship Between Industrial Structure and Employment Structure

3.3.1 Cointegration analysis of the development of the three industries

Since in the previous section we have already analyzed the structural deviation between industrial structure and employment structure, the next step in exploring the relationship between the two will focus on examining the coordination of the development of Jiangsu Province's three industries. From the stationary tests mentioned earlier, it was found that LNG1 is a first-order differenced stationary series, while LNG1 and LNJ3 are second-order differenced stationary series. Next, a Granger causality test will be conducted on the three industries to examine whether there is consistency in the development of industrial structures and whether the development of the three industries is coordinated. As mentioned earlier, correlation coefficients alone cannot fully reflect their relationships. Therefore, the next step involves verifying the development relationship between the three industries through cointegration tests and Granger causality tests to examine the causality relationship.

According to the cointegration test results, it can be concluded that there are three cointegration relationships among the time series at a 5% significance level. This indicates that the development of the three industries in Jiangsu Province over the past 18 years exhibits a certain degree of balance. Next, a Granger causality test will be conducted on the three industries. The results are presented in Table 6.

Table 6 Granger Causality Test Results for the Three Industries

Null hypothesis	Sample size	F-value	P-value
LNG2 is not the Granger cause of LNG1	18	9.50	0.00
LNG1is not the Granger cause of LNG2	18	2.06	0.17
LNG3 is not the Granger cause of LNG1	18	1.77	0.20
LNG1 is not the Granger cause of LNG3	18	0.40	0.53
LNG3 is not the Granger cause of LNG2	18	0.97	0.34
LNG2 is not the Granger cause of LNG3	18	14.71	0.00

Based on the analysis from Table 5-6, under a significance level of 10%, it can be concluded that the second industry not being accepted as a Granger cause of the first industry implies that the second industry can promote the development of the first industry and has a stimulating effect on it.It can also be observed that the first industry cannot promote the development of the second industry, and there is a 17% probability of acceptance. Therefore, there is a unidirectional causality test between the first industry and the second industry, indicating that the first industry does not drive the development of the second industry, while the second industry does have a driving effect on the first industry. The third industry does not reject the null hypothesis at a 10% significance level, suggesting that the development of the third industry does not promote the first industry, with a 20% probability of acceptance. Similarly, from the Granger causality test, it is also found that the development of the first industry does not promote the third industry, with a 53% probability. Therefore, there is no causal relationship between the first industry and the third industry. The third industry is not the Granger cause of the second industry, indicating that the third industry does not drive the development of the second industry. At the same time, the second industry can promote the development of the third industry, showing a unidirectional causal relationship between the second industry and the third industry.

3.3.2 Granger causality test

Next, we will continue to conduct Granger causality tests on the three industries and employment. The results are as shown in the table 7 below.

Table 7 Granger Causality Test between the Three Industries and Employment

Null hypothesis	Sample size	F-value	P-value
LNJ1 is not the Granger cause of LNG1	18	1.79	0.20
LNG1is not the Granger cause of LNJ1	18	0.96	0.34
LNJ2 is not the Granger cause of LNG2	18	2.14	0.16
LNG2 is not the Granger cause of LNJ2	18	50.29	0.24
LNJ3 is not the Granger cause of LNG3	18	0.06	0.27
LNG3 is not the Granger cause of LNJ3	18	0.03	0.02

According to the table, at a significance level of 5%, it is not rejected that the employment in the primary industry is not the Granger cause of its output increase, indicating that its employment is not the reason for the growth in output. Furthermore, the increase in output of the primary industry from 111.044 billion yuan to 453.672 billion yuan over 18 years occurred alongside a decline in employment numbers. This suggests that during this period, Jiangsu Province invested in automation technology in the primary industry and overall workforce skills improved. Simultaneously, the labor force in the primary industry shifted towards other industries.

The Granger causality test accepts that the increase in output in the secondary industry is not caused by its employment, with a 16% acceptance probability. Additionally, the test accepts that the increase in output does not cause growth in employment. Therefore, there is no causal relationship between employment and output growth in the secondary industry. From the above data, we can also analyze that over these 18 years, the output in 2020 was 7.89 times that of 2002, while employment in 2020 was only 1.33 times that of 2002. This indicates that the increase in output in the secondary industry did not significantly increase its employment numbers. Similarly, the increase in employment did not have a substantial impact on the development of its output. This corroborates the findings of the Granger causality test.

The hypothesis that the increase in employment in the tertiary industry is not caused by its output growth is accepted with a 27% probability. However, it is accepted that the increase in output in the tertiary industry affects the growth in its employment. This situation is related to the development of the tertiary industry in Jiangsu Province. According to the development situation in Jiangsu Province, the movement of personnel contributes to the development of the tertiary industry, leading to an increase in employment numbers. The rapid development of the industry has also resulted in an increase in employment numbers. From the data, it can be seen that employment in the tertiary industry has increased by more than 10 million people. Among the three major industries, the tertiary industry has developed the fastest, with the most prominent changes in employment numbers.

In summary, there is no causal relationship between output and employment numbers in the primary and secondary industries. The increase in output in the primary industry coincides with a decrease in employment, indicating an improvement in labor productivity rather than relying on increased employment for economic development. In contrast, both output and employment in the secondary industry are increasing, but the growth in output far exceeds the increase in employment, suggesting that the secondary industry is not solely dependent on labor to drive economic growth.

On the other hand, there is a unidirectional causal relationship between output and employment in the tertiary industry. An increase in output in the tertiary industry promotes an increase in employment numbers, highlighting its strong ability to absorb labor and significant potential for development.

4 ADVICE

This article analyzes the data of the three major industries' output and employment in Jiangsu Province from 2002 to 2020. Using methods such as structural deviation and Granger causality test models, it investigates the relationship between industrial structure and employment structure. The specific conclusion is:

The output of the primary industry shows no causal relationship with employment. With slow growth in output, surplus labor emerges. Concurrently, workers from the primary industry transition to the secondary and tertiary sectors, though their capacity in these sectors is limited. Therefore, recommendations for the primary industry include optimizing it, enhancing specialization in agricultural production, improving labor quality, and guiding surplus labor towards the secondary and tertiary sectors.

There is no causal relationship between output and employment in the secondary industry. Employment lags significantly behind output growth, indicating a need for internal restructuring despite labor absorption. Recommendations for the secondary industry thus focus on stabilizing its development, elevating skill levels, optimizing industry structure, and phasing out outdated capacities.

The tertiary industry exhibits a unidirectional causal relationship between output and employment. Increased output promotes employment growth, effectively absorbing skilled labor and making substantial contributions to economic development. Consequently, suggestions for the tertiary industry involve intensifying its development efforts, expanding employment opportunities, nurturing technical expertise, particularly in modern service sectors.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

REFERENCES

[1] Ma Xiao, Li Hongjuan, Sang Xiuli. Analysis and Forecast of Coordinated Development between Industrial Structure and Employment Structure in Yunnan Province. Reform and Opening-up, 2020(15): 76-85.

[2] Luo Wenqian. Study on the Dynamic Relationship between Industrial Structure Adjustment and Employment Structure in Yunnan Province. China Collective Economy, 2022(06): 27-30.

[3] He Yan, Zhang Changyao, Sun Zibao. Research on the Coordinated Development of Industrial Structure and Employment Structure in Tibet. Journal of Tibet University for Nationalities (Philosophy and Social Sciences Edition), 2021, 42(02): 112-117.

[4] Diao Xingwen. Evaluation of the Coordination between Industrial Structure and Employment Structure and Development Forecast: An Analysis of Provincial Data Based on the SVR Model. Journal of Social Sciences of Jiamusi University, 2021, 39(03): 65-68.
[5] Wu Lijun, Zhu Ke. Research on the Coordination of Industrial Structure and Employment Structure in Guangxi. Marketing Circle, 2021(26): 87-89.
[6] Wen Qing. Research on the Coordination of Industrial Structure and Employment Structure in Urumqi. Cooperative Economy and Science, 2021(14): 7-10.
[7] Qin Xinhao, Chen Mengdi, Xu Nazii, Bian Fei, Wang Qian, Mao Yanxin. Analysis of the Coordination between Forestry Industry Structure and Employment Structure in China. Chinese Forestry Economics, 2022(01): 60-65.
[8] Liu Fenglin, Yin Cong, Lu Xusheng. Research on the Coordinated Development of Industrial Structure and Employment Structure in Southern Xinjiang. Cooperative Economy and Science, 2022(04): 52-53.
[9] Ren Yadi, Tang Enbin. Research on the Relationship between Industrial Structure and Employment Structure in Beijing-Tianjin-Hebei Region. IOP Conference Series: Earth and Environmental Science, 2019, 330(2).
[10] Yan Shu-xi. A Quantitative Study on the Relationship between Industrial Structure and Employment Structure in Yulin. 3rd International Conference on Social Science and Technology Education (ICSSTE 2017), 2017.