

An Empirical Analysis of the Relationship between the Prosperity of Tertiary Industry and Residents' Income and Employment -- A Case Study of 260 Samples in Jiangsu Province from 2000 to 2020

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Abstract. As the development of the tertiary industry has increasingly become an inevitable trend in the modern global economy, the impact of this industry on residents' income and employment pressure is worth exploring. Based on this, this paper analyzes the effects of the development of tertiary industry on residents' income and employment by building a fixed-effect model, then carries out a heterogeneity analysis of various cities in Jiangsu Province. The results show that: (1) The prosperity of the tertiary industry in Jiangsu province has a strong driving force on residents' income and employment, and has promoted the growth of both to some extent; (2) Jiangsu province has an equivalent positive effect on the prefecture-level cities, but there is still an imbalance in regional economic development among prefecture-level cities; (3) For this purpose, Jiangsu province puts forward the following countermeasures: Stabilize the primary industry and develop the tertiary industry; Strengthen policy adjustment, increase social employment; Strengthen regional cooperation and promote industrial integration

Keywords: Output value of tertiary industry; Employment of residents; Household income; Fixed effect model.

1. The introduction

Since the reform and opening up, due to the higher status and greater weight of the tertiary industry in the social economy, China has considered the tertiary industry output a vital index of regional economic development. Therefore, based on the long-term equilibrium relationship between income and employment, what kind of influence the tertiary industry has on them, to what extent, whether it will be interfered with by other factors, and whether it will change with the changes of individual cities are essential issues that need to be studied urgently in this paper.

According to such problems, this paper starts from a regional perspective and analyses based on panel data of 13 cities in Jiangsu Province from 2000 to 2020. First of all, aiming at the target urbanization of tertiary industry, this paper measures residents' income with disposable income of urban households, residents' employment with the number of employed people in urban units, and the development degree of the tertiary industries with industrial added value and municipal districts added value. Secondly, this paper adds control variables -- population, education level, and family size to constrain the influence. Moreover, different from the research of many scholars at home and abroad, this paper adopts the fixed effect model to measure the influence level of the tertiary industry on residents' income and employment, and adopts the hybrid model of WLS and OLS+ robust standard error to conduct robustness test. Finally, considering the individual differences of cities, panel data are screened according to city classification to achieve heterogeneity analysis, thus reflecting the unity and scientific nature of personality and commonness in this study.

2. Literature review

2.1 Prosperity of tertiary industry and resident income

Combing the existing literature, existing scholars have studied the influencing factors of residents' income: national policies (tax policies, double dividend), Internet popularity, teaching quality, residents' conditions, etc.

The prosperity of the tertiary industry theoretically brings about factors of government, society and residents that affect the income of residents. For example [1-5], In foreign literature, Zhenxing Xiong (2019) used a recursive dynamic computing general equilibrium model to reflect the relationship between tax policy, double dividend hypothesis and resident income. Xiaoli Zhou (2015) explained the direct impact of Internet popularization on residents' income through the mediating effect analysis. Congyi Zheng (2020) and Wei Han (2021) investigated the significant impact of education level and non-agricultural sector on residents' income through regional differences. In domestic literature, Huang Yongkang (2018) used the VAR model to conclude that only unilateral Granger causality exists between the tertiary industry and residents' income. Zhang Jianhua (2019) used a spatial econometric model to analyze that the development of the service industry is conducive to narrowing the income gap between urban and rural residents.

2.2 Prosperity of tertiary industry and employment of residents

Combing the existing literature, existing scholars have studied the influencing factors of residents' employment, including social policies, environmental factors, economic factors and education level.

Theoretically, the prosperity and development of the tertiary industry have brought political, economic, cultural, and other factors to the employment of residents. For example [6-10], Yazid Dissou (2013) used the general equilibrium model in foreign literature to explore the negative impact of inferior environmental factors on residents' employment. Moreno Monroy (2016), based on the data from Chinese cities from 2004 to 2009, showed an "inverted U-shaped" relationship between urban residents' employment and economic development level. Rafat Hussain (2018) investigated 242 participants and analyzed the relationship between social policies and employment. Domestic literature Wang Xiaojie (2014) used the 2007 Chinese Household Income Survey data (CHIP) to test the positive effect of trade opening on the employment of urban residents. Zou Ying (2020) analyzed the impact of the proportion of people's livelihood on residents' employment status based on Wuhan's economic and social development data.

2.3 Literature Review

In terms of residents' income, scholars have analyzed the direct or indirect impact of the tertiary industry from three aspects: government, society and residents. In terms of residents' employment, scholars have explored the overall or partial impact of the tertiary industry from political, economic, cultural and other aspects.

First of all, most scholars take the country as the macroscopic research object, and their results ignore the regional differences. This paper analyzes the panel data of 13 prefecture-level cities in Jiangsu Province from 2000 to 2020 from a regional perspective, emphasizes the timeliness of data, and uses heterogeneity analysis at the end of the paper. Panel data were screened and analyzed according to city classification. Secondly, in view of the insignificance of some variables and the neglect of per capita income by scholars, this paper visualized and digitized the variables, adopting urban residents' disposable income to measure residents' income and urban unit employment to measure employment. Finally, considering scholars only consider the influence of individual factors on residents' employment and income, this paper adds three control variables of population, education level, and family size to constrain further the influence of the prosperity of the tertiary industry on residents' income and employment.

3. Sample selection, research data and statistical description

3.1 Sample selection and data sources

In this paper, all cities in Jiangsu province are selected as samples, and the sample data of each index in nanjing, Wuxi, Xuzhou and Changzhou from 2000 to 2020 are obtained from the statistical yearbook of Jiangsu Province and the statistical yearbook of each city.

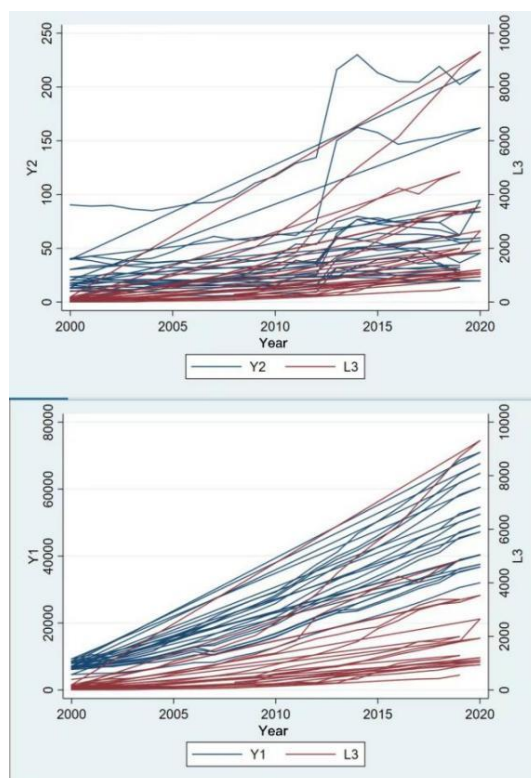


Fig. 1 Variation trend of variables at the time series level

The figure above shows the variation trend of variables at the time series level.

(1) Explained variable: resident income Y1 and resident employment Y2. It is measured by the disposable income of urban residents and the number of people employed in urban units.

Explanatory variables: development level of the three major industries L1, L2, L3, measured by the added value of the first, second and industrial municipal districts (the proportion of added value in GDP of each city * GDP of each municipal district)

(2) Control variables: Population POPU; EDU, measured by the number of students enrolled in regular institutions of higher learning each year. Family size FAM is measured by the average number of people per household.

3.2 Research data and descriptive statistics

According to the results of descriptive statistics below, the range of L3 is the largest among the three industries, and the mean value of $\ln L2$ is the largest, indicating that the development level of the tertiary industry in Jiangsu has grown significantly in the past 20 years. From the standard deviation of each variable, it can be seen that the absolute value of most variables is small, indicating that the data fluctuation is small and the change is relatively stable.

Table 1. Descriptive statistical results

VARIABLES	mean	sd	min	max
lnY1	9.891	0.669	8.438	11.17
lnY2	3.460	0.835	0.880	5.438
lnL1	3.654	1.068	-0.134	5.692
lnL2	6.435	1.142	2.355	8.559
lnL3	6.268	1.321	2.114	9.139
lnPOPU	6.358	0.328	5.651	6.980
lnEDU	1.945	1.279	-2.996	11.47
FAM	2.839	0.232	2.430	3.510

4. Empirical analysis of the prosperity of tertiary industry and residents' employment and income

4.1 Correlation analysis of the prosperity variables of the tertiary industry

In this paper, Spearman correlation coefficient and Kendall correlation coefficient are used to analyze the correlation of the variables that affect the prosperity of the tertiary industry.

Table 2. Correlation test table of the prosperity variables of the tertiary industry

	lnY1	lnY2	lnL1	lnL2	lnL3	lnPOPU	lnEDU	FAM
lnY1	1.000	0.661*	0.618*	0.852*	0.835*	0.464*	0.778*	-0.604*
lnY2	0.838*	1.000	0.507*	0.786*	0.815*	0.581*	0.735*	-0.482*
lnL1	0.775*	0.670*	1.000	0.630*	0.647*	0.470*	0.590*	-0.393*
lnL2	0.960*	0.914*	0.772*	1.000	0.972*	0.544*	0.846*	-0.581*
lnL3	0.951*	0.927*	0.783*	0.997*	1.000	0.561*	0.852*	-0.576*
lnPOPU	0.590*	0.740*	0.554*	0.678*	0.692*	1.000	0.539*	-0.308*
lnEDU	0.908*	0.894*	0.756*	0.955*	0.954*	0.708*	1.000	-0.536*
FAM	-0.759*	-0.625*	-0.544*	-0.733*	-0.736*	-0.386*	-0.684*	1.000

*Represents a correlation coefficient with a significance level greater than 0.05. The shaded area in the lower-left corner is the Pearman correlation coefficient, and the shaded area in the upper right corner is the Kendall correlation coefficient.

As can be seen from the correlation test table, the significance level of correlation coefficients of all variables in this model is greater than 0.05, that is, there is no significant difference and no correlation between variables, so the variables selected in this paper are independent. Among them, the coefficients of FAM and other variables are negative, indicating a significant negative correlation between FAM and other variables. When FAM decreases, all variables tend to increase.

4.2 Empirical analysis of the prosperity of the tertiary industry and residents' income

Since the intercepts of time series (Year2000-2020) of each city are the same, but the intercepts other variables are different, the time-point fixed effect model is constructed in this paper to measure factors affecting Y1. The specific steps are as follows: Forward step regression was used to add control variables, and a fixed-effect model was used to conduct regression analysis on various factors affecting residents' income. The model was assumed as

$$\ln Y1_{it} = \gamma_t + \beta_1 \ln L1_{it} + \beta_2 \ln L2_{it} + \beta_3 \ln L3_{it} + \beta_4 \ln POPU_{it} + \beta_5 \ln EDU_{it} + \beta_6 FAM_{it} + \mu_{it}$$

lnY1 is resident income, lnL1, lnL2, and lnL3 are development levels of the three major industries, lnPOPU is population, lnEDU is education level, FAM is family size, γ is constant term, β is regression coefficient, μ is a random error, i is the sectional unit, and t is the year. The regression results are shown in the following table:

Table 3. Empirical analysis of the prosperity of the tertiary industry and resident income

	(1)	(2)	(3)	(4)
lnL1	-0.114***	-0.148***	-0.127**	-0.143**
lnL2	-0.145	0.001	-0.169	0.150
lnL3	0.793***	0.685***	0.832***	0.675***
lnPOPU		0.753***		
lnEDU			0.007	
FAM				0.168
Constant	6.327***	1.391	6.245***	4.535***
R-squared	0.970	0.977	0.961	0.983
Company FE	YES	YES	YES	YES
F test	0	0	0	0
F	276.8	485.8	303.3	663.6

Robust t-statistics in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

As can be seen from the above table, Item (1) is listed without the addition of control variables, and Item (2), (3), and (4) are listed as the simple regression result after the addition of control variables one by one. In model (2), $\beta_4 = 0.753$, indicating that lnPOPU was positively correlated with the significance level of 1%. In models (3) and (4), P values of lnEDU and FAM are less than 1.64, so they are insignificant. Meanwhile, since F tests are all 0, the model passes the general test.

Among the above, $\beta_1 = -0.148$, significant negative, $\beta_2 = 0.001$, $\beta_3 = 0.685$, both significant at the level of 0.01. Therefore, the primary industry has a significant negative effect on residents' income, while the tertiary industry has a significant positive impact on residents' income. The reasons for this result are as follows:

(1) The proportion of the primary industry in the overall URBAN GDP is decreasing year by year. Since 2000, the added value of the primary industry has been much lower than that of the secondary and tertiary industries. This shows that the saturation state of the first industry hinders the growth of residents' income.

(2) Steady development of heavy industry. Jiangsu province has a good geographical advantage and a strong natural ability to transfer natural resources. So Jiangsu province has maintained a historical advantage in heavy industry, but there has been no major breakthrough in the past 20 years.

(3) The tertiary industry is developing rapidly. Jiangsu province takes advantage of its urban and environmental advantages to vigorously develop the service industry and tourism, which makes the proportion of added value of the tertiary industry rise year by year.

Based on the above three reasons and the results of linear regression, we can know that among the three industries, the development of tertiary industry has the strongest driving force on the income of residents in Jiangsu Province, and has the possibility of sustainable development.

4.3 Empirical analysis of the prosperity of tertiary industry and residents' employment

In this section, the model is assumed to be the same as in 4.2:

$$\ln Y2_{it} = \gamma_t + \beta_1 \ln L1_{it} + \beta_2 \ln L2_{it} + \beta_3 \ln L3_{it} + \beta_4 \ln POPU_{it} + \beta_5 \ln EDU_{it} + \beta_6 FAM_{it} + \mu_{it}$$

LnY2 stands for resident employment, and the interpretation of other characters is the same as that of 4.2. The regression results are as follows:

Table 4. Empirical analysis of the prosperity of tertiary industry and residents' employment

	(1)	(2)	(3)	(4)
lnL1	0.060	-0.037	0.128	0.191
lnL2	-0.417	-0.549	-0.518	-1.020**
lnL3	0.696***	0.938***	0.723***	0.979***
lnPOPU		-0.702		
lnEDU			-0.002	
FAM				0.019
Constant	1.649**	5.776*	1.910**	3.378
Observations	239	190	201	36
R-squared	0.691	0.670	0.666	0.557
Company FE	YES	YES	YES	YES
F test	0.000357	9.26e-07	0.000167	0.00774
F	276.8	485.8	303.3	663.6

Robust t-statistics in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

From the above table, in the model (2), $\beta_4, \beta_5 < 0, \beta_6 = 0.019$, indicates that lnPOPU and lnEDU negatively correlate with residents' employment, while FAM is positively correlated with them. However, the P values of the three are all less than 1.64, so the three are not significant.

Among the above results, $\beta_1 = 0.060$, $\beta_3 = 0.696$, significant positive, and significant at the level of 0.01. Therefore, the primary industry has a negative effect on residents' employment, while the tertiary sector has a significant positive effect on residents' work. The reasons for the results are as follows:

(1) The proportion of the employed population in the primary industry has decreased. The absorption degree of the primary industry is limited. The research shows that the per capita living expenditure of rural residents in Jiangsu has gradually increased, resulting in a decrease in the proportion of the employed population in the primary industry.

(2) The rapid development of the tertiary industry provides job opportunities. Jiangsu, in recent years continuously published several opinions about the province to speed up the development of the third industry and the construction of the modern industrial system, so there is an apparent recovery in the tertiary industry, forming a good pattern of its stability.

Based on the above two reasons, the development of the tertiary industry has provided the most powerful driving force for employment in Jiangsu Province.

4.4 The robustness test of the prosperity of tertiary industry and residents' employment and income

In order to make the results more robust, this paper adopts mixed regression, WLS and OLS+ robust standard error models, respectively, to test the robustness of the final model in 4.2 and 4.3, and the results are as follows:

Table 5. Tests the robustness of the prosperity of the tertiary industry and residents' employment and income

VARIABLES	(1) lnY1	(2) lnY2	(1) lnY1	(2) lnY2
lnL1	0.196***	-0.243***	0.196***	-0.225**
lnL2	0.199	-1.485***	0.178	-1.317***
lnL3	0.185	1.706***	0.219	1.535***
lnPOPU	-0.297*	0.250	-0.294	0.334*
lnEDU	-0.110	0.329***	-0.122	0.347***
FAM	-0.364	-0.168	-0.347	-0.106
Constant	9.938***	1.319	9.822***	0.495

t-statistics in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Based on the robustness test results above, all variables are similar to the results in 4.2 and 4.3, so they are not affected, and the standard error decreases. In conclusion, the model is robust.

4.5 Heterogeneity analysis of the prosperity of tertiary industry and residents' income and employment

Based on Jiangsu province as a whole, heterogeneity analysis is required as the impact may vary from city to city, that is, panel data are screened according to city classification, multiple linear regression is performed, and analysis tables of lnL3 are constructed. The results are as follows:

Table 6. Heterogeneity analysis of the prosperity of tertiary industry and residents' employment and income

CITY	Y1	Y2
Nanjing	0.690***	0.362***
Wuxi	0.752***	0.314***
Xuzhou	0.553***	0.143***
Changzhou	0.610***	0.365***
Suzhou	0.570***	0.507***
Nantong	0.618***	0.526***
Lianyungang	0.540***	0.314***
Huai'an	0.521***	0.289***
Yancheng	0.572***	0.412***
Yangzhou	0.586***	1.048***
Zhenjiang	0.716***	0.075***
Taizhou	0.464***	0.964***
Suqian	0.450***	0.599***

t-statistics in parentheses*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

As the above table, due to the small number of urban samples, the heterogeneity analysis of this paper remains to be studied. In terms of residents' income, the regression coefficients of all cities indicate that the tertiary industry's development can drive the residents' income. In Wuxi, the tertiary industry has the most significant driving effect on its income. Besides, the difference between the 13 cities is not big, within 0.1.

In residents' employment, the regression coefficients of all cities are positive, indicating that the prosperity of the tertiary industry can expand residents' employment. Yangzhou has a value of 1.048, significantly higher than other cities. Compared with other cities, Zhenjiang and Xuzhou have slight changes.

In a word, the impact of the tertiary industry on residents' income is noticeable and balanced in 13 cities, while the impact on employment has a great disparity. It can be seen that the impact of the tertiary industry on the economic development of cities is unbalanced.

5. Research conclusions and policy implications

5.1 Research Conclusions

In this paper, panel data of 13 cities in Jiangsu from 2000 to 2020 are obtained from the statistical yearbook of Jiangsu province, and a fixed-effect model is constructed for empirical analysis, robustness test, and heterogeneity analysis on the impact of the development of tertiary industry on residents' income and employment. The results are as follows:

(1) In residents' income, the tertiary industry has the strongest driving force for residents' income in Jiangsu. However, the limitation of the primary industry has suppressed the improvement of residents' income.

(2) In residents' employment, the tertiary industry provides more jobs, thus providing the strongest force for developing resident employment in Jiangsu.

(3) The impact on residents' income is relatively balanced, while the impact on employment varies greatly in different cities. It can be seen that the impact of the tertiary industry on 13 cities is not balanced.

5.2 Policy Implications

Based on the above conclusions, this paper proposes the following policy implications:

(1) Stabilize the primary industry and develop the tertiary industry. We should adhere to the strategy of rural revitalization, the quality and green development, and the scientific innovation.

(2) Strengthen policy adjustments to increase employment. We should build a financial innovation platform to stimulate the emergence of labor-intensive industries.

(3) Strengthen regional cooperation and promote industrial integration. To reshape the relationship between urban and rural areas, we should form the dominant industry with regional characteristics and encourage the integration of the three industries.

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