

An Empirical Analysis of Service Sector Development with Resident Income and Employment--Take the Data of 99 Samples in Jilin Province from 2010 to 2020 as an Example

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Abstract: With the increasing importance of the service sector to economic development, the impact of service sector development on resident income and employment has also received widespread attention. This paper constructs an individual fixed-effects model based on panel data of nine cities in Jilin Province from 2010 to 2020 to test the relationship between service sector development and resident income and employment. The conclusions are as follows: (1) the service sector has the most potent pulling force on resident income and employment among the three major sectors; (2) the decline in the value-added of the secondary sector and the restricted development of heavy industry hurt resident income; (3) the severe problem of population loss leads to a decrease in employment.

1. Introduction

The service sector is considered one of the economy's essential elements in the post-industrial development stage [1]. In 2020, Jilin Province's service sector accounted for 50.97% of GDP, a significant gap with developed countries, while there is a problem of unreasonable industrial structure. Given this, this paper studies the relationship between service sector development and resident income and employment in Jilin Province, which is of great theoretical and practical significance for clarifying the direction of the transformation of Jilin Province's industrial and economic structure, uncovering the real problems that hinder economic development and providing targeted policy recommendations.

Can the service sector drive income and employment growth? Can the service sector stand out compared to the primary and secondary sectors? Based on this idea, this paper constructs an individual fixed-effects model to compare the service sector with the primary and secondary sectors, not only focusing on the impact of the development of the service sector on employment, which is a common concern among scholars but also taking into account the per capita disposable income, which is more reflective of economic development and people's lives.

This paper will be divided into the following sections: literature review, variables and sample selection, statistical description, empirical analysis of the development of the service sector with resident income and employment, research findings, and policy implications.

2. Literature Review

2.1 Service Sector Development and Resident Income

Domestic and foreign scholars have different research focuses through the existing literature. Foreign scholars focus on the impact of per capita income on the development of the service sector. In contrast, domestic scholars focus on the relationship between employment in the service sector and urban-rural income imbalance. For example, foreign scholars Kongsamut P et al. (2001) found a linear relationship between the share of service sector GDP and per capita income through data analysis[2]; Eichengreen B et al. (2009) found that the share of service sector GDP first rises with per capita income, then stabilizes at the middle income level, and then starts to rise again at higher income levels by building a weighted regression model with four relationships[3]; Based on this, Park D et al. (2013)

concluded that a similar quadratic relationship exists between the share of service employment and per capita income[4]; By constructing a multiple linear regression model, domestic scholars Wang Peigang et al. (2005) obtained the conclusion that the number of people employed in the service sector temporarily increases the urban-rural income gap during the economic transition period[5]; Using impulse response analysis, Ding Yuan et al. (2014) found that an increase in service employment in China in the long run will have an impact on reducing the income gap [6]; Huang et al. (2018) concluded that the income of urban residents will be increasingly affected by service employment in the long run, but the effect is not yet significant[7].

2.2 Service Sector Development and Residents Employment

The studies of domestic and foreign scholars can be broadly divided into the overall impact of the service sector on employment and the local impact of the subsectors through the existing literature. In terms of the overall impact, Godlewska - Dzioboń B et al. (2018) concluded through a literature review that employment in the service sector grows faster than the economy during the post-industrial period in Poland[8]; Ding YY et al. (2020) concluded that the service sector can effectively absorb surplus labour in the primary and secondary sectors by analyzing the synergies and the degree of deviations[9]; Liu YR et al. (2016) concluded that the employment absorption capacity of the service sector is characterized by phases and that China is still in a period of accelerated rise through a fixed-effects model[10]; In terms of local effects, Du Chuanzhong et al. (2016) found through impulse response analysis that knowledge-intensive service industries have the highest employment absorption elasticity and sustained employment creation, followed by capital-intensive service industries and the lowest labour-intensive service industries[11]; Johnston A et al. (2018) used a multi-factor partitioning technique to conclude that there are regional and sub-sectoral differences in the growth of service employment in the UK[12].

2.3 Literature Review

Firstly, in terms of residents' employment, the research results of domestic and foreign scholars are more comprehensive. In terms of resident income, foreign scholars neglect the impact of the development of the service sector on per capita income, and domestic scholars neglect the trend that with the popularization of education and the improvement of living standards, the income gap between urban and rural residents is narrowing. Therefore, it is focused on developing the service sector, and income imbalance no longer has long-term guiding significance for domestic economic transformation. Therefore, this paper focuses on the impact of service sector development on resident income to make up for the shortcomings of the previous works.

Secondly, most scholars apply their findings at the national level, ignoring the uneven development of different regions of a country and other particular problems. Therefore, the data used in this paper focus on the municipal level, explicitly analyzing the relationship between service sector development and resident income and employment in Jilin Province in general and at the prefecture-level.

Finally, to address the issue that urban resident income is not significantly influenced by employment in the service sector as proposed by Huang et al. (2018), this paper uses the value-added of the service sector instead of the share of people employed in the service sector as the explanatory variable. It establishes an individual fixed-effects model to conduct stepwise regression and robustness tests to measure the influence of the service sector on resident income by observing the regression coefficients.

3. Variable Selection, Sample Selection, and Statistical Description

3.1 Variable Selection and Handling

(1) Dependent variables: Resident income Y1 and resident employment Y2, measured by urban resident per capita disposable income and the number of urban residents employed.

(2) Independent variables: the development levels of the three major sectors I1, I2, and I3, measured by the value-added of the primary, secondary, and service sectors.

(3) Control variables: Population POPU; Education level EDU, measured by the number of students enrolled in general higher education per 10,000 population; Household size FAM, measured by the average number of people per household.

In order to weaken the problem of biased coefficients due to different orders of magnitude of the variables while reducing the effect of heteroscedasticity and improving data smoothness, Y1, Y2, I1, I2, I3, POPU, and EDU are logarithm zed.

3.2 Sample Selection and Data Sources

The data used in this paper are all obtained from the Jilin Provincial Statistical Yearbook. Data from 2010 to 2020 for nine cities in Jilin Province are selected for 99 samples.

3.3 Research Data and Descriptive Statistics

From the descriptive statistics, it can be seen that lnI2 has the largest extreme deviation and lnI3 has the most considerable mean value among the three major sectors. The standard deviation of each main variable is below 1.0, so the data are less volatile.

Table 1. Descriptive statistics for main variables.

Variable name	Sample size	Mean	Std. Dev	Minimum	Maximum
lnY1	99	10.0533	0.1773	9.6743	10.4505
lnY2	99	3.2090	0.6489	2.0541	4.8429
lnI1	99	4.7857	0.7024	3.5334	6.2801
lnI2	99	6.0921	0.7918	4.3870	7.9223
lnI3	99	6.0999	0.7686	4.8584	8.1156

4. An Empirical Analysis of Service Sector Development with Resident Income and Employment

4.1 An Empirical Analysis of Service Sector Development and Resident Income

After the F-test and Hausman test, the individual fixed-effects model is chosen, while to prevent heteroskedasticity and serial autocorrelation, Panel EGLS is used for estimation. Using EViews software, forward stepwise regression is used to include control variables, and the model is set as:

$$\ln Y_{1it} = \alpha_0 + \beta_1 \ln I_{1it} + \beta_2 \ln I_{2it} + \beta_3 \ln I_{3it} + \beta_4 \ln POPU_{it} + \beta_5 \ln EDU_{it} + \beta_6 FAM + \varepsilon_{it} \quad (1)$$

Where α is the constant term, β is the regression coefficient, ε is the random disturbance term, i is the cross-sectional unit (each municipality), t is the year, and the specific variable characters are explained in section 3.1 of this paper, the regression results are as follows:

Table 2. Results of regression of resident income.

	(1)	(2)	(3)	(4)
lnI1	0.1305*** (0.0098)	0.1353*** (0.0095)	0.1521*** (0.0108)	0.0903*** (0.0119)
lnI2	-0.1922*** (0.0097)	-0.1970*** (0.0095)	-0.1812*** (0.0074)	-0.0920*** (0.0067)
lnI3	0.4560*** (0.0172)	0.4559*** (0.0171)	0.4470*** (0.0150)	0.1946*** (0.0163)
lnEDU		-0.0240*** (0.0065)	-0.0328*** (0.0049)	-0.0004 (0.0045)
lnPOPU			-0.5207*** (0.0322)	-0.1338*** (0.0233)
FAM				-0.6822*** (0.0367)
C	7.8181*** (0.0904)	7.8680*** (0.0891)	10.6388*** (0.1552)	11.4983*** (0.1395)
Observations	99	99	99	99
Adj. R^2	0.9616	0.9663	0.9676	0.9591
Prob>F	0.0000	0.0000	0.0000	0.0000

Note: Standard errors in brackets, *, **, *** indicate significant at the 10%, 5% and 1% levels respectively

A simple regression of $\ln Y_1$ on each control variable is first performed. The order of entry of the control variables into the model is determined based on the F-statistic as $\ln EDU$, $\ln POPU$, and FAM . According to the adjusted R^2 , $\ln EDU$ and $\ln POPU$ should be retained, and FAM should be excluded. Therefore, model (3) is taken as the final model.

From the regression results, it is clear that β_1 , β_3 are significantly positive and β_2 is significantly negative, all significant at the 1% level, which means that the development of the primary and service sectors has a significant positive effect on resident income. In contrast, the development of the secondary sector has a significant negative effect on resident income. Obviously contrary to the objective economic law, we should try to find the reasons for this result:

(1) The value-added of the secondary sector continues to fall. Since 2013, except for Changchun, the value-added of the secondary sector in the rest of Jilin Province has been continuing to fall, for example, Jilin City, which is second only to Changchun in terms of the economic scale, fell from 127986 million yuan in 2013 to 51076 million yuan in 2020.

(2) The development of the heavy industry is restricted. At present, more than 60% of the machinery and equipment of industrial enterprises in Jilin Province are still in the 1970s and 1980s, which directly leads to high energy costs and a lack of competitiveness. There are also problems of high pollution, low efficiency, imbalance in the ratio of light and heavy industries, overcapacity, and structural solidification of state-owned enterprises, which drag down economic development.

For these two reasons, the β_2 is a negative value, and then β_1 . It is indicated that the development of the service sector is the most vital pulling force for resident income in Jilin Province among the three major sectors.

4.2 An Empirical Analysis of Service Sector Development and Resident Employment

This section uses the same econometric model as 4.1, setting the model as:

$$\ln Y_{2it} = \alpha_0 + \beta_1 \ln I_{1it} + \beta_2 \ln I_{2it} + \beta_3 \ln I_{3it} + \beta_4 \ln POPU_{it} + \beta_5 \ln EDU_{it} + \beta_6 FAM + \varepsilon_{it} \quad (2)$$

The characters are interpreted as in 4.1, and the regression results are as follows.

Table 3. Regression results for resident employment.

	(1)	(2)	(3)	(4)
lnI1	0.0183*** (0.0067)	0.0044 (0.0066)	-0.0005 (0.0121)	-0.0029 (0.0154)
lnI2	0.2562*** (0.0027)	0.2751*** (0.0035)	0.2995*** (0.0067)	0.2981*** (0.0069)
lnI3	0.0043 (0.0056)	0.0040 (0.0049)	- 0.1037*** (0.0424)	-0.1046*** (0.0162)
lnEDU		0.0556*** (0.0071)		
FAM			- 0.2787*** (0.0240)	-0.2866*** (0.0302)
lnPOPU				0.0468 (0.0899)
C	1.5346*** (0.3170)	1.3861*** (0.0426)	2.7399*** (0.1356)	2.5274*** (0.4118)
Observations	99	99	99	99
Adj.R ²	0.9995	0.9993	0.9996	0.9996
Prob>F	0.0000	0.0000	0.0000	0.0000

Note: Standard errors in brackets, *, **, *** indicate significant at the 10%, 5%, 1% levels respectively.

A simple regression of lnY2 on each control variable is first to run. The order in which the control variables entered the model is determined based on the F-statistic as lnEDU, FAM, and lnPOPU in that order. In model (2), lnEDU changes lnI1 from significant to insignificant and should be excluded. FAM in the model (3) improves the adjustedR². Moreover, it changes lnI3 from insignificant to significant, so FAM should be retained. In model (4), lnPOPU is an extra variable and should be excluded. In summary, model (3) is taken as the final model.

From the regression results, it is clear that β_3 is significantly negative at the 1% level, and β_2 is significantly positive at the 1% level, which indicates that the development of the service sector has a significant negative effect on employment, while the development of the secondary sector has a significant positive effect on employment. Obviously contrary to the objective economic law, we should try to find the reasons for this result.

Data from the seventh census shows that the total population of Jilin province was 204,073,500 in 2020, down 3,379,400 from a decade ago, a drop of more than 12%. Only Changchun's population increased slightly by 299,500 over the past decade, while the rest of the prefecture-level cities saw their populations decline. The population loss in Jilin province includes many scientific and technological talents and skilled laborers, with a consequent reduction in urban employment in all prefecture-level cities except Changchun.

It excludes the effect of the COVID-19, and the value-added service sector in Jilin Province generally maintained an upward trend from 2010 to 2020. It explains why β_3 is negative. Currently, the development of heavy industry in Jilin Province is restricted, leading to a continuous decline in the value-added of the secondary sector in most prefecture-level cities over the past seven years, which explains why β_2 is positive.

From the regression results, it is clear that β_1 is insignificant, indicating that the primary sector has no significant impact on employment. Therefore, the development of the service sector among the three major sectors has the most potent pulling force on the resident employment in Jilin Province.

4.3 Robustness Tests of Service Sector Development with Resident Income and Employment

4.3.1 Substitution of independent variables

Replacing the value-added of the three major sectors by the value-added of the three sectors as a share of GDP, without changing the model, the estimation results are as follows:

Table 4. Robustness test results.

	lnY1	lnY2
lnI1	-0.1552*** (0.0132)	-0.2212*** (0.0170)
lnI2	-0.2617*** (0.0097)	0.1322*** (0.0196)
lnI3	0.2310*** (0.0093)	-0.4686*** (0.0312)
lnEDU	-0.0410*** (0.0033)	
lnPOPU	-0.2732*** (0.0140)	
FAM		-0.4531*** (0.3347)
C	12.1267*** (0.0906)	6.1801*** (0.2349)
Observations	99	99
Adj. R^2	0.9807	0.9989
Prob >F	0.0000	0.0000

Note: Standard errors in brackets, *, **, *** indicate significant at the 10%, 5%, 1% levels respectively.

The results show that the sign and significance of the regression coefficients of lnI2 and lnI3 are consistent with the previous section. In terms of resident income, an increase in the value-added of the primary and secondary sectors as a proportion of GDP will reduce resident income, which shows the importance of accelerating the transformation of the industrial structure.

In terms of resident employment, the absolute value of β_3 is significantly larger than the absolute value of β_1 . It is shown that the service sector has a greater impact on resident income than the primary sector. In conclusion, the service sector has the most potent pulling force on resident income and employment among the three major sectors, which is consistent with the conclusions of the previous section.

4.3.2 Substitution of the estimation model

Do the above conclusions still hold after replacing the estimation model? Based on this, this paper uses the Logit method to estimate again. Firstly, this paper standardizes the independent variables data, then takes the first 50% of Y as 1 and the rest as 0, and the estimation results are as follows:

Table 5. Robustness test results (Logit).

	Y1	Y2
I1	0.4694 (0.6639)	0.2808 (0.3750)
I2	-4.6830*** (0.8803)	3.8214*** (0.9069)
I3	6.2480*** (1.2293)	-2.8789*** (0.7100)
EDU	0.6157 (0.5055)	
POPU	-3.2388*** (1.0088)	
FAM		-0.6382* (0.3347)
C	0.2167 (0.2783)	-0.6243** (0.2860)
Observations	99	99
McFadden R^2	0.4884	0.2869
Prob >LR	0.0000	0.0000

Note: Standard errors in brackets, *, **, *** indicate significant at the 10%, 5% and 1% levels respectively

The results show that the sign and significance of the regression coefficients of lnI2 and lnI3 are consistent with the previous section. Moreover, the impact of the primary sector on income and employment is not significant. In conclusion, the service sector has the most potent pulling force on resident income and employment among the three major sectors, which is consistent with the conclusions of the previous section.

After the robustness tests, the findings of this paper still hold true. Therefore, the relevant conclusions in this paper are relatively accurate and robust.

5. Research Findings and Policy Implications

5.1 Research findings

This paper constructs an individual fixed-effects model through a sample of selected 2010-2020 panel data from nine cities in Jilin Province. It conducts an empirical analysis on the impact of service sector development on resident income and employment in Jilin Province, with the following conclusions:

(1) Resident income: The service sector is the most vital driver of resident income in Jilin Province among the three major sectors. The secondary sector hinders the increase of resident income due to the restricted development of the heavy industry.

(2) Resident employment: Because of the population loss, the development of the service sector in Jilin Province hurts resident employment. According to the regression results, the service sector is the most potent pulling force of resident employment among the three major sectors.

5.2 Policy Implications

Based on these findings, this paper offers the following two policy takeaways.

(1) Consolidate the secondary sector and develop the service sector. Innovating industrial enterprises' management systems can speed up technology development and equipment renewal to

form large-scale production. It also can develop the ice and snow economy by building ski resorts, ice skating rinks, and ice sculptures with the help of geographical advantages; use the rich tourism resources, such as Changbai Mountain and the Net Moon Lake, to drive the development of the service sector.

(2) Retain the local population and bring in foreigners. Strengthen infrastructure construction and urban greening to create a livable environment; vigorously attract investment, increase financial expenditure and create jobs; relax settlement and provide preferential treatment to senior talents in terms of medical treatment, transportation, children's education, and living allowance.

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