The Relationship between Service Industry Development and Employment

Models and Empirical Analysis Based on The Data of Jiangsu Province

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Abstract—The main aim of this study wanted to find that changes in the absorptive capacity of employment of service industry. We use Jiangsu province as an example, calculating the employment elasticity coefficient to compare the absorptive capacity of employment of the three major industries, and also to compare the absorptive capacity of employment within various industries in services. Then we establish the regression model to predict the GDP of service industry (it is equal to the third industry in this study) from 2014 to 2018 in Jiangsu province, using C - D function method to establish model to predict the employments in service industry from 2014 to 2018. Finally, we predict the absorptive capacity of employment of service industry in Jiangsu province in the future 5 years. Our results show that there is some fluctuation in the employment absorbing ability of service industry in this period of time, the growth the GDP of service industry is a bigger leading role to the employment.

Keywords—services; employment absorption capacity; employment elasticity coefficient; regression analysis; prediction

I. INTRODUCTION

The services mentioned in this paper means the third industry.

II. EMPLOYMENT ABSORPTION CAPACITY COMPARISON BERWEEN THREE INDUSTRIES IN JIANGSU PROVINCE

Employment Elasticity Coefficient is the ratio of the employment growth rate and the GDP growth rate. That is to say 1% GDP growth will promote how many points of employment growth. Larger the coefficient is, the employment absorption capacity is stronger. The weaker is conversely.

The mathematical model of the employment elasticity coefficient is:

$$E_{xy} = \frac{\Delta L_x / L_x}{\Delta GDP_x / GDP_x} \qquad (1)$$

E_{xy} —Industry employment elasticity coefficient.

X —The x industry. Take x as 1, 2, 3 to main the first, second and third industry.

GDP_x—the GDP value of the x industry.

$\triangle GDP_x$—GDP changing rate of the x industry.

L_x—Employment quantity of the x industry.

$\triangle L_x$—Employment changing rate of the x industry.

The employment elasticities of the three industries of Jiangsu province was calculated using the above model based on the data of GDP of the three industries and the data of employment from 1990 to 2013 of Jiangsu province. In order to see the change of employment elasticity coefficient clearly ,four periods were divided as 1990-1997,1998-2003,2004-2009,2010-2013.In the Fig.1. below, the change of average employment elasticity coefficient in four periods was appeared.
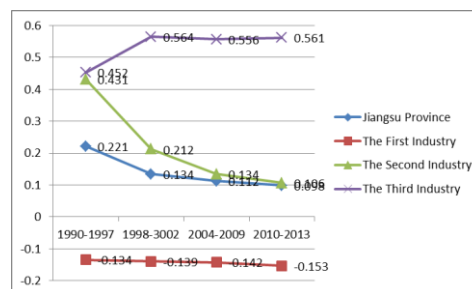

Fig. 1. The employment elasticity coefficient of variation of the three industries in1990-2013 in Jiangsu province

It appears a downward trend in the employment elasticity of Jiangsu province. Although large number of workers in the first industry in Jiangsu province in the past twenty years, the employment elasticity coefficient value is negative and appears a downward trend. The accommodation of labors is becoming saturate in the first industry. On the contrary, is crowding out for labors. It also appears a downward trend in the employment elasticity of the second industry. Employment absorption capacity is weak. It is concerned with the situation of the enterprise reforms. Reduce use of outdated production capacity caused spillover effect of employment. Employment absorption capacity was rapidly rising in the first period. It is move smoothly in the three periods later. And it's appearing rising TREND. So the employment absorption capacity of service

industry appears relatively stronger. It is a good way to develop the service to increase the employment.

III. EMPLOYMENT ABSORPTION CAPACITY COMPARISON AMONG SECTORS OF SERVICE INDUSTRY OF JIANGSU PROVINCE

A. Employment Absorption Capacity Comparison between Traditional Service Industry and Modern Service Industry of Jiangsu Province

Data was collected according to "the provisions of the three divisions of industry" which was published by the National Bureau of Statistics in 2003.Traditional service industry was divided into Wholesale and retail (WR), The transportation, warehousing and the postal service (TWPS), Accommodation and catering industry (ACI), Education(Ed), The department of health and social work (DHSW) with reference to the standard of the world trade organization (WTO) and the current situation of China. Because there is no clear standards of traditional service and modern service now. The modern service include Information transmission, software and information technology services(ITSITS), The financial sector(FS), The real estate industry(REI), Leasing and business services(LBS), Scientific research, technical services(SRTS), Water resources, environment and public facilities management(WREPFM), Residents service, repair and other services(RSROS), Culture, sports and entertainment(CSE), Public management, social security and social organization(PMSSSO).

TABLE I. EMPLOYMENT ABSORPTION CAPACITY COMPARISON BETWEEN TRADITIONAL SERVICE INDUSTRY AND MODERN SERVICE INDUSTRY OF JIANGSU PROVINCE IN 2013

Industry	GDP(Billion yuan)		△GDP /GDP	Employment （Ten thousand people）		△L /L	Employment elasticity coefficient E
	2012	2013		2012	2013		
Traditional Service Industry	11254.32	12122.6	0.08	206	262.59	0.27	3.56
Modern Service Industry	12263.66	14299.05	0.17	161.47	227.06	0.41	2.45

Qata Source: Jiangsu statistical yearbook

From the table 1, Employment elasticity coefficient of traditional service industry of Jiangsu province in 2013 is 3.56. Employment elasticity coefficient of modern service industry of Jiangsu province in 2013 is 2.45. There is larger advantage of absorbing employment in traditional service industry than in modern service industry. This is closely related to the industry. Modern service industry is the prime mover in technology innovation and improving productivity. It can also promote the human capital accumulation. The striking features of modern service are high knowledge intensive and technology intensive, Conservation and rational utilization of human resources. So its employment absorption capacity is a bit poor than traditional labor-intensive service industry.

B. Employment Absorption Capacity Comparison among sectors of service industry in Jiangsu province

TABLE II. EMPLOYMENT ABSORPTION CAPACITY COMPARISON AMONG SECTORS OF SERVICE INDUSTRY IN JIANGSU PROVINCE IN 2013

Ssectors of service Industry	GDP(Billion yuan）		△ GDP /GDP	Employment （Ten thousand people）		△L /L	Employment elasticity coefficient E
	2012	2013		2012	2013		
WR	5704.66	6223.46	0.09	33.48	61.40	0.83	9.17
TWPS	2352.40	2500.11	0.06	30.61	48.41	0.58	9.26
ACI	1045.21	1052.97	0.01	11.94	19.20	0.61	81.90
ITSITS	1103.84	1341.62	0.22	10.79	30.46	1.82	8.46
FS	3136.51	3808.79	0.21	29.36	30.79	0.05	0.23
REI	2992.82	3308.40	0.11	8.23	21.19	1.57	14.93
LBS	1415.19	1861.56	0.32	12.32	31.86	1.59	5.03
SRTS	612.53	703.64	0.15	12.78	19.25	0.51	3.40
WREPFM	321.98	348.00	0.08	13.27	14.03	0.06	0.71
RSROS	685.95	803.20	0.17	1.26	3.57	1.83	10.73
Ed	1420.47	1527.03	0.08	88.85	89.67	0.01	0.12
DHSW	731.58	819.03	0.12	41.12	43.91	0.07	0.57
CSE	302.99	383.38	0.27	6.07	7.79	0.28	1.07
PMSSSO	1691.85	1740.46	0.03	67.39	68.12	0.01	0.38

From the table 2, Employment elasticity coefficients among sectors of service industry are difference. ACI appears the strongest employment absorption capacity. Per GDP growth of 1%，Will drive the employment growth of 81.90%. The weakest employment absorption capacity is appeared in the financial sector. Per GDP growth of 1%, only will drive the employment growth of 0.23%.

IV. FORECAST ANALYSIS OF EMPLOYMENT ABSORPTION CAPACITY IN SERVICES OF JIANGSU PROVINCE

A. GDP forecast

Determination of time series trend was done first using the software SPSS basing on the data of the service industry of Jiangsu province from1990 to 2013. The observation Out of the service area GDP scatterplot is growth up with the time. And the growth trend year by year. Variety of models were tried in order to get more accurate results.
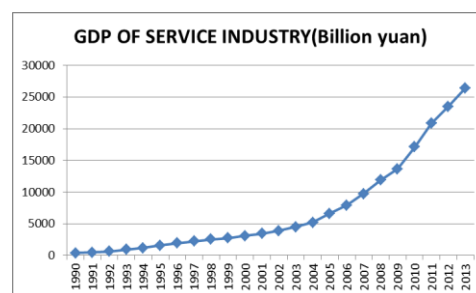

Fig. 2. GDP Scatter diagram of service industry of Jiangsu province 1990-2013 Qata Source: Jiangsu statistical yearbook

Modeling prediction analysis in Service industry:

TABLE III. Arameter ESTIMATION TABLE

Model	Model Summary					Estimate Parameters		
	R Square	F	df1	df2	Sig.	Constant	b1	b2
Linear	.788	81.625	1	22	.000	-5208.425	1000.535	
Quadratic	.974	386.892	2	21	.000	3318.275	-967.165	
Pow	.903	204.884	1	22	.000	147.276	1.429	78.708
Expo	.985	1471.157	1	22	.000	429.714	.175	

From the appeal of SPSS software analysis results can be concluded:

The value of R Square of Determination coefficient index model in service industry is up to 0.985.It is the highest one. So, exponential model was chosen to forecast the value of GDP in service industry.

$$Y_3 = 429.714e^{0.175t} \qquad (2)$$

Bring the time value into the model (2) to calculate the value of GDP in services industry of Jiangsu province in the period of 2014-2018:

TABLE IV. THE VALUE OF GDP FORECAST OF SERVICE INDUSTRY OF JIANGSU PROVINCE IN 2014-2018

Years	GDP of service industry（Billon yuan）	Proportion（%）
2014	30664. 87	43. 58
2015	38441. 87	44. 12
2016	47706. 20	44. 55
2017	58742. 29	45. 18
2018	69654. 30	47. 25

By the forecast results, an upward trend of service industry GDP is appeared. Its accounts are for nearly fifty percent of GDP, It has a large room to improve.

B. Employment forecast

C-D production function was put forward by mathematician Cobb and economist Douglas in the 1930 s. It is very useful to modern production. The model is:

$$Q = A * L^{\alpha} * K^{\beta}$$

Q—Products

L—Labor

K—Capital inputs

A, α and β—parameter,$0＜\alpha,\beta＜1$

Using C-D production function, a model is built analyzing the relationship between employment and the value of GDP of service industry. Than the service industry employment in 2014-2018 is forecasted.

$$X_{(t)} = F[Y_1(t), Y_2(t), Y_3(t)] = A(t) * Y_1(t)^{\alpha} * Y_2(t)^{\beta} * Y_3(t)^{\gamma} \qquad (3)$$

X1（t）,X2（t）,X3（t）——the employment of the first industry, the employment of the second industry,the employment of the service industry in t period.

Y1(t),Y2（t）,Y3(t)——the GDP of the first industry, the GDP of the second industry,the GDP of the service industry in t period.

Due to the natural logarithm transformation of data don't change the original relationship, and it can make its change trend linearization, also eliminate the phenomenon of time series variance of variation, so natural logarithms was taken on both sides of equation:

$$LnX_{(t)} = LnA(t) + \alpha LnY_1(t) + \beta LnY_2(t) + \gamma LnY_3(t) \qquad (4)$$

Based on the time series data of the third industry (service industry) and employment in 1990-2013, regression analysis is done by using the least square method with the help of SPSS software. The analysis results are as follows:

TABLE V. ANALYSIS OF VARIANCE TABLE

Model	Unstandardized coefficients		Standardized Coefficients	Estimate Parameters	
	B	Std. Error	Beta	t	Sig.
1(Constant)	4.296	.512		8.396	.000
GDP₁	.060	.135	.116	.441	.023
GDP₂	.403	.191	1.388	2.107	.048
GDP₃(Service)	-.136	.205	-.517	-.663	.033

The result which sig values are less than 0.05 is seen from the analysis using SPSS software. The result shows that the regression equation was established. Organize the related analysis results, long-term relationships model that the GDP of service industry and the employment can be written:

$$LnX_3(t) = 4.296 + 0.06LnY_1(t) + 0.403LnY_2(t) - 0.136LnY_3(t) \qquad (5)$$

The model (5) appears there is a positive correlativity between employment in service industry and GDP in the first industry. Also there is a positive correlativity between employment in service industry and GDP in the second industry. There is a negative linear correlation between employment in service industry and GDP in service industry. It is show that service industry is attracting professionals from the first industry. The employments in service industry will lead to a drop when the GDP of service industry is increasing.

Based on the data in table 3, used model(5),the employments in 2014-2018 were forecast in below:

TABLE VI. THE EMPLOYMENTS FORECAST OF SERVICE INDUSTRY OF JIANGSU PROVINCE IN 2014-2018

Years	Employment（Ten thousand people）	Proportion（%）
2014	615. 07	39. 75
2015	790. 98	41. 96
2016	1036. 97	42. 84
2017	1311. 76	43. 70
2018	1710. 53	44. 56

The forecast result shows employment proportion of the service industry in the total number of employees keeps rising steadily. The employments in 2018 are 1710.53 thousand people. The proportion is 44.56%. The employment proportion of service industry in Jiangsu province is rising while the employment proportion of the first industry and the second industry is falling. This kind of trend conforms to the pattern of the industrial structure adjustment. The forecast result shows the service industry has gradually become the largest industry in absorbing employment of Jiangsu province.

C. Forecase on the employment absorption capacity of the service industry in Jiangsu province

Based on the data in table 3 and table 4, used model(1), the employment elasticity coefficient E of the service industry of Jiangsu province in 2014-2018 were forecast in below:

TABLE VII.   EMPLOYMENT ABSORPTION CAPACITY FORECAST OF JIANGSU PROVINCE IN 2014-2018

Years	GDP(Billion yuan）	△GDP/GDP	Employment （Ten thousand people）	△L/L	Employment elasticity coefficient in service industryE
2013	26421. 65		489. 65		
2014	30664. 87	0. 16	615. 07	0. 26	1. 59
2015	38441. 87	0. 25	790. 98	0. 29	1. 13
2016	47706. 2	0. 24	1036. 97	0. 31	1. 29
2017	58742. 29	0. 23	1311. 76	0. 26	1. 15
2018	69654. 3	0. 19	1710. 53	0. 30	1. 64

The result in table 5 shows that there are some swings in the employment Absorption Capacity of Jiangsu province in 2014-2018. But the overall trend is stable. The exemplary role of the GDP growth in service industry is strong to the employment.

V.   CONCLUSION

After analysis we found that the overall employment elasticity of Jiangsu province is declining. The employment elasticity of the service industry is falling lower and leveled off late on. The employment absorption capacity of the traditional service industry in Jiangsu province is stronger than the modern service industry. There are big differences of the employment elasticity coefficient in internal industries of the service industry in Jiangsu province. ACI appears the strongest employment absorption capacity. The weakest employment absorption capacity is appeared in the financial sector. There is an upward trend in GDP of the service industry of Jiangsu province. The employment proportion of service industry in Jiangsu province is increasing steadily. There is some fluctuation in the employment absorbing ability in the future 5 years, but it is relatively stable. Leading role of GDP growth in the services industry is bigger to the employment.

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