

Can the service industry promote China's employment chronically?*

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In recent years, there have been both economic callbacks and employment increases in China, and the service industry has played an important role in this change. Through empirical analysis we prove that the service industry has long-term mechanisms to promote employment growth. Firstly, based on the Baumol-Fuchs hypothesis test, we find that the income elasticity of demand of the Chinese service industry exceeds 1, and the Chinese service industry has huge development potential due to its currently inadequate development. Secondly, based on a modified employment equation, we find that the elasticity of employment of the service industry is far higher than that of the industrial sector, and the service industry has stronger employment stickiness. The service industry can serve as the absorber and stabilizer of employment. China's current employment pressures mainly grow out of migrant workers and college graduates; to solve the employment problem for these two groups, it is essential to promote both the development of a traditional service industry and the upgrade of the emerging service industry. At last, this paper proposes corresponding suggestions.

Keywords: service employment, the hypothesis of Baumol-Fuchs, employment elasticity

1. Introduction

China's economic growth rate fell to 7.7% in 2013, which was a historically low level in modern times. However, the employment situation has not deteriorated. 13.1 million new urban jobs were added over the year, which surpassed the target of 9 million set at the beginning year. It can be said that the coexistence of low growth and high employment is a notable feature of the economy compared with the past several years. In this process, service sector plays an important role, which serves as the absorber and stabilizer of employment. In 2013, the tertiary industry reached 26.2 trillion yuan, an increase of 8.3%, which accounted for 46.1% of GDP. Whether the absolute amount, or the growth rate, or the proportion, the tertiary industry exceeded the secondary industry, which is rare in recent years. The rapid development of the service sector

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has laid a solid foundation for employment growth. According to statistics, each additional one percentage point of output in the service sector can create about 700,000 jobs.¹ Thus, the question of whether the long-term development of China's service industry can completely relieve employment pressure deserves serious study because it will answer questions related to the future direction of macro-control policies. If the answer is yes, then it will not rely on high economic growth to achieve employment goals. On the contrary, more resources can be allocated to stabilize prices and to achieve a good pattern of "low growth, low inflation, and high employment." Conversely, if there is no long-term mechanism to promote employment in the service industry, then high economic growth is still needed to achieve the employment objectives, and a target for price stability should be placed in a relatively minor position. It is clear that this issue has important research value.

This paper answers these questions in two dimensions. First, we use the hypothesis of Baumol-Fuchs to examine the development potential of the service sector and the growth mechanisms of employment. It is found that the income elasticity of demand exceeded 1, which means the service sector, especially the production service sector, will grow faster along with higher growth of national income. It has been long suspected that employment growth in the service sector is due to its lagging productivity. Therefore, once the service sector is upgraded, employment growth will be stagnated. We find that this problem presents a dichotomy. For the consumer services and public services, employment growth is positively related to lagging efficiency, and upgraded efficiency will damage employment. For the producer service sector, however, there is no obvious relationship between employment growth and productivity. The upgrading of these industries will not lead to the problem of "efficiency swallowed employment." Secondly, we have further deepened the understanding of service employment functions through comparison methods of employment elasticity ratios. The result shows that the long-term employment elasticity of the service sector is far higher than the industrial sector in general. Among which, the consumer service sector is about 2 times the industrial sector, producer service is also close to 1.5 times, and the public service sector is between the consumer service sector and producer service sector. More importantly, with respect to the industrial sector, the service sector has stronger viscosity. It takes longer conduction delay from output volatility to employment fluctuation, which shows that not only the absorption function of the national economy will be enhanced, but also employment stability can be improved along with the focus of economic development that will transform the service sector. Currently, innovation in macro-control modes is ongoing. Only when the economy is out of its security zone, can the government carry out large-scale intervention. The current bottom line is the employment goals. Through proving the service sector's function of preserving employment, we argue that the Chinese economy can be operated in a safe range, which supports the regulatory thinking of a "reasonable range." We also clarify the mistaken argument that the upgrading of the production service sector will inevitably weaken

¹ Source: <http://www.fx678.com/C/20130716/201307161546061610.html>

employment, and we also provide a theoretical basis for the transformation and upgrading of producer services.

2. Literature review

For the foregoing problems, we divide the documents into two parts. On one hand is the current status as well as the future development trends of service sectors; on the other hand is the internal stimulating mechanism of service sector employment. First, according to the Petty-Clark Law, the center gravity of one economy will gradually shift from agriculture to industry to services sectors along with economic development. Especially when industrialization is advanced to a certain stage, the rising proportion of the service industry is inexorable (Jiang & Li, 2004). This inevitability began with its important role in the national economy, among which is its function as the “glue” of the national economy. Services play an irreplaceable role in enhancing operational efficiency and economic competitiveness. Production services, as a high-level input element, especially enable the industrial sector to get more specialized intermediate service, which enhances overall efficiency (Jiang, Liu & Yu, 2007).

However, China’s service industry development has been seriously lagging, which is still not commensurate with the current level of economic development. The potential role of the service sector on the national economy has not been fully realized. Through comparison, we find that the proportion of China’s service industry in national economy is generally lower than that of other countries (Research Institute of NDRC Macroeconomic Research Group, 2005). At present, China has stepped into the middle-income stage,¹ but the development level of services is far behind the average level of middle-income countries. The average proportion of the service sector in GDP in middle-income countries is 55.9%, while the proportion in China is only 46.1%. Moreover, there are still serious structural problems in China’s service industry in which traditional consumer services are given priority while the emerging producer services are neglected (Cheng, 2008). The proportion of production services in GDP is generally more than 40% in developed countries, while in China this level has been around 15% since the 1990s.

The Baumol-Fuchs hypothesis is undoubtedly the most influential concept in explaining the promoting mechanism of services on employment. They argue that the employment growth of the service sector is mainly due to its lagging labor productivity (Baumol, 1967; Fuchs, 1987). Clark’s theory of the three industries also proposed that productivity in manufacturing is high but demand growth, while the services are the very reverse, with low productivity and high demand growth. So the result of this economic development is the labor’s inevitable shift from manufacturing to services (Clark, 1957). Many scholars have tested the Baumol-Fuchs hypothesis and most are inclined to accept this hypothesis. In most studies, however, time series data was

¹ Li Keqiang: “China has entered into the middle-income stage with the per GDP of 6000 dollars.” Xinhua Net, Berlin, May 29, 2013.

used and the sample size is greatly limited. For example, the sample period in one of Cheng's (2004) empirical analysis was only 22 years. The degree of freedom in the model is obviously insufficient and the scientific validity of the test is difficult to guarantee.

Other scholars explain employment growth mechanisms from the perspective of factor inputs. For example, the Chinese Academy of Social Sciences Research Group (2009) find that investment growth of services and infrastructure improvement have a significant effect on services. The limitation of the analysis is that only the employment effect of services is taken into consideration. In practice, the service sector's stimulating employment may not be achieved through the service sector, but can also be indirectly achieved through the development of other industries (Zheng, He & Xia, 2007). It can be said that the latter view emphasizes the service sector's basic character as an intermediate input in the process of social investment, which is closer to the reality of modern economy and society. However, how to prove the existence of such hidden employment mechanisms has not been systematically tested in these documents.

People tend to regard the service sector as a singular unit to study, while ignoring the structural differences between internal services, which is an important issue in the case of today's internal service differentiation. The development of the service sector, as well as employment growth, may be either the result of other external effects, such as institutional change, or the result of conversion of the service sector's internal structure (Gu, 2010).

The concept of the service industry is broad with multiple sub-sectors. We not only need to identify the overall employment function, but also the difference of employment functions between various types of service sectors. Only through this can the basis of appropriate service development policies be provided. Gershuny & Miles (1983) show that the main driving force of employment growth in the service sector is production services, rather than the consumer services. Along with an increase of economic development levels, the demand for intermediate services in industrial production render long-term growth and continue to accelerate while residents' demand for services is more gentle; ultimately, the relative proportion decline. Other scholars (Gruber & Walker, 1993) propose a similar view. It should be said that this school of argument is synchronized with the reality of developed countries, and it can't necessarily explain the problems of developing countries. Producer services in developing countries are relatively backward and the scale is not sufficient to absorb a lot of labor. On the contrary, employment from retail, catering, hospitality, and other traditional consumer services may be more prominent.

In order to better promote employment, which categories of service should be focused on? Some scholars believe that China should focus on the development of producer services (Zhang, 2012), but the employment absorption function of this sector is relatively weak (Ding, 2009) and too much emphasis on the development of producer services will undermine the capacity of the service sector. Because of this, some scholars stress that China should focus on the development of a traditional labor-intensive service industry, which is both necessary and feasible (Wei, 2006).

Some scholars consider this issue entirely from the perspective of economic efficiency and propose that those sectors that can overcome the issue of cost should be focused on boosting employment, especially those sectors that can achieve standardization (Li & Sun, 2012). It should be said that the composition of the Chinese labor structure is complex. In order to solve the employment problems of different groups, it needs to develop different types of services. The argument of “either A or B” may be biased.

Overall, the domestic and foreign scholars conduct lots of research on the development trends of the service sector, growth mechanisms, and the future evolution of structure. Although enlightening, there still exist obvious flaws—mainly in the following three aspects: first, it generally focuses on the analysis of employment outcomes, and lacks a systematic analytical framework to reveal the internal drive mechanisms of the service sector to promote employment. Accordingly, there is no way to answer whether this mechanism has long-term issues or not. Second, the employment effects of the service sector are generally studied from the perspective of quantity, not quality. Which different characteristics do the different sectors have when comparing the employment effects with other sector? No systematic answer provides a full understanding of the function of services. Third, from the perspective of promoting employment, which direction should be revolutionized in the future? On this issue, it is only analyzed from the perspective of specifications and lacks empirical support. It is important to note these issues, because biased conclusions will lead to weakened policy value.

From this view, the rest of this paper will focus on these issues.

3. Theoretical framework

We will analyze these issues with the model provided by Baumol (1967). Assuming there are two sectors in economy: the sector with advancing productivity and the sector with lagging productivity. The former is represented by the industrial sector and indicated by the subscript 1. The latter is represented by the services sector and indicated by the subscript 2. Baumol (1967) assumes that labor productivity in the lagging sector absolutely lags behind a growth rate (g_2) of zero. However, this is too absolute for a stagnant service sector because it is compared with its progressive counterpart. In practice, productivity grew at a slower pace but rarely remained absolutely unchanged. Thus, we don't limit the value of g_2 as zero. We only assume that the growth rate of the stagnant sector is lower than that of the progressive sector (g_1). We suppose that in addition to the labor factor, the role of the other factors is fixed. The out model of manufacturing and the service sectors respectively take on the following form:

$$Y_1 = A_1 L_1 e^{g_1 t}; \quad Y_2 = A_2 L_2 e^{g_2 t}; \quad (1)$$

Y_1 and Y_2 respectively represent the output of manufacturing and the service sector. A_1 and A_2 respectively represent the technical factors. L_1 and L_2 respectively represent the labor input

of these two departments. t is the time variable. We assume that people's demands for service products depend on the relative price of manufactured goods: p_1/p_2 , wage W , and the exogenous shocks εt :

$$Y_2/L = \varphi (p_2/p_1)^\zeta W^\gamma e^{\varepsilon t} \quad (2)$$

In the above formula, φ is a constant item, ζ is the demand price elasticity of service commodities, and γ is the demand income elasticity of service commodities. W is the wage. The individual demand for manufactured goods is expressed with the following formula:

$$p_1 (Y_1/L) = W - p_2 (Y_2/L) \quad (3)$$

We assume that manufacturing goods are the standard valuation products. That means $p_1=1$. At the same time, according to the marginal principle, we assume that wages equal marginal output. Through partial derivation, we can get the marginal product of these two sectors:

$$MP_1 = A_1 e^{g_1 t}, \quad MP_2 = A_2 e^{g_2 t}, \quad (4)$$

Further, wages can be expressed as:

$$W = A_1 e^{g_1 t} \quad (5)$$

In the conditions of a perfectly competitive market, the price of products is equal to the marginal cost. For the two departments, the price is expressed as follows:

$W/MP_1 = p_1$, $W/MP_2 = p_2$, then we can get the following formula:

$$p_2/p_1 = (A_1/A_2) e^{(g_1 - g_2)t} \quad (6)$$

This equation shows that if $g_1 > g_2$, then the relative prices of the service sector will rise over time.

Since the total quality of national employment is $L = L_1 + L_2$, then the service sector's share of total employment is expressed as $r_2 = L_2/L$. Based on the formula (1), we get the following formula:

$$r_2 = (Y_2/A_2 L) e^{g_2 t} \quad (7)$$

then we can get:

$$Y_2/L = \varphi [(A_1/A_2) e^{(g_1 - g_2)t}]^\zeta (A_1 e^{g_1 t})^\gamma e^{\varepsilon t} \quad (8)$$

When we combine formula (7) and formula (8) and take the differential, we can find the equilibrium path of the service sector employment share:

$$d(\ln r_2)/dt = \varepsilon + (\gamma - 1)g_1 + (1 + \zeta)(g_1 - g_2) \quad (9)$$

This formula provides the basic framework for subsequent empirical analysis. The left of the formula represents the growth of the share of service sector employment. The right consists of three parts, which determines the three possible sources of the share. These three sources are random disturbance factors ε , the growth rate of industrial labor productivity g_1 , and the extent that the growth rate of service sector productivity lags behind that of the industrial sector ($g_1 - g_2$). The latter two factors are the core of the test. The four elements can be judged from their coefficients and they can outline the development prospects of the service sector and employment growth mechanisms.

The four test elements are as follows: first, if the coefficient is significantly positive, this means that the growth rate of industry labor productivity plays a positive role. We can say that the service sector's production characteristics are obviously generalized because in comparison with consumer services, producer services and the productivity of industrial labor are closely linked. Otherwise, the production characteristics of the service sector are not prominent. Second, if the coefficient of the term $g_1 - g_2$ is significantly positive, then we can say that the hysteresis characteristic of the service sector's productivity plays a positive role in employment growth. Otherwise, it will indicate that employment growth in the service sector is not due to lagging productivity. This is the core of the Baumol-Fuchs hypothesis. If the coefficient of the term g_1 is significantly positive, then the demand income elasticity is significantly different from 1. The coefficient of formula (9) shows that the demand income elasticity should be equal to the value of 1 plus the factor: if the coefficient is greater than 1, then the demand income elasticity is elastic, which means along with the growth of national income, the demand for services will increase at a faster rate, and that the service industry has a broad potential for development and vice versa. Fourth, if the coefficient of the term $g_1 - g_2$ is significantly positive, then the demand price elasticity is significantly different from 1. The coefficient of formula (9) shows that the demand income elasticity should be equal to the value of 1 minus the factor. If its absolute value is smaller, then the demand for services is insensitive to the price, which will lead to a higher price of the service products. On the contrary, if the demand price elasticity is high, then services can only rely on low prices to seek a competitive advantage.

4. Development trends of service industry and mechanisms of employment growth

The provincial panel data is used for analysis; the section unit is province, autonomous region, or municipality. In view of the special nature of Tibet and Qinghai, we exclude them

from the sample and 29 cross-sectional samples are left. Based on the following two reasons, we will choose the years from 2003 to 2011 as the sample period. First, since 2003, there has been a shortage of migrant workers in China. The conditions of this labor supply began to change and the structure of factor inputs may change. Second, the unified caliber of employment is taken into consideration. Before 2003, the “China Statistical Yearbook” released figures on total provincial employment by industry. This data has not been released since 2003 and been replaced by the number of employees in urban units and private employment units by industry. Using a sample period of the years after 2003 can avoid the effect of inconsistent statistics. The concept of workers is relative to the individual and private workers. We can obtain the approximate employment quality of various sectors through the sum of these two factors.

In addition to analyzing the overall situation of the service sector, we also compare various service sectors through empirical analysis. The service sector has a variety of sub-classification method. For example, services can be divided into producer services, consumer services, distribution services, and social services according to Browning & Singleman (1975). The main criticism of this approach is that a large part of the flow of services is for producer services, especially in today’s increasingly fine divisions. As an independent industry, circulation transportation has increasingly become an important part of intermediate inputs for industrial production. People often put circulation transportation into the category of producer services and the so-called method of the “rule of thirds” appeared. That is, producer services, consumer services, and public services (Gruber & Walker, 1993). Of course, these methods can’t strictly define a service as a production-oriented, consumer, or public service. Take circulation transportation as an example, it serves both for industrial producer services and for household final consumption services. To solve this problem, Goodman & Steadman (2002) also proposed a hybrid classification method. This method uses an input-output table and classifies the sector whose intermediate demand is higher than 60%, and the service sector and those whose demand is lower than 40% as the consumer services. Those between the two services are defined as mixed services. The main drawback of this method is that the critical standard value is too subjective without an objective basis.

In view of this, we will not take on a rigorous method for calculating these classifications. According to the current common practice and the combination of China’s experiences in practice, we divide the services into the following classifications.

For the service sector as a whole, we use the tertiary industry to represent the whole. According to Table 1, we respectively analyze production services, consumer services, and public services. Labor productivity is equal to the added value’s division by employment quality. Added value reached a comparable level beginning in 2003. The share of employment in each sector is equal to the employment quality divided by the sum of its employment quality and industrial employment. Total employment data is the sum of each sector. The test results, based on formula (9), are as follows.

Table 1
Service industry classification

Service type	Industries
Producer services	Transportation, storage and postal services, information transmission, computer services, software industry, finance, leasing and business services, technical services, geological exploration industry
Consumer services	Wholesale and retail trade, accommodation, catering industry, real estate, residential services and other services, culture, sports and entertainment
Public services	Water conservancy environment and public facilities management industry, education, health, social security and social welfare, public administration and social organizations

Note: China's real estate is mainly purposed to meet final consumption demand. Therefore, many domestic scholars focus on the consumer services sector, which is different from the standard western classification. This paper also puts it in consumer service with this approach.

Table 2
Test results of the hypothesis of Baumol-Fuchs

	Estimation methods	Constant term	g_1	$g_1 - g_2$	Adjusted R^2
Service industry as a whole	Fixed effects model	0.086	0.089	0.310***	0.305
Producer services	Fixed effects model	-0.595	0.160*	0.208	0.328
Consumer services	Random effects model	-1.103**	0.108	0.115***	0.411
Public services	Fixed effects model	0.776	-0.093	0.364***	0.370

Note: ***, **, * respectively represent passing through the significance test of 1%, 5%, 10%.

On the basis of the foregoing principle, with the combination of the regression results, we can calculate the demand income elasticity and the demand price elasticity, as shown in the Table 3.

Table 3
Demand elasticity of various kinds of services

	Demand income elasticity	Demand price elasticity		Demand income elasticity	Demand price elasticity
Services as a whole	1.089	-0.690***	Consumer service	1.108	-0.885***
Producer service	1.160*	-0.792	Public service	0.907	-0.636***

Note: Because the demand income elasticity and the price elasticity are calculated based on the results of Table 1, ***, **, * respectively represent income elasticity's significantly difference from 1 at the level of 1%, 5%, and 10%, while price elasticity's was significantly different from -1.

Table 3 shows that, generally speaking, the demand income elasticity of the service industry in China is 1.089, which is approximate to the 1.12 income elasticity level of services in 1960s in the USA, as estimated by Fuchs. According to the results of Summers(1985), the fluctuation range of service's income elasticity in 34 countries in the 1970s was from 0.912 to 1.458. These results are also in this range. A demand income elasticity greater than 1 indicates the growth rate of demand for services is greater than the rate of income. There is huge potential for the future. Among these elasticities, the elasticity of producer services is largest with a value of 1.16, which

is followed by the consumer services with a value of 1.108. This also verifies the preliminary judgment that China's service industry will enter into a fast track along with the improvement of economic development. In particular, as industrialization comes into a stage of high degree of processing and upgrading the industrial structure, as well as the refinement of division, the demand for intermediate services will get rapid growth, which creates good conditions for the production services' development. As for the development of consumer services, the level of per capita national income in China continues to increase, and has now surpassed the global average of middle-income countries. Consumer services are responsible for China's higher level of consumption. The rapid growth of service demand is in line with Engel's law as well as the basic evolution principle revealed by Maslow's hierarchy.

As for demand price elasticity, Table 3 shows that it lacks flexibility in the service industry, with a value of -0.69. Low price elasticity in this case can provide a platform for low-efficiency services, especially public services. As for producer services, the reason why price elasticity is low is because industrial customers are more concerned with the quality of services rather than the price level. The low price elasticity of public services may be attributed to the nature of public goods. Since individuals have no need to pay for the cost because the government pays for the cost, there is a lack of concern about the cost, and thus the price would not be a significantly weighed factor. Consumer services are quite different. Because individuals or families pay the costs directly, they will be more sensitive to the price, and therefore the price elasticity will be higher. Table 3 shows the value is -0.885. This indicates that competition for consumer services will focus on low costs and low prices. In practice, these sectors are mainly engaged in low-end services and are also the main source of employment for migrant workers.

For the entire service industry, the coefficient of g_1 is not significant, which indicates that there is no significant relationship between rising industrial productivity and employment's share of services in general. It also reflects that services in China are not focused on production service. The coefficient g_1 of producer services is significantly positive, with a value of 0.16, which indicates that the growth rate of industrial productivity can promote the employment share of production services. Its internal mechanism is clear: the growth of industrial productivity relies on intermediate inputs such as the building of information networks. The increase of the intermediate input of production services can stimulate employment in these sectors as well. The insignificant coefficient g_1 of consumer and public services indicates that the growth rate of industrial productivity cannot significantly boost their share of employment growth. After all, there is no direct link between them and industrial production. Because services in China still focus on consumer services and public services, while the share of production service is lower. The combined result is that the changing trajectory of the service employment's share is separate from the growth of industrial productivity, which is a typical characteristic of backward service.

Table 2 shows the coefficient of the term g_1 - g_2 . For services as a whole, the coefficient is significantly positive, with a value of 0.31. This indicates that the greater the lagging of service

efficiency, the faster the growth of the employment share, which is basically in line with the prediction of Baumol-Fuchs. For the producer services, the insignificant coefficient of the term g_1 - g_2 shows the increased share of employment of production services is not due to lagging productivity. The reason is that producer service is committed to improving productivity efficiency of the industrial sector. In addition to a few industries such as transportation, most industries are knowledge-intensive and technology-intensive, with relatively high productivity. With respect to the industrial sector, its lagging productivity is not obvious, which will not constitute a significant share of employment growth. But it's different for consumer and public services. Most consumer services belong to traditional industries with the obvious characteristic of lagging productivity. On the contrary, the main supplier of public services is the government and other public sector institutions. The institutional factor, principal-agent problem, and other issues often lead to inefficiencies. Therefore, the growth of the employment share in these two types of services is entirely due to lagging productivity. Table 2 shows the coefficients of the term g_1 - g_2 in both the consumer service and public service are positive, as evidenced by this point.

Since the growth of the employment share in producer service is not due to lagging productivity, it can be asserted that promoting the upgrading of production services will not bring the issue of "efficiency swallowed employment." On the contrary, it can create a greater proportion of high-quality jobs, which will contribute to the high-end workforce as represented by college graduates.

5. Further validation of employment elasticity

The tests on the Baumol-Fuchs hypothesis prove that the service sector has great potential and the employment structure of the national economy has a transforming trend in regards to the service sector. However, it is not sufficient to prove that the service sector's development can create more jobs than the industrial sector. For this problem, we will estimate and compare the employment elasticity of various sectors for further investigation.

The so-called employment elasticity indicates how much employment can be created by one unit of additional output. The most frequently used method of calculation is point elasticity or arc elasticity. It is divided by the percentage change of employment with the percentage change of output during the review period. This method is simple but has lots of deficiencies. Because each year of employment elasticity is calculated and the value between each year may vary greatly, it is difficult to judge the size of employment elasticity. There may be only one year of employment that is calculated this way, but it needs a conduction process from the change of output to the change of employment, which means the production reduced in the current period will not necessarily lead to the reduction in employment. The traditional calculation method includes the impact on current employment but ignores the lagging impact.

In order to overcome these shortcomings, we will draw on a method proposed by Ding (2009)

and estimate values through the use of a regression equation. The main feature of this approach is that the adjustment lag of employment is taken into consideration. We know that when the output of a business changes, the optimal labor input will also change. This can be achieved either through adjusting the level of employment (generalized way) or through adjusting labor time (a more specific and deeper way). The former will affect the employment level while the latter will not. If the generalized way is used to adjust labor inputs, this step is not enough. Because of various restrictions such as labor regulations on corporate layoffs in advance, it is often carried out in phases from the actual amount of employment to the optimal amount. In this regard, a form of Koyck's hypothesis is usually used to describe the lagging process. Most studies show that the lagging adjustment of employment can be completed within two years (Pehkonen, 2000). Therefore, the variable of two lagging periods can be introduced in the employment equation. Based on the above ideas, we build the following employment equation:

$$\ln E_{i,t} = \alpha_0 + \alpha_1 \ln Q_{i,t} + \alpha_2 \ln E_{i,t-1} + \alpha_3 \ln E_{i,t-2} + \sum \beta z_{i,t} + \varepsilon_{i,t} \quad (10)$$

The explained variable $\ln E$ is the logarithmic function of employment in each department. $\ln Q$ is the logarithmic function of added value for each sector. Among them, the coefficient α_1 represents the percentage change of employment created by the change of output—this is the short-term employment elasticity. $\ln E_{t-1}$ and $\ln E_{t-2}$ are respectively the variables that tend to lag from one period to the next, which represents the previous employment affect the current level of employment. This is the lagging adjustment force of employment. Therefore, the greater the efficiency of the two variables, the more strongly the employment adjustment lags. Taking into consideration the combined effects of immediate and the lagging effects, long-term employment elasticity should be expressed as $\alpha_1 / (1 - \alpha_2 - \alpha_3)$.

As a control variable, z has three categories: first is the logarithm of the average wage in each sector of $\ln w$. Wages will not only affect labor supply, but will also affect labor demand. We can acquire the average provincial sub-sector wage in each sector from the yearbook. Although this does not reflect wage levels of individuals, the private employment wages should remain a relatively stable proportional relationship with worker wages under equilibrium conditions. In other words, the average wage of all workers should be multiplied by a stable coefficient. Hence, the worker's wage replacing the industrial wage will not lead to serious problems. For industrial sector wages, since the share of employment in the manufacturing sector amounts to more than 70%, it is reasonable to be substituted by the wages in the manufacturing sector. Second are the time variable t , and its squared value. The introduction of these two indicators is mainly used to reflect non-linear technology trends. Technological factors can affect the structure of factor inputs. Third are the regional dummy variables D_m and D_e . If a province is located in the central region, then the value of D_m is 1 and D_e is 0. If a province is located in the eastern region, then the value of D_m is 0 and D_e is 1. If a province is located in the western region, both the value of D_m and D_e are 0. We know different areas have different institutional environments and different

allocation mechanisms. Compared with the eastern region, the administrative intervention force of midwest may be stronger, which will exogenously affect the input structure. The introduction of these two dummy variables is to control regional effects.

Similarly, for the sample capacity consideration, panel data is also used in model (10). Among them, the cross-section unit and time-series are similar to model (10). We will estimate model (10) with different industries and services and compare consumer services, production services, and public services. Specific results are shown in Table 4.

Table 4

Estimated results of equation of various industries (explanatory variables: $\ln E$)

	Industry Fixed effect model	Services Fixed effect model	Consumer services Random effect model	Producer services Fixed effect model	Public services Fixed effect model
Constant term	3.25	-0.723	-2.210	0.795*	3.101
$\ln Q$	0.113***	0.171***	0.180***	0.160***	0.149***
$\ln E_{t-1}$	0.289**	0.310***	0.321**	0.330**	0.382***
$\ln E_{t-2}$	0.676	0.061*	0.107**	-0.580	0.097**
$\ln w$	0.090*	-0.230	-1.208	0.232***	-2.130
t	-1.286	0.280	-0.975	0.647	0.708
t^2	-0.031	-0.997	0.521	0.183	-1.336
D_m	0.885	-1.056	1.034	-2.802	0.795
D_e	0.191*	0.071	0.087	0.200**	0.633***
$A-R^2$	0.283	0.267	0.301	0.296	0.280
Hausman	19.38	10.15	-0.503	23.25	15.00

Note: ***, **, * represent passing through the significance test with 1%, 5%, 10%.

For the above panel data model, we estimate with the fixed effects model and random effect model, and then choose according to the Hausman index. For example, the value of Hausman in the employment equation of the industrial sector is 19.38. It refused the null hypothesis that the estimated results of the two models have no systematic differences at the significance level of 1%. The fixed effect model should be used in order to ensure the consistency of the estimation results. Similarly, the fixed effects model can be also used in estimation of services, both production and public. For consumer services, the value of the Hausman coefficient is -0.503, even at the significance level of 10%. Thus, it can not reject the null hypothesis that the results of two models have no systematic differences. In this case, we should choose the random effect model.

We can see from Table 4, the coefficient of $\ln Q$ for the employment equation in the industrial sector is 0.113. It represents short-term employment elasticity according to the principle, which reflects only the immediate effects. The coefficient of $\ln E_{t-1}$ is 0.289 and the coefficient of $\ln E_{t-2}$ is not significant, which indicates that the employment quality of the lagging year will affect the current employment while the lagging from two years prior will not. Accordingly, we can calculate the long-term employment elasticity including the hysteresis effects: $0.113/$

$(1-0.289)=0.159$. Similarly, we can calculate the short-term and long-term elasticity of services, consumer services, producer services, and public services, as shown in Table 5.

Table 5

Comparison between employment elasticity in all sectors

	Industry	Services	Consumer services	Producer services	Public services
Short-term elasticity	0.113	0.171	0.180	0.160	0.149
Long-term elasticity	0.159	0.272	0.315	0.239	0.286

As seen from Table 5, the service sector is higher than industry sector both in terms of short-term and long-term elasticity. The value of short-term and long-term elasticity in the industrial sector are 0.113 and 0.159, respectively, while in the service sector they are 0.171 and 0.272, respectively. In the service sector, the employment elasticity in consumer services is largest. Short-term elasticity and long-term elasticity are 0.18 and 0.315, respectively. The value of producer services are 0.16 and 0.239, respectively. The short-term employment elasticity in public services is not large, with a value of 0.149, while the long-term elasticity is higher with a value of 0.286, which is only lower than the consumer services. This difference has a great relationship with the low speed of employment adjustment. For this problem, these issues will be discussed further.

In short, if the lagging effect of output fluctuation is taken into consideration, the employment elasticity in consumer services is two times that of the industrial sector, while the producer services are slightly lower with about 1.5 times that of the industrial sector. Public services is somewhere between 1.5 and 2 times the level of the industrial sector. In the future, if the focus of China's economic development gradually shifts to the service sector, then employment will certainly increase and more jobs will be created.

In addition to significantly driving the employment, the development of services can also slow down the impact of output fluctuation on employment, which has an important role on social stability. For this role, we can measure through the adjustment speed of employment. In the previous section, we have estimated the coefficients of the variable of one period lagging, α_2 , as well as the two periods together, α_3 . They show the impact of current employment on the pre-employment, which is the lagging effect. Therefore, the speed adjustment of employment departments can be described by the value of $1-\alpha_2-\alpha_3$.

Table 6

Comparison of adjustment speed in all sectors

	Industry	Services	Consumer services	Production services	Public services
α_2	0.289	0.310	0.321	0.330	0.382
α_3	-	0.061	0.107	-	0.097
Velocity of employment adjustment	0.711	0.629	0.572	0.670	0.521

As shown in Table 6, the speed of employment adjustment is 0.711, which means that only 71.1% of employment changes led by output changes can be completed in the current year and the lagging adjustment level is one year. The speed of employment adjustment in the service sector is 0.629, which means that only 62.9% of the employment changes led by output changes can be completed in the current year and lagging adjustments can continue into a second year. This indicates a stronger viscosity in the service sector, which needs a much longer time for output fluctuation to carry over to employment.

In the service sector, there are differences in the employment adjustment speed amongst the three subsectors. The speed of consumer services is 0.572, lower than services as a whole, and the effect of the second year remains significant. The speed in producer services is 0.67 and the lagging effect lasts only one year. The speed in public service is lowest with the value of 0.521 and a lagging effect that will continue into the second year.

Capital formation can explain the difference of employment adjustment speeds between the industrial and service sectors. The industrial sectors depend more on fixed capital, and the specificity of fixed capital is stronger. Once production is cut, it's difficult to be used for other purposes and the mechanisms will release more labor immediately. Therefore, the conduction velocity from output to employment is fast. In contrast, the dependence of services on fixed capital is low and labor is the main input. Since the adjustment of labor is flexible, more space for adjustment will be released when output falls. It is easy to understand the differences in employment adjustment speed in the service industries. Producer services aim to provide intermediary services for the industrial sector and specialization of human capital is high. Once the demand is reduced, the conversion costs of human capital are relatively high. So the conduction speed of output fluctuation on employment will be faster. The labor force of most consumer services is mainly manual workers and the cost of training these workers is low. Therefore, it is not necessary to adjust the size of the employee pool immediately once the output fluctuates. Institutional factors may be relevant to the lowest employment adjustment velocity in public services. Public services have the nature of public property, especially in the state-owned public services of China. The allocation mechanism of labor resources has a strong administrative feature and the conduction process of output fluctuation on employment may be artificially slowed down. Although efficiency may be the cost, it can play the role of stable employment to some extent.

6. Concluding comments

China is a populous country with great employment pressure, which forces the national economy to maintain a rapid growth rate. However, the past two years has brought about a new situation; although economic growth has slowed, employment is maintaining healthy levels. The service sector plays an important role. In the future, whether the development of the service sector can promote the long-term growth of employment will be an important point to investigate.

This paper proves the feasibility through empirical analysis. First, based on the Baumol-Fuchs hypothesis, we test the development trends of the service sector and employment growth trends. Then, we compare the absorptive employment capacity of the service sector with the method of employment elasticity. The main conclusions are as follows.

First, based on the Baumol-Fuchs hypothesis, we test that the demand income elasticity of the Chinese service sector is greater than 1, which means the growth rate of services demands exceeds income growth, which further means that service sector has a broad development space. The Chinese service sector has been seriously lagging—this is incompatible with the national economy's development level. With the transformation of China into an accelerated phase, the development and upgrading of services has an inherent inevitability. On one hand, along with industrialization advancing to a higher degree of processing stages, the demand for production services is increasing. On the other hand, with the increasing national income level, the demand for consumer services and public services will continue to increase.

Second, the analysis of employment elasticity suggests that the development of the service sector will promote employment, which is reflected in two aspects: first, with respect to the industrial sector, the employment elasticity of the service sector is at a high level. If the lagging impact is taken into consideration, the employment elasticity of consumer services is twice that of the industrial sector. Producer services can reach 1.5 times such a level and the public services will fall somewhere between these two sectors. The focus of economic development shifting to services can effectively stimulate employment. Moreover, with respect to the industrial sector, the conduction velocity of the service sector's output volatility on employment is much slower, and the viscosity is larger, which can effectively alleviate the effects of economic fluctuation and can help to maintain employment stability. We can say that the service sector not only serves as a sponge but also as a shock absorber.

Third, the service industry of the future still needs the parallel development of both emerging and traditional services, and should not be premature in neglecting traditional services. At present, China's new employment pressure stems from four main groups: migrant workers, college graduates, urban employment, and veterans. Among them, the first two groups occupy the absolute number and is a top priority. Due to quality and skills limitations, the employment of migrant workers should be solved through the consumer services sectors that are represented by traditional industry while the employment of college graduates relies on producer services that are represented by the emerging industry. However, the test we conducted, based on the Baumol-Fuchs hypothesis, proves that the employment growth of the traditional service sector is due to lagging productivity. In these industries, within the timescale where migrant and low-end laborer's skills are promoted to modern standards, there still needs to be maintenance of current productivity features, rather than just transforming or upgrading efficiency. However, on the other hand, we also find that the employment growth of producer services is not necessarily linked with productivity features. Therefore, for these

industries, industrial upgrading can be feasible without worrying about the issue of “efficiency swallowed employment.” They can optimize the structure of employment from the perspective of incremental change.

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