

From an Economic Perspective: Service Efficiency of China's Museums

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Abstract. This paper uses SFA model to measure the museum service efficiency in China and finds that both museum employees and cultural relics have a positive impact on museum visitors. That is, museums can attract more visitors by hiring more employees or displaying more cultural relics. Besides, the museum service efficiency in China showed an upward trend from 2010 to 2015, which means that museums now can serve more visitors with less input.

Keywords: Museum service efficiency, SFA, static efficiency

1 Introduction

Cultural services can be classified as for-profit services and non-profit services. For-profit services, with the characteristics of excludability and rivalry, usually are private goods. On the contrary, non-profit services, a kind of public goods, have the characteristics of nonexcludability and nonrivalry. Public cultural services, including cultural infrastructure, products and services such as public libraries, cultural stations, and museums, are non-profit services. Due to the insufficient supply in private sector, like other public goods, public cultural services are mainly provided by the government. Since the provision of public cultural services relies on the government's financial allocations and cultural institutions such as museums play an important role in public cultural services, attention must be paid to the efficiency of museums, or it may cause resource waste and low service quality.

By 2015, the total number of museums in China was 3,852, and the number of museum employees was 89,133. At the same time, there were more than 30 million cultural relics in China's museums, and the number of visitors increased year by year. In 2010, only 406 million people visited public cultural museums in China while in 2015 the number was 781 million, nearly doubled in six years. As an important part of public cultural services, most of museums in China are free to visitors. According to China Ministry of Culture, by 2013, more than 80% of museums in China are free to visitors, which means that instead of making profit from selling tickets, museums need sustained financial support from the government. Therefore, if we ignore the efficiency of museums, it will undoubtedly cause waste of public resources.

However, unlike for-profit services which usually use profit to evaluate operational efficiency, profit is not an appropriate standard to measure the efficiency of non-profit services since non-profit services aim at creating social benefits instead of making a profit. Therefore, scholars have used different methods to evaluate non-profit services' operational efficiency. Most of the previous research focused on the evaluation of internal management performance, mainly considering the museum's research achievements. On the other hand, some scholars have studied from the perspective of input and output, considering how museums can achieve maximum output with minimal input. And now scholars are gradually paying attention to the social benefits of museums, that is, the service level of museums, has gradually received attention.

This paper also pays attention to the social benefits of museums, using panel data of 31 provincial administrative units from 2010 to 2015 in China and the SFA model to measure the service efficiency of museums in China.

2 Data and Model

2.1 Data

Museum service efficiency can be evaluated from subjective aspects such as social recognition and satisfaction, as well as objective aspects such as the number of museum visitors. Since the selection of research variables needs to consider about the collectability and quality of data, and subjective data is difficult to collect and also hard to assess its quality, this research chooses to use objective indicators to calculate the service efficiency of museums. Objective indicators related to museums include: number of employees, financial allocation, number of patents, number of exhibitions, number of visitors and so on.

Besides, there are two types of efficiency, namely, production efficiency and allocation efficiency. Production efficiency is evaluated from the perspective of input and output, and allocation efficiency is evaluated from the perspective of preference satisfaction. This paper uses SFA model to estimate the production efficiency of museums, so it is necessary to find appropriate indicators to measure the input and output of museums. Considering the social benefits of museums, this research uses the total number of visitors as museums' output. As for input, both labor input and capital input should be considered. The museum employees can be used as labor input, and the financial allocation can be used as capital input. However, the financial allocation data is incomplete, so this paper uses the number of cultural relics to measure the capital input of museums. Thus, the number of museum employees and the number of cultural relics are used as input variables of museums in this research.

The data used in this paper, including the number of visitors, the number of employees and the number of cultural relics are collected from the National Bureau of Statistics of the People's Republic of China. It's a panel data of 31 provinces from 2010 to 2015, including the eastern region, the central region and the western region in China. According to the National Bureau of Statistics of the People's Republic of China, the eastern region includes 11 provinces: Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan, and the central region includes 8 provinces: Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, and Hunan, while the western region includes 12 provinces: Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, and Xinjiang.

2.2 Model

To measure efficiency, we can use non-parametric methods, such as data envelopment analysis (DEA), or parameter methods, such as stochastic frontier analysis (SFA). Data envelopment analysis does not require setting specific functional forms, so it can avoid error caused by functional forms, and it also allows for multiple outputs, which can be used to calculate the efficiency of multiple outputs and inputs. Stochastic frontier analysis, on the other hand, requires setting a specific functional form and is only suitable for a single output problem. But stochastic frontier analysis can distinguish between random error terms and inefficiency terms. Both DEA and SFA are popular methods used in the field of efficiency calculation, and both of them have advantages and disadvantages. Considering the characteristic of single output of museums in this research, this paper will use SFA model to calculate the service efficiency. Following is the model:

$$\ln Y_{it} = \beta_0 + \beta_1 \ln L_{it} + \beta_2 \ln K_{it} + v_{it} - u_{it} \quad (1)$$

$$TE_{it} = \exp(-u_{it}) \quad (2)$$

$$\lambda = \frac{\sigma_u}{\sigma_v} \quad (3)$$

Formula (1) is the basic input-output equation, where the outcome variable Y_{it} measured by the number of visitors, represents the output of museum i in the year of t . L_{it} is the labor input of museum i in the year of t that is measured by the number of museum employees. And K_{it} measured by the number of cultural relics, is the capital input of museum i in the year of t . The SFA model also contains a random error term v_{it} and an inefficiency term u_{it} . The random error term v_{it} is used to measure the difference between different museums and obeys $N(0, \sigma_v^2)$ distribution. And the inefficiency term u_{it} is used to measure inefficiency and obeys $N+(0, \sigma_u^2)$ distribution. There is no correlation between the random error term and the inefficiency term, that is, they are independent.

Equation (2) gives the calculation method of efficiency. TE_{it} represents the efficiency of museum i in the year of t . The value of TE_{it} is determined by u_{it} . The closer the TE_{it} is to 1, the higher the efficiency is. When $u_{it}=0$, $TE_{it}=1$, there is no inefficiency. But $TE_{it}=1$ does not mean that there is no loss of efficiency. Because SFA method yields a relative efficiency value compared to other individuals rather than an absolute efficiency value. Besides, this model produces static efficiency instead of dynamic efficiency.

Equation (3) is used to find out whether there exists an inefficiency term. When there is no inefficiency term, SFA model is not an appropriate method to calculate efficiency. That is, if $\sigma_u=0$ and $\lambda=0$, there is no inefficiency term, we should not use SFA method to estimate efficiency.

3 Basic Results

Table 1 presents the basic results. It shows that both β_1 and β_2 are positive and significant, which indicates that museum employees and cultural relics both have a positive effect on visitors. Judging from the results, we can see that an increase of 1% in the number of employees will increase about 1.062% in the number of museum visitors while an increase of 1% in cultural relics will only lead to 0.091% increase. However, this doesn't mean that museum employees rather than cultural relics play a more important role in attracting visitors. In fact, according to the National Bureau of Statistics of the People's Republic of China, averagely every museum served 160,000 visitors with 23.59 employees and 7208.41 cultural relics in 2010, and the number became 200,000 visitors with 23.14 employees and 7902.76 cultural relics in 2015. Obviously, it is cultural relics that contribute to attract more visitors. This can also rule out the probability that the increase of employees is just a passive response to the increase of visitors, that is, there may be a reverse causality problem in this research. Although the number of visitors per museum increased year by year, the number of employees per museum remained almost the same. Besides, σ_u and σ_v are significant, which means that the random error term and the inefficiency term are both existed. At the same time, as λ is significant, we can reject the null hypothesis, indicating the appropriateness of using SFA method to estimate efficiency.

Table 1. Basic results

Parameter	Estimator
β_1	1.062*** (19.73)
β_2	0.091** (1.97)
β_0	-1.858*** (-4.57)
σ_u	0.104*** (3.15)
σ_v	0.154*** (7.65)
λ	0.675*** (13.42)
N	186

*** p < 0.01, ** p < 0.05, * p < 0.1

Now, we turn to the efficiency result in table 2. It shows that the museum service efficiency in China's 31 provinces is between 0.5620 and 0.9698 from 2010 to 2015, with a mean of 0.9013.

Table 2. Efficiency value

Variable	Obs	Mean	SD	Min	Max
TE_{it}	186	0.9013	0.0540	0.5620	0.9698

Table 3 presents detail museum service efficiency value in China's 31 provinces from 2010 to 2015. Among the three regions, the eastern region is relatively developed in economy, followed by the central region, and the western region is relatively underdeveloped. As we can see from the result, compared to the eastern region and the central region, museum service efficiency in underdeveloped western region is relatively low. However, not all provinces in the western region have low museum service efficiency. We can find that museum service efficiency in Jiangsu, Sichuan, Hebei, Fujian, and Guangxi is relatively high, and among these top five provinces, there are three in the eastern region, two in the western region but none in the central region. Besides, the museum service efficiency difference in eastern region and western region is high while it is relatively small in the central region.

Table 3. Efficiency value by region

Province/Year	2010	2011	2012	2013	2014	2015	Mean	Rank
The Eastern Region								
Beijing	0.9117	0.9111	0.9217	0.9237	0.8953	0.9229	0.9144	10
Tianjin	0.7341	0.7523	0.8428	0.9028	0.9581	0.9600	0.8583	29
Hebei	0.9076	0.9237	0.9291	0.9281	0.9113	0.9089	0.9181	3
Liaoning	0.9034	0.8520	0.9079	0.9259	0.9175	0.9280	0.9058	18
Shanghai	0.9467	0.9250	0.8821	0.8816	0.9097	0.9095	0.9091	16
Jiangsu	0.9145	0.9216	0.9153	0.9068	0.9247	0.9350	0.9197	1
Zhejiang	0.8509	0.8937	0.9119	0.9368	0.9392	0.9350	0.9112	15
Fujian	0.9340	0.9079	0.9011	0.9218	0.9221	0.9170	0.9173	4
Shandong	0.8392	0.8376	0.9364	0.9391	0.9345	0.9142	0.9002	24
Guangdong	0.8553	0.9009	0.9055	0.9219	0.9414	0.9431	0.9113	14
Hainan	0.8093	0.9150	0.9448	0.9585	0.8053	0.7082	0.8569	30
Mean	0.8733	0.8855	0.9090	0.9225	0.9144	0.9074	—	—
The Central Region								
Shanxi	0.9089	0.9094	0.9341	0.9198	0.9066	0.9103	0.9149	9
Jilin	0.8307	0.9292	0.9483	0.8410	0.9240	0.9334	0.9011	23
Heilongjiang	0.8722	0.9252	0.9182	0.9178	0.9324	0.9160	0.9136	12
Anhui	0.8676	0.9609	0.9172	0.8635	0.8952	0.9096	0.9023	22
Jiangxi	0.9151	0.8873	0.8963	0.9294	0.9226	0.9437	0.9157	7
Henan	0.8319	0.8890	0.9138	0.9254	0.9286	0.9380	0.9045	19
Hubei	0.9421	0.9038	0.9069	0.8959	0.9153	0.9160	0.9133	13
Hunan	0.8494	0.9013	0.9219	0.8771	0.9200	0.9506	0.9034	20
Mean	0.8772	0.9133	0.9196	0.8963	0.9181	0.9272	—	—
The Western Region								
Inner Mongolia	0.8422	0.8022	0.9380	0.9221	0.9297	0.9426	0.8961	25
Guangxi	0.8967	0.9346	0.9060	0.9033	0.9366	0.9246	0.9170	5
Chongqing	0.9295	0.9427	0.9128	0.9064	0.8909	0.9185	0.9168	6
Sichuan	0.9226	0.9137	0.9239	0.9104	0.9152	0.9263	0.9187	2
Guizhou	0.9274	0.9037	0.8637	0.9188	0.9325	0.9446	0.9151	8
Yunnan	0.9231	0.8928	0.8651	0.9012	0.9315	0.9354	0.9082	17
Tibet	0.7692	0.9050	0.9296	0.9498	0.9468	0.6504	0.8585	28
Shaanxi	0.8175	0.9382	0.9147	0.9058	0.9310	0.9075	0.9024	21
Gansu	0.7029	0.8643	0.8591	0.9387	0.9441	0.9465	0.8759	27
Qinghai	0.8816	0.8665	0.8849	0.5620	0.9698	0.9172	0.8470	31
Ningxia	0.8363	0.7528	0.8879	0.9124	0.9249	0.9648	0.8798	26
Xinjiang	0.9195	0.9326	0.9395	0.8873	0.8799	0.9252	0.9140	11
Mean	0.8640	0.8874	0.9021	0.8848	0.9277	0.9086	—	—
Mean of All Provinces	0.8707	0.8934	0.9090	0.9011	0.9205	0.9130	—	—

In addition, the trend of museum service efficiency from 2010 to 2015 is shown in Figure 1. In the central region, museum service efficiency is higher than that in the eastern and the western region from 2010 to

2012. However, after 2012, museum service efficiency in the central region had declined. In 2013, museum service efficiency in the eastern region was higher than that in the central region and the western region, and then declined, too. Besides, although museum service efficiency in China declined in 2013 and 2015, in general, it still showed an upward trend from 2010 to 2015. This means that the increase of visitors was larger than that of the museum employees and the cultural relics, so service efficiency of museums increased.

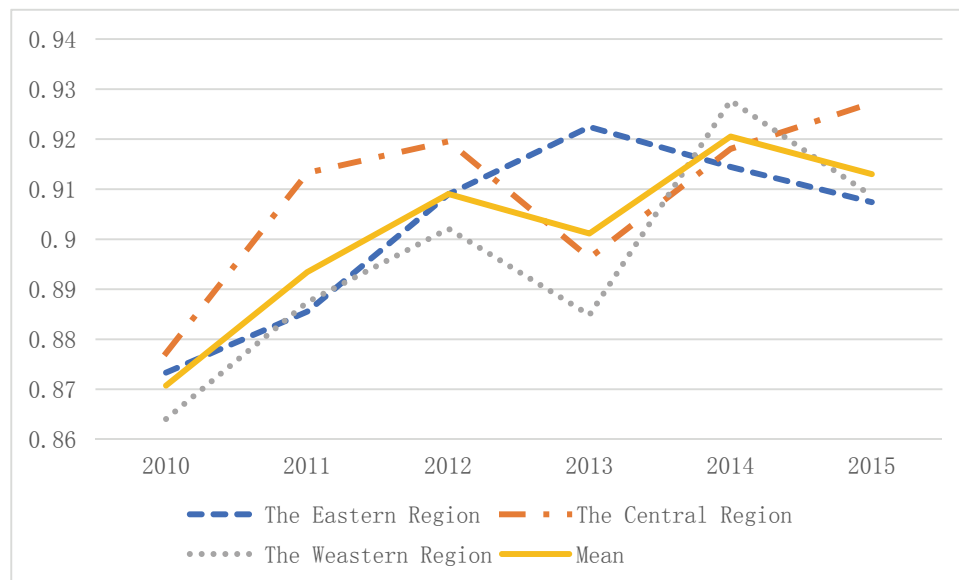


Figure 1. Museum service efficiency from 2010-2015

4 Conclusion

This paper calculates the efficiency of China's public cultural services by measuring the service efficiency of China's museums. Based on the consideration of social benefits of public cultural services, and ignoring the influence of subjective factors that are difficult to measure, the result in this paper shows that both museum employees and cultural relics have a significantly positive impact on the number of visitors to the museum. This indicates that museums can attract more visitors by hiring more employees or displaying more cultural relics. Besides, the museum service efficiency in China has gradually increased. Compared with 2010, the service efficiency in 2015 is higher, which means that museums now can serve more visitors with less input.

However, this paper only estimates the museum service efficiency but does not analyse the reasons for this efficiency difference. At the same time, this paper only takes the objective factors into consideration while ignoring the subjective ones. To have a more comprehensive understanding of the current situation of public cultural services in China, further research is still needed.

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