

An Application of Cost-Benefit Analysis to the Economic Value Evaluation of China's University Libraries: Model Construction and Empirical Research

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Abstract

For the increasing pressure on the library budgets, libraries need to prove their existing value through evaluating the monetary value. Cost-benefit analysis and economic impact analysis are the major methods for estimating the economic value, libraries usually adopt cost-benefit analysis due to the limitations of economic impact analysis. Firstly, this study expounded the theoretical basis of economic value evaluation of university libraries and presents a model of evaluating the economic value of university library. Secondly, a case research was carried out to test the feasibility of the constructed model by using the consumer surplus method, contingent valuation method. Meanwhile, we draw the conclusion that the economic value of the university library is 77817670.15 CNY, the ratio of cost-benefit is 1: 3.2758. Finally, some suggestions were given for the future development of university library economic value.

Keywords

Economic Value; University Library; Consumer Surplus; Contingent Valuation; Empirical Research

1. Introduction

The study on the economic value of the library began in the 1970 s, so far only a short span of thirty years. However, with the development of society and knowledge economy, the economic value of the library has become an important index to evaluate the level of library management and service. From the perspective of economics, this paper briefly discusses the economic value of university library based on cost-benefit analysis.

2. The Theoretical and Practical Significance of Library Economic Value Evaluation

In 1973, the American scholar R.H.Orr proposed to evaluate library services from the perspective of the effectiveness of investment and expand the research on the evaluation of library service from the quality level to the value level [1]. In 1988, F.W. Lancaster summed up the three methods of library service evaluation, including cost and benefit evaluation, which further expanded the library evaluation theory [2]. From then on, from the public library to the university library, from the theory to the practical application, the foreign related evaluation research has been deepened and developed. In China, a large amount of literature on the study of the economic value of the university library, is more focused on the value of a narrow range of services, such as the electronic resources, and is lack of a comprehensive reflection on the economic value of university libraries. There is a lot of theoretical research on the quality evaluation system of the library, but there is only a little empirical research on the economic value based on cost-benefit analysis.

This paper evaluates the economic value of university library by the method of cost- benefit analysis. It is necessary to use econometric method and the sociological investigation method. Fully absorbing foreign experience and combining with the local university library to carry out research are conducive

to deepening the research content in Chinese university library evaluation, providing a reference for the future research, and promoting self-renewal of the discipline.

University library is the main part of campus culture, which provides the information resources for scientific research and teaching. However, for a long time, the library has a low status and suffers neglect because of the thinking set. The evaluation of the economic value of the university library can fully show the economic value index of the university library in aspects of input and output. And after quantification and comparison, this paper reasonably identifies and scientifically reveals the economic value of university library to show the contribution and value for scientific research productivity and show that university library service has an important role in the social and economic benefits. It is helpful to promote the sustainable influence of the university library on the social culture and economic development, and it is also helpful to further explore the effective way to improve the economic influence of the university library.

3. The Theoretical Basis And Feasibility Analysis of Library Economic Value Evaluation

3.1 Theoretical Basis of Evaluation Methods

Like public libraries, the total economic value of the university library contains two dimensions: the use value and the nonuse value. The use value is divided into direct use value and indirect use value. The direct use value can be determined by the direct contribution of library service which is easy to measure. The indirect use value and nonuse value are not easy to measure, but in most cases, they take a large proportion, so we need to pay attention to it. According to foreign research, the indirect use of the library value and nonuse value are evaluated mainly from the perspective of cost-benefit analysis, using the value analysis methods in economics, such as "consumer surplus" and "contingent valuation" to investigate.

Consumer surplus is based on the principle of economics: the difference between the market price of a given product or service and the actual price paid by the consumer in order to obtain a product or service [3]. In economics, the contingent valuation method is based on the assumption that consumers have a personal preference. According to the preference of consumers, they make own price of goods and services based on their willingness, including the maximum number of money which people are willing to pay for the use and protection of the given environmental goods or services(WTP), or the minimum number of monetary compensation which people are willing to pay for the loss of a given environmental goods or services(WTA), in order to get the economic value of goods and services. The deep principle is that consumers have different preferences for goods and services, and their combination can also bring different utility functions to consumers. The utility of consumers are affected by many different factors, including goods that can be used in market transactions(x), goods that can not be used in market transactions(q), personal preference(s), random errors (ξ , including personal preference error and measurement error). Namely, $U = (x, q, s, \xi)$. The problem faced by consumers is to maximize the utility of consumers ($\max U(x, q)$) at a given price level and budget level ($s.t. \sum p_i \cdot x_i \leq 1$). Based on the observation of consumers' equivalent point under different conditions, a consumer satisfaction curve (CVM) can be obtained. After further investigation, personal willingness to pay and compensation willingness of the respondents can also be obtained. [4]According to the antecedent research of the foreign counterparts, this paper investigates by using the "willingness to pay" method which tends to be conservative and not exaggerated.

The time cost method is a method which investigates time users spent for their use of library. It takes the user's income level as the reference system to calculate the value of these time costs, and then uses the reverse thinking to derive that the value of library services is at least not less than the time costs which users pay for. Because of the difficulty of this method in the actual operation, this method is not recommended in foreign research, but it can be used as a complementary method of the former two methods. [5]

3.2 The Feasibility Analysis of the Application of Evaluation Method in the University Library Economic Value Evaluation

Whether the "Academic Library Effectiveness Evaluation Report" which was published in 1998 by American University and Association of Research Libraries, or the British "impact implementation initiative" is apt to think that effectiveness evaluation of university library is mainly to obtain the input and output data, such as the number of circulation literature, the amount of reference problems solved by librarians and so on. The latter one more emphasis on information literacy and the use of electronic resources [6]. Some scholars have suggested that the influence of personal quality, ability and spirit should be considered in the effectiveness evaluation of university libraries. However, from the results of the pre-survey, the majority of respondents believe that improvements of their own knowledge, information literacy, ability improvement and other changes are mainly due to individual efforts, rather than the credit of the library. Through the use of library, people are influenced by culture and knowledge, it improves personal quality and enhances the ability of solving problems and the professional competitiveness. The impact assessment in theory seems to be plausible, but in reality it is difficult to quantify the implementation of evaluation and draw a more scientific conclusion. Therefore, the author thinks that the evaluation of the economic value of the university library should be based on the cost benefit evaluation practice of foreign libraries and the reality of China.

The university library provides services to the teaching and scientific research of the university, and also provides services to the other social public. These services which reflect the value of the library has the nature of public goods, and do not have a complete exclusion and competition. The theoretical basis of "consumer surplus" and "contingent valuation" originates from the theory of public goods which means the noncompetitive and nonexclusive resources. Therefore, the above methods can be used to analyze the value of service with nature of public goods in the university library. There are some existing economic valuation cases of foreign libraries. For example, the Saint Louis Public Library uses the consumer surplus method, contingent valuation method, and time cost method to evaluate the cost benefit ratio of the library which is 1: 4 [7]. In 2004 the British Library used the same method to conclude that output is 4.4 times of input [8]. In 2007, the library of University of Illinois, Urbana-Champaign in the United States studied on the return of investment and gained 1:4.38 investment return of scientific research projects [9]. Therefore, it is feasible to apply the method of "consumer surplus" and "contingent valuation" to the economic value evaluation of university libraries.

4. Economic Value Evaluation of University Library based on Cost Benefit Analysis

The economic value evaluation system of University Library based on cost-benefit analysis includes the following parts. As shown in figure 1:

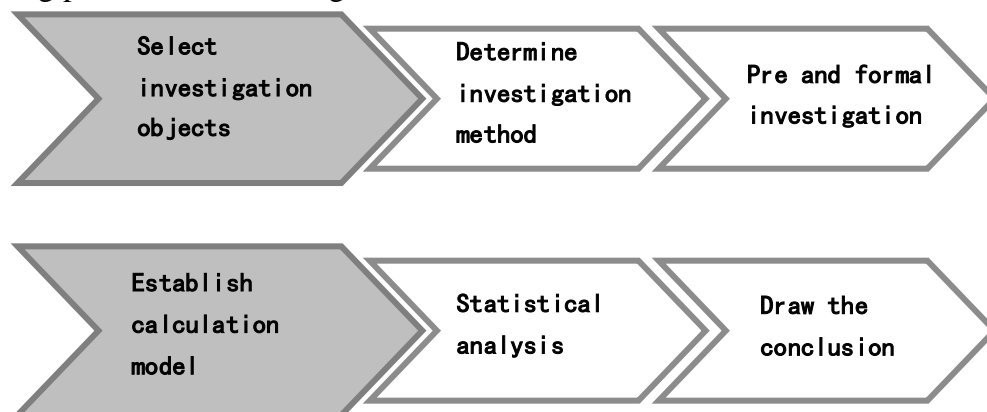


Fig.1. Economic value evaluation process of university library Based on cost benefit analysis

4.1 Determine the Investigation Objects

In order to analyze cost benefit of the economic value of the university library, first of all, it is necessary to clearly define the main service items and user groups of the library, and build the two-dimensional matrix of service and users.

All kinds of resources of university library include printing, electronic resources and human resources which are the most important resources of the library and represent the core value of the university library service. At the same time, these service resources are carried out around the users. Therefore, when building university library service-user matrix, the classification of library resource service is mainly from the user's point of view to ensure that evaluation is scientific. After considering the service related to library resources, combining with the mature evaluation framework of foreign public libraries and the local reality of Chinese university libraries, the service-user matrix of university libraries is formed. As shown in table 1:

Table 1.The service-user matrix of university libraries

Resource service projects		Visitors to the library
Circulation service	Paper resource service	Students, teachers and other researchers
	CD lending	Students, teachers and other researchers
	Interlibrary loan	Students, teachers and other researchers
Digital resource Service	Electronic resource service	Students, teachers and other researchers
	Electronic reading room service	Students
Thematic literature service	Reference service	Students, teachers and other researchers
	Novelty retrieval and SDI Service	Teachers and other researchers
	Other research services	Teachers and other researchers
Information literacy education service	Information Retrieval Course	Students
	Lecture training	Students, teachers and other researchers
Other services	Film projection	Students
	Self-study service in reading room	Students

Because of the particularity of university library resource service object, the economic benefit is connected with the use of information resources of teachers or students and the income, especially the return income generated by teaching, scientific research projects and other factors. Therefore, the user group of the university library is further subdivided into the students' users, the teachers users and other researchers users. This method is helpful for concerned people to control the process of sampling survey and improve the credibility of the research. The classification of library resource service is based on the user's cognition and utilization of library service, which makes the questionnaire investigation to have operability.

4.2 Design and Investigation of Questionnaire

Based on the cost-benefit analysis, the questionnaire on the economic value of university library is composed of 4 parts and 24 questions. [10] In addition to the basic information, the payment card questionnaire is used to investigate the respondents' willingness to pay for the non use value of resources. It means how much money the users are willing to pay to obtain the resource service. In the questionnaire of payment card, the 4 -5 initial bid values were determined between 0-50 CNY, and other bid values which could be filled out freely were also determined (Table 2) In addition, this paper investigates and analyzes the research projects and funding which are applied by scientific research personnel, the quantify scientific research productivity as a digital form. In order to ensure

the validity of the questionnaire, after the completion of the questionnaire design, a small range of pre-test was carried out and the questionnaire was partially modified according to the results. 600 questionnaires were released in this survey, the total recovery of the questionnaire reached 587 copies, the recovery rate was 97.8%. In the returned questionnaires, effective rate was 98.1%. The proportion of protest questionnaires in the effective questionnaires was 1.3%, which was less than 10%. It shows that result of questionnaire survey is effective. Through SPSS statistical analysis, the average value of each service is obtained and shown in Table 2.

Table 2. Questionnaire of payment card

Core issues	Remarks
In order to guarantee the existence of library and its service, how much would you like to pay from your monthly income?	Payment background issues
Please select the appropriate amount: 0 CNY; 5CNY; 10CNY; 50CNY; others_____	Bid value selection
If you choose 0 CNY please state your reason:_____	Reason of payment willingness
If the library of university lack for funds, how much would you pay for the service(including reading room, consulting service, film projection) provided by library?	Payment background issues
Please select the appropriate amount: 0 CNY;1 CNY; 2 CNY; 5 CNY; 10CNY; 50CNY; others_____	Bid value selection
If you choose 0 CNY please state your reason:_____	Reason of payment willingness

4.3 Establishment of Computation Model

Based on the benefit computation model used in the evaluation process of foreign libraries, combined with the practical conditions in China, the main computation model of the economic value of university libraries is determined based on cost benefit analysis[11]:

Model 1 : The benefit of a resource service = the number of users using the resource × the price of the market alternatives

Model 2: The benefit of a resource service = the number of users using the resource × the price willing to pay

Model 3:The scientific research output benefit of a resource service = the total amount of funding for research projects ×the percentage of users who use the library resources to successfully apply for research projects

4.4 Results of the Implementation of the Assessment

According to the investigation and interview of the library managers, users and other relevant personnel, as well as the evaluation model of the economic value of the university library, we can get the benefit statistics of each resource service project. (see Table 3)

Table 3. Library resources service projects and related benefit statistical results

resources service projects	Total data for a fiscal year	Value(CNY)	economic benefits(CNY)	illustration
Paper resource borrowing	614299 (times)	CS:33.8	20763306.2	Be calculated by 50% of foreign conservative literature price
CD lending	9818(people)	CS:44	431992	Be calculated by the average price of import CD and domestic CD, about 44 CNY
Interlibrary loan	55 (times)	CS:36	1980	Be calculated by average number of market charges
Electronic resource download	4865052(times)	CS:8	38920416	Download cost of Web Services is 2 CNY per page (Each information is 4 pages)
Electronic reading room	59315(people)	CS:3	355890	Be calculated by 2 hours per person, take consumption price of Internet bar as substitute price
Reading room service	60470(people)	WTP:4.17	252159.9	Calculate human traffic by seats
film projection	4750(people)	WTP:8.63	40992.5	Calculate human traffic by seats
Information literacy education courses and lectures	57120+52370 (people)	WTP:12.32	1348916.8	Calculate human traffic by actual number of participants
Reference service	3727(people)	WTP:3.51	13081.77	Calculate human traffic by network, telephone and face to face consultation
Science and technology novelty retrieval and SDI Service	1104(projects)	CS:180	198720	Be calculated by average number of market charges
Output of research projects	408(projects)		15490215	Be calculated by using the formula in model 3

Source from Annual statistics of Heilongjiang University (December 2016)

By using the method of consumer surplus and contingent valuation method to calculate the profit of a university library, we can get the economic value of 62327455.17 CNY. In addition, the output benefit of the special research project of the university library is 15490215 CNY, and the total economic benefit of a university library in a fiscal year will be 77817670.17 CNY. According to the data provided by the library and the relevant departments, the total cost of the library to provide

services for these resources is 23750826.63 CNY per year. Therefore, cost-benefit ratio of the university library is 1:3.27590. This means that the government and university put 1 CNY into the library and then it may produce the economic value of 3.2759 CNY. The result shows that less input will bring higher output.

5. Research Conclusions and Recommendations

This paper is based on the principle of foreign assessment that does not underestimate the cost, does not overestimate the benefits, does not exaggerate the number of users and ensure that there is no prejudice against the results of the survey. Economic value evaluation model of university library is constructed by using consumer surplus and contingent valuation method based on a case model of university library. After caution evaluation, the economic value of the university library is 77817670.15 CNY, the ratio of cost-benefit is 1: 3.2758. The result of the evaluation is consistent with the empirical value, which shows that the model is reliable and practical, and can reflect the value and influence of the resource service of the university library for the social and economic development.

The quantitative research on the value and influence of university library was realized by bringing consumer surplus and contingent valuation method into this paper. However, compared with the foreign university libraries, there is still a certain gap in the economic value of the university libraries in China. Therefore, it is necessary to further develop its economic benefits, dig the value of scientific research projects.

5.1 Broaden the Access to the Resources of University Library

The various resources of university library includes paper resources and electronic resources which are the premise and basis for the survival of the library. With the advent of big data era and the rapid development of cloud technology, network information resources are increasing rapidly. It is difficult to meet the growing needs of different readers relying solely on the financial and material resources of just single library. Therefore, it is necessary to strengthen the network cooperation between university libraries, not only to share the resources of each other, but also to coordinate the procurement [12]. This can avoid the repeated purchase of large databases and avoid the repeated development of electronic or digital documents, which enables member libraries to share electronic literature resources. Through the online catalog, the co-construction and sharing of printing literature and other media literature can be realized, it ensures that users can use the relevant academic information as much as possible and improves the ability of library collection and management of relevant resources.

5.2 Deepen the Service Level of University Library

On the basis of broadening the access to library resources, university library should make full use of the existing information resources, human resources and technical resources to create an open, flexible and attractive service space. They also should expand the connotation and extension of talent training and information resources, excavate scientific research achievements. They also analyzes the end users of new products of application project achievements and market demand space of new products of application project achievements. By using vertical portal and other personalized services, they were send to users of scientific research achievements to meet needs of users and stimulate the popularization and application of scientific and technological achievements in colleges and universities. Furthermore, through sci-tech novelty retrieval service and other high added value services, university library can strengthen the identification ability of scientific and technological achievements, speed up the pace of development of science and technology, promote the transformation of scientific and technological achievements into practical productive forces, and further enhance the value and contribution of university libraries for the integration of economy and technology.

References

- [1] Jingli Chu. Review of western library evaluation theory[J]. Journal of Library Science in China, 1999,25(3): 53–59.
- [2] F.W. Lancaster. If You Want to Evaluate Your Library[M]. London:Library Association Publishing Ltd, 1988.
- [3] Neal K Kaske. Book Review:Measuring Your Library Value:How to Do a Cost-Benefit Analysis for Your Public Library[J]. Portal:libraries & the Academy, 2007, 7(4): 499–500.
- [4] Bin Ye. A study on the economic evaluation of public library: based on cost benefit analysis[D]. Hangzhou: Zhejiang University, 2010.
- [5] Glen E.Holt, Donald S.Elliott. Cost benefit analysis a summary of the methodology[J]. The Bottom Line, 2002, 15(4):154–158.
- [6] British Library. Measuring our value. <http://www.bl.uk/pdf/measuring.pdf>. 2007-01-22.
- [7] Holt G E, Elliott D, Moore A. Placing a value on public library services[J]. Public Libraries, 1999, 38(2):73–76.
- [8] Paula T. Kaufman. Library as Strategic Investment: Results of the Illinois Return on Investment Study[J]. Liber Quarterly, 2008, 18(3):424–431.
- [9] Youcen Wei, Hui Zhou. Empirical Study on social value evaluation of Public Libraries[J]. Library Development, 2010(7):21–25.
- [10] Xuan Liu. Research on Economic Value for public Library Based on cost-benefit Analysis[J]. Library Journal, 2010, 29(2):10–15.
- [11] Xiangxun Tan. Government public investment decision and cost benefit analysis[J]. Social Sciences in Yunnan, 2004(5):58–60.