SITUATIONS OF KEY THEATERS AND MUSIC HALLS IN JAPAN AND THEIR EVALUATION USING PRODUCTION FUNCTIONS

Akitoshi Edagawa

Tokyo University of the Arts, Japan

cloverclevercat@yahoo.co.jp

Abstract

For this study, a theater is taken as an economic agent. And Japan's top 20 theaters and music halls (each with the average number of visitors exceeding the national average by at least 25 times) were monitored for four years. Based on the data collected through the tracking, a production function was estimated for the theaters and music halls monitored. Employed in the estimation was the Cobb–Douglas-type production function, usually used as a production function model for the service industry. The number of theater and music hall seats are taken as capital while the number of people employed by the theaters and music halls are regarded as labor. Both are production factors and categorized as capital assets. The number of employees was adjusted based on their salaries, which are different according to where they work and how capable they are. The extent of the contribution to the revenue of the theaters and music halls was 0.671 for the number of seats and 0.773 for the number of employees, showing increasing returns to scale. The total factor productivity, estimated based on the differences between actual revenue of the theaters and music halls and their estimated revenue, was found to have a strong correlation with the kind of hall each theater has and with the number of years the theater has operated. All these factors were taken into consideration for the estimation of the production function at the theaters and music halls. The extent of the contribution to their revenue was found to be 0.500 for the number of seats, 0.725 for the number of employees, 0.297 for the type of hall, and 0.286 for the number of years the theater has operated. With this, about 90% of the revenue generated at the theaters and music halls is explainable. The two production functions mentioned here were estimated using a random-type inherent-effect model, which takes into consideration inherent characteristics of theaters and music halls. The two production

functions were appropriately estimated based on the random-type inherent-effect model because theaters and music halls are most likely to have inherent characteristics regarding management methods, human resources, and types of halls.

INTRODUCTION

Since the turn of the 21st century, efforts to establish a legal framework to promote Japanese art and culture in a comprehensive manner have gathered impetus, including the enforcement of the Basic Law for Culture and Art and the Law on Vitalization of Theaters, Music Halls, and Other Facilities. Behind the trend are several factors. First, the Japanese government's postwar art-and-culture-promotion policy other than protection of cultural assets focused on the exercising of discretion by the government side and provision of a subsidy instead of an administrative policy on the legal front, a situation that led to strong calls for making the government's policy on art and culture transparent. Second, demand made by art organizations for art promotion has become a political issue, resulting in the alliance of nonpartisan lawmakers for culture and art promotion being formed in 1997. Strong lobbying by such lawmakers led to their actions at the Japanese parliament. Third, Japanese culture has drawn keen interest in the United States and Europe. Japan's "soft power" has come to be known as "Cool Japan" in the world, making it necessary for people in the country to get united in promoting its art and culture from the viewpoints of sightseeing, cultural policy, and cultural industry. Promoting Japan's cultural resources as the third tourism resource for the country has been a major policy challenge for the current government. Using such resources is thought to be effective in enhancing Japan's status in the world and attracting tourists to Japan, along with the 2020 Tokyo Olympics.

Immediately after Tokyo's hosting of the 2020 Olympics was decided, the Basic Law for Culture and Art was revised to cover the formulation of government industrial promotion measures in fields related to art and culture, such as tourism, community-building, international exchange, welfare service, education, and industry. In addition, formulation of food policies under the jurisdiction of the Ministry of Agriculture, Forestry and Fisheries and the Ministry of Health, Labor and Welfare came to be regarded as art and culture activities, a decision taken from the viewpoint of food culture. The decision also reflected a judgment by the central government that the major purpose of foreigners visiting Japan is experiencing the country's food culture. To enable art and culture to provide solutions to all kinds of issues, the government

is apparently considering expanding the scope of areas covered by the Basic Law for Culture and Art. The government believes that if the law's coverage widens, a range of issues, from decreasing childbirths amid the aging of society to challenges facing the art-and-culture community amid cultural globalization, will find solutions under the law.

The Basic Law for Culture and Art focuses on showing nonbinding goals and guidelines. Therefore, specific administrative actions under the law are impossible unless there are separate laws stipulating specific policy measures and specific administrative plans on an individual basis. The specific policy measures mentioned above are the 2018 basic plan for promoting art and culture and the Law Concerning the Vitalization of Theaters and Music Halls and Other Facilities. As stipulated under the basic plan and the theaters vitalization law, theaters, and music halls served as venues for art and culture events, especially performance arts, and as bases for cultural activities by local people, and have played a pivotal role in promoting art and culture. During a period of nearly 50 years between the inception of the Agency for Cultural Affairs in 1963 and the enforcement of the Basic Law for Culture and Art, theaters and music halls have been subsidized by the government. Most of the subsidies were meant to build theaters and music halls, and make up for red ink that resulted from activities by art organizations at these facilities (Neki, Edagawa, Kakiuchi, Sasai, 1997; Shimizu, 1999).

The art-and-culture-promotion fund was established in 1990 using money donated from the central government and the business community. The fund attracted public attention as it marked Japan's first arts council, a mechanism already popular in the United States and Britain whose aim is subsidizing art activities through expert reviews. Theaters and music halls currently operating in regional areas are often called culture halls, with the number of such facilities, most of them run publicly, standing at about 2,000. Many culture halls were established in the 1970s and what we call "proscenium arches" were incorporated into the halls' performing area, which serve as the frame into which the audience observes the stage events covering various genres. Many culture halls are multi-purpose halls, which are facilities usable by local people during art events. In the 1980s, art organizations filed increasing criticism against multi-purpose halls, which spurred the establishment of music halls dedicated to specified genres starting with Bach Hall in northeastern Japan. In those days, music halls dedicated to certain fields did not belong to particular art groups. Instead, such halls were rented out to parties wishing to use them on a one-time basis. This way of using theaters or music halls was far from how they are supposed to be used.

In 1990, the year when the art-and-culture-promotion fund was established, the Art Tower Mito opened in Ibaraki Prefecture. This art facility is characterized by the employment of art directors and art professionals. The Art Tower Mito drew attention from people in the art

community, who were impressed with the facility providing opportunities for artists to undertake artistic activities using theaters and halls built exclusively for art events instead of using halls on a rental basis as done in the past. Later, one after the another, theaters and music halls staffed by art directors and art professionals to plan and create performance arts opened, including the Setagaya Public Theatre, set up in 1997, the New National Theatre, also established in 1997, the Biwako Hall Center for the Performing Arts, created in 1998, and the Shizuoka Arts Theatre. In 1997, the Sumida Triphony Hall was completed with the New Japan Philharmonic acting as a franchising orchestra. Since the turn of the 21st century, multi-purpose halls have come to acquire the ability to generate the same acoustic effect as that of halls built exclusively for music concerts, aided by the advancement of computer technologies, reducing functional differences between exclusive music halls and multi-purpose halls.

For this paper, a nationwide survey was conducted to quantitatively grasp the role and function that have been played by theaters and music halls, with the development stages of these facilities taken into consideration. Their functions as economic agents will be evaluated and analyzed through the estimation of a production function.

ACTIVITIES OF THEATERS AND MUSIC HALLS, AND A FRAMEWORK FOR THEIR SURVEY

In research for this paper, a survey was conducted on theaters and music halls in Japan, mainly to evaluate their productivity. The survey was designed to quantitatively grasp the activities of these theaters and music halls. Questionnaires for the survey were developed by this paper's author. The survey was the first of its kind, as nothing like this had previously been conducted by Japanese think tanks or Japanese government agencies including the Agency for Cultural Affairs.

Characteristics of theaters and music halls

According to a social and educational survey conducted by the Ministry of Education, Culture, Sports, Science and Technology, the number of theaters and music halls in Japan stood at 1,851 as of May 2017. Profit-seeking corporations accounted for 5.5% of the sum, which means that most of the 1,851 facilities are publicly run or public-interest entities including nonprofit organizations. Publicly run culture halls have provided local people with venues for undertaking cultural activities. Privately run culture halls exist only in big cities and they are commercial theaters and music halls whose operational purpose is seeking profit. Most famous among such commercially operating halls are the Takarazuka Theater and the Shochiku Kabukiza Theatre—operated by Japan's two biggest entertainment companies. Given most culture halls in Japan

are publicly run as mentioned above, this paper will deal with only nonprofit theaters and music halls.

Among parties engaging in cultural activities on the supply side are artists and artist groups. In performance arts, those belonging to the supply side are performers (including musicians, dancers, and actors), composers, choreographers, playwrights, and directors. Artists are backed by backstage people, whose duties include management, technologies that support art performance, and responding to requests from media companies such as publishing and broadcasting firms. The management listed above includes arts planning and production, management of artists and operation of art groups and cultural facilities.

Connecting the audience of performing arts, technically called demand-side people (cultural consumers), and artists are critics, who act as agents for linking both sides by reviewing the arts presented. If theaters and music halls are defined as a place of communication between art groups engaging in performing arts and their audience, and viewpoints of stakeholders of these facilities are taken into consideration, the roles to be played by three parties—art groups performing art activities at theaters and music halls as parties close to these facilities, local people participating in art performance events as the audience, and local people engaging in cultural activities mainly at local theaters and music halls—will become clear. In other words, the characteristics of theaters and music halls will become different according to the relationship between the stakeholders concerned. How certain theaters or music halls are utilized is mostly determined by their characteristics decided during their inception—whether the facilities are mainly used by local people or by art groups for art performance—and other factors including the size of the cities that host the facilities and the social structures in the surrounding area (Edagawa, 2013; Ei, 2000).

Theaters and music halls should serve as bases for cultural activities by local people. It is usual for the side of theaters and music halls to make efforts to raise the level of cultural activities by local people. If the interchange between both sides is strengthened, regional cultural activities will gather steam. For these activities to be vitalized, it would not be sufficient for theaters and music halls to blindly accept performance offers from promoters. What is important is for theaters and music halls to take initiative in planning and implementing performance events while taking each region's situation into account. Exercising leadership would help these facilities strengthen and refine their planning abilities and the quality of what is presented would improve, eventually stimulating cultural activities by local people. If this happens, the move will be shared by the side of cultural halls, a positive feedback mechanism believed ideal by some critics (Edagawa, 2015). However, this move is reversed, regional cultural activities will inevitably come to a stall. Event undertaking under the leadership of

theaters and music halls would enhance their functions dramatically because positive feedback can be expected through such initiative.

With theaters and music halls having existed independently of art (performance) groups in Japan, no particular attention has been paid to promoting their coexistence, a situation that derives from historical reasons. In fact, theaters and music halls have been established in Japan by the heads of municipalities with certain political motivation. In this country, establishing such facilities has been separated from operating them, resulting in many of them becoming facilities that are used on a rental basis. This is in contrast with the United States and Europe, where art groups use theaters and music halls built exclusively for their activities. Mostly, they are based there for activities. When necessary, they travel to other theaters and music halls for performance. For American and European people, "theaters and music halls" are different from the buildings (hardware) that house them. For them, art groups and buildings together constitute "theaters and music halls." American and European people attach more importance to activities of art groups than to buildings. In Japan, however, people have perceived theaters and music halls as the buildings that house them. This perception, very strong in this country, reflects the fact that theaters and music halls have historically been used on a rental basis. Under these circumstances, Japanese people have understood that any culture halls are top-rated ones as long as the buildings are gorgeous. This is a wrong idea. All that must be done by the municipalities in charge of managing the buildings was managing their hardware, making it effectively impossible for theaters and music halls to develop the functions they were initially supposed to hold (Edagawa, 2015; Shimizu, 1999).

Survey method

Theaters and music halls subject to the survey

Theaters and music halls subject to the survey will be chosen based on the standards listed below. The legal and administrative role to be played by theaters and music halls is raising the cultural level of local people and making these facilities function as a base for disseminating Japan's culture to the rest of the world. This role is shown in the purposes of the guidelines concerning measures to vitalize the business of theaters, music halls, and other facilities, and in the purposes of the business to vitalize theaters, music halls, and other facilities, both of which are included in the preamble of the Law Concerning the Vitalization of Theaters, Music Halls and Other Facilities. First, theaters and music halls whose performance quality has been rated high will be chosen on a nationwide basis. This selection process will not take into consideration regional characteristics (population, area, industry, and social and economic conditions). Meanwhile, a quantitative survey on the theaters and music halls chosen in the initial selection

process will be conducted as much as possible concerning the content of their business, content of performance, facility conditions, and financial standing. And a total of 20 theaters and music halls will be chosen from among those receiving long-term subsidies from the Agency for Cultural Affairs, the Japan Arts Council, or the Japan Foundation for Regional Art-Activities. In selecting the 20 facilities, comments from at least two critics on performance arts will be weighed and a questionnaire will be sent to the chosen theaters and music halls. Theaters and music halls which have rejected survey requests will be removed from the selection list and the selection process will start again, this time from among the remaining theaters and music halls, until 20 facilities are chosen. Using this method, the survey was conducted between October 2018 and February 2019. The survey analyzed the business activities, facilities, and number of employees for four business years from fiscal 2014, starting in April 2014. The largest nine theaters and music halls in the Tokyo metropolitan area were chosen for the survey, reflecting the fact that the absolute number of highly functional theaters and music halls is the largest in the Tokyo area. Also selected were one in the other Kanto region, three in the Hanshin area, four in the Tokai region, and one in the Kita-Kyushu region. Two more theaters and music halls chosen were those in regional cities with a population of 500,000 to 700,000.

Situations on staff working at theaters and music halls, and physical conditions

Implementation of art events at theaters and music halls is mostly determined by the physical conditions of their facilities and staffing capability. Such conditions and capability decide the ability of theaters and music halls to execute events and their art-performing functions. Tables 1 and 2 show the situations on staff working at the

Table 1: Average number of employees at theaters and music halls subject to the survey, and their comparison with the national average

	Number of theaters and music halls polled	Minimum number	Maximum number	Average	Standard deviation	Number of theaters and music halls covered in the nationwide survey	National average
Art director	20	0	4	1.40	1.10	1805	Unknown
Employee in charge of managing performing projects	20	11	48	21.75	9.25	1805	7.78
Employee in charge of supporting performing events	20	0	28	10.05	7.71	1805	1.28
Employee in charge of administrative management	20	0	62	13.15	12.79	1805	1.11
Other staff	20	0	43	8.90	12.53	1805	—
Total number of employees	20	15	127	55.25	25.59	1805	11.14

(Note) (1) An art director has the full responsibility for the performing projects at a theater by taking leadership in planning and executing the projects.

An employee in charge of managing performing projects assists the art director in the implementation and management of the projects.

An employee in charge of supporting performing events is tasked with providing technical support and assisting stage performers for the smooth implementation of the events.

An employee in charge of administrative management is assigned to execute management-related duties at theaters and music halls.

Other staff undertake duties not directly related to performing projects, including child-rearing and taking care of children.

(2) The number of workers employed at the polled theaters and music halls represents the simple average between fiscal year 2015 and fiscal year 2017. The average and standard deviation shown in each type of employee were calculated based on the individual figures of the polled theaters and music halls.

Table 2: Number of seats at theaters and music halls subject to the survey, and their comparison with the national average

Number of seats	National average		Theaters and music halls subject to the survey	
300 seats to less than 500 seats	682	32.4%	2	10.0%
500 seats to less than 750	575	27.3%	2	10.0%
750 seats to less than 1,000	271	12.9%	1	5.0%
1,000 seats to less than 1,250	293	13.9%	2	10.0%
1,250 seats to less than 1,500	119	5.6%	3	15.0%
1,500 seats to less than 1,750	60	2.8%	1	5.0%
1,750 seats to less than 2,000	50	2.4%	5	25.0%
2,000 or more	58	2.8%	4	20.0%
Total	2,108	100.0%	20	100.0%

(Note) The number of seats at the polled theaters and music halls represents the simple average between fiscal 2014 and fiscal 2017.

theaters and music halls polled, and the physical conditions of their facilities. The figures listed in the tables represent the simple average of the surveyed items, obtained through the survey covering a four-year period between fiscal 2014 and fiscal 2017. Generally speaking, the number of facilities and staff at each theater and music hall tend to remain unchanged over the years. However, the number of event projects for a year may change. This is because the number of event projects that can be implemented per year would not change much over the years in view of the fact that the budget allotted for each year is almost the same for any given year. This makes it possible to grasp each year's activity trend at Japan's theaters and music halls based on the simple average of each index. The national average figures listed in the tables are taken from the 2015 social and educational survey, conducted by the Ministry of Education, Culture, Sports, Science and Technology every three years via nationwide municipalities. The survey items change every year. Based on this fact, it was determined that the national average figures in the 2015 survey can be used for this paper. Based on the American economist Irving Fisher's concept on capital, this paper broadly defines capital as a stock of rare resources that are required in the process of production and consumption. Human resources at theaters and music halls, such as artistic and technical knowledge, and business and management ability, are human capital. They are fixed capital.

The ability of theaters and music halls is divided into two kinds. One is the ability to hold conventional art events for a conventional audience in a continuous manner. The other is the ability to tap new audiences by launching new projects (new businesses if discussed from the viewpoint of management). In light of what is targeted under the Basic Law for Culture and Art and the Law Concerning the Vitalization of Theaters, Music Halls, and Other Facilities, and from the view point of the recent government policy on cultural affairs, it can be said that the second ability is sought more about theaters and music halls. In that sense, expectations are placed on theaters and music halls attaining functional growth. In the art community, there is a move to require art directors at theaters and music halls to play the same role as the one being played by project managers at commercial companies in a new product development project. When a new project is planned, there is a need for the management side to manage and coordinate the project from a business viewpoint. In the case of a business corporation, development of new products and their production and sales are managed in an integrated manner. The organizational ability (function) of theaters and music halls can be compared to this integrated process. This is why art directors began to be deployed at theaters and music halls in the 1990s, when cultural halls dedicated to art events expanded in Japan. However, conflicts between art directors and the management side occurred at many theaters and music halls concerning how to hold art events, eventually casting doubt over the deployment of art directors.

Even now, the management side of some theaters and music halls does not see a need to deploy art directors.

Operating theaters and music halls is a labor-intensive service industry. Facilities set up at theaters and music halls can be effective and high-quality performing arts are possible only when there are excellent human resources. When the theaters and music halls subject to the survey were compared with nationwide theaters and music halls on the manpower front, it was found whether art directors are deployed at nationwide theaters and music halls is not certain. (Identifying art directors is impossible under the social and educational survey statistics because they are included in the number of employees in charge of managing performing projects.)

Meanwhile, at the theaters and music halls surveyed, a maximum of four art directors and an average of 1.4 art directors are deployed. (At many of the surveyed theaters and music halls, one director is deployed for one genre.) The average number of employees in charge of managing performing projects is 22 at the surveyed theaters and music halls—3 times higher than the national average. Meanwhile, the average number of employees in charge of supporting performing events is 10—7 times higher than the national average. Moreover, the number of employees in charge of administrative managements at the surveyed theaters and music halls is 12 times higher than the national average. The combined number of employees in the four categories at the surveyed theaters and music halls is about 5 times higher than the national average (Table 1).

The findings above show that human resources are significantly rich at the theaters and music halls surveyed in view of their relatively small size, compared with nationwide theaters and music halls. Some performing projects at small-sized theaters and music halls are labor intensive, depending on whether the event is held there on a rental basis or held independently by the theaters and music halls. Therefore, generally speaking, the number of seats (size) at theaters and music halls is not proportional to the number of employees. Given that human resources are rich at the surveyed theaters and music halls, performing projects at many of them are likely to be undertaken on their own initiative instead of being conducted on a rental basis.

The seating capacity and other facility-related capabilities of theaters and music halls are also regarded as components of their business resources. Table 2 lists the number of seats at theaters and music halls. For the mainstay theatrical performance business, technology-related facilities, such as acoustic systems and stage mechanisms, are also important. However, such facilities were not covered by the 2015 social and educational survey. Based on this fact, this paper will use the number of seats as a benchmark for evaluating the level of facilities at

theaters and music halls in Japan, and compare the number of seats at the surveyed theaters and music halls with those in the country.

According to the survey, the number of seats is 1,500 or more in half of the theaters and music halls polled (10 theaters and music halls). In contrast, the national average seating capacity is less than 1,000, meaning that many of the surveyed theaters and music halls are relatively large. About one-third of the nationwide theaters and music halls are small-sized with a number of seats less than 500. At the surveyed theaters and music halls, one-fifth have such seating capacity and one-fourth have 1,000 to 1,500 seats, showing an equally balanced distribution of seating capacity among all-sized halls. Having large-scale halls enables the number of individuals in an audience to be expanded if the number of idle (vacant) seats is cut as much as possible in efforts to use halls' real resources efficiently. At commercial companies, they need to combine various real property efficiently in the process of producing goods and services. Labor and capital are not always replaceable, which means that part of the capital is always idle. At theaters and music halls, what kinds of functions they have is the only real resources that can contribute to the expansion of an audience. Such functions cannot be completely replaced by labor power. In this sense, the efficient use of halls (filling the hall to capacity) is especially important to increase the size of the audience. The hall can be fully booked if a popular art event is held using an excellent art director, or theaters and music halls are operated properly employing people with an excellent management ability. However, if the hall is not filled to its capacity, economic opportunity will be lost.

Situations on size of the audience

Table 3 shows the size of the audience at the surveyed theaters and music halls, and the size of audience at nationwide theaters and music halls, both measured in terms of annual total and per-project average. The "project" mentioned in this paper represents a series of programs being launched for a certain purpose. Examples of such programs are Shakespeare plays by a British theatrical troupe invited to Japan for the performance, a concert of Mozart symphonies by the Tokyo Symphony Orchestra, and a dance performance event by an overseas dance group invited to Japan—all of them being launched as a way of providing the audience with opportunities to appreciate high-quality art performances. The combined number of annual audience at the surveyed theaters and music halls plunged by 470,000 or 7.2% between 2015 and 2017, from 6,527,000 to 6,056,000. The number of per-hall annual average audience at the polled theaters and music halls declined from 2014 to 2017, an expected result in light of the fact that their combined annual audience dropped during the same period. However, the annual average per hall still topped 300,000 during the same period, 25 times higher than 12,000 at

nationwide theaters and music halls. The combined number of annual audience at nationwide theaters and music halls increased 6.0% between 2014 and 2017 in accordance with a rise in the number of theaters and music halls across Japan during this period. However, the number of per-

Table 3: Number of annual audience at the surveyed theaters and music halls, number of per-hall annual audience at surveyed theaters and music halls, number of annual audience at nationwide theaters and music halls, number of per-hall annual audience at nationwide theaters and music halls

	Number of theaters and music halls	Minimum number	Maximum number	Total	Standard deviation
Combined number of annual audience at surveyed theaters and music halls (2014)	20	66476	709939	6,197,626	194,742.25
Combined number of annual audience at surveyed theaters and music halls (2015)	20	60,774	667,265	6,526,847	203,554.83
Combined number of annual audience at surveyed theaters and music halls (2016)	20	15,488	673,792	6,263,558	202,642.35
Combined number of annual audience at surveyed theaters and music halls (2017)	20	70,966	802,775	6,056,440	182,533.06
Number of per-hall annual average audience at surveyed theaters and music halls (2014)	20	175.6456	10867.603	309,881	2,261.10
Number of per-hall annual average audience at surveyed theaters and music halls (2015)	20	175	9,214	326,342	1,897.83
Number of per-hall annual average audience at surveyed theaters and music halls (2016)	20	143	10,386	313,178	2,165.68
Number of per-hall annual average audience at surveyed theaters and music halls (2017)	20	187	12,685	302,822	2,664.07
Combined number of annual audience at nationwide theaters and music halls (2014)	1,483	-		18,145,488	—
Combined number of annual audience at nationwide theaters and music halls (2017)	1,600	-		19,232,488	—
Number of per-hall annual average audience at nationwide theaters and music halls (2014)	1,483	-		12,236	—
Number of per-hall annual average audience at nationwide theaters and music halls (2014)	1,600	-		12,020	—

hall annual average audience at nationwide theaters and music halls remained almost unchanged at about 12,000 during the same period.

The combined number of audience at the polled theaters and music halls in 2017 accounted for 6,056,000, or 31.5% of the combined number of audience at nationwide theaters and music halls, standing at 19.23 million. Given we only surveyed 20 theaters and music halls against 1,600 nationwide theaters and music halls, the ability of the polled theaters and music halls to attract a large number of audience is strong.

Financial situation at theaters and music halls

Revenue side

Timely investment is necessary to effectively use human and physical resources. Such investment is usually allotted to finance expenses for running the business and facility improvement. This paper will deal with flow expenses (balance) related to running the business. Among such expenses are yearly expenses for running the business, personnel expenses, and administrative expenses. Administrative expenses include expenses for facility improvement aimed at managing, maintaining, and upgrading facilities in response to a decrease in their value. Data used in this paper, shown in Table 4, were taken from statistics compiled in the fiscal year 2016 study report on activities of theaters and music halls, undertaken by the Agency for Cultural Affairs on a consignment basis because nationwide research on expenses is not covered by the social and educational survey.

Unlike the social and educational survey, the study report on activities of theaters and music halls is neither a state-designated statistical report nor a complete enumeration survey.

Table 4: Revenue at surveyed theaters and music halls and its comparison with the revenue at nationwide theaters and music halls (Unit: 1,000 yen)

	Number of surveyed theaters and music halls	Minimum number	Maximum number	Average	Standard deviation	Number of theaters and music halls that replied	National Average
Total revenue 2014	20	122,536	3,277,427	1,260,375.0 100.0	725862.4247	-	
Total revenue 2015	20	122,053	3,340,058	1,258,692.9 100.0	753,448.5	-	
Total revenue 2016	20	126,497	3,083,198	1,266,460.9 100.0	752,470.6	582	207,140.0 (Estimated)
Total revenue 2017	20	119,057	3,409,026	1,270,187.6 100.0	782,860.3	-	
Revenue firom mainstay business 2014	20	31,138	1,371,073	317,567.2 25.2	350,693.2	-	
Revenue firom mainstay business 2015	20	30,888	1,406,586	320,300.1 25.4	329,815.6	-	
Revenue from mainstay business 2016 I	20	33,040	1,646,503	364,729.3 28.8	404,447.2	711	28,206.4
Revenue from mainstay business 2017	20	29,486	1,519,953	333,714.7 26.3	344,603.6	-	
Subsidies 2014	20	0	705,129	217,766.9 68.6	225,651.6	-	
Subsidies 2015	20	7,740	1,026,115	233,348.2 18.5	259,923.9	-	
Subsidies 2016	20	5,688	982,136	223,789.3 17.7	252,265.7	475	33,695.1
Subsidies 2017	20	8,160	727,245	183,511.5 14.4	176,102.5	-	

(Note)(1)National average figures for 2016 are most recently data. Of the 711 nationwide theaters and music halls that replied 475 received subsidies.

(2) Figures shown below avenge figures represent the percentge apinst the base of 100 for total revenue.

(3) Figures listed as national average are the average of figures for theaters and music halls that replied. Simple addition is not possible.

(4) Revenue from the mainstay business represents the revenue from mainstay theatrical activities (revenue from theatrical event tickets, sales of pamphlets). Revenue from rent on facilities used for cafes, restaurants, and parking is not included.

(5) Subsidies do not include grants from the state, municipalities, business corparations, and private support organizations, and money and physical donation for support.

(Sources: National average data are based on figures included in the fiscal 2016 study report on activities of theaters and music halls compiled by the Association of Public Theaters and Halls

The entities subject to the study are limited to theaters and music halls belonging to the Association of Public Theaters and Halls in Japan, entrusted with conducting the study. The average rate of valid answers in the study is 65.1%, with member theaters and music halls not replying to all questions. Theaters and music halls without sufficient capability to answer may not have replied. In addition, there are many theaters and music halls which do not disclose their financial conditions. For this paper, replies from 1,431 theaters and music halls were collected, including those listed in Table 4, based on which an analysis was conducted for this paper. In view of the number of replies and how the questions were answered, this is not a random-sampling survey. Therefore, the figures used in this paper are likely to be biased. Of the 711 theaters and music halls which replied to the fiscal 2016 survey, 475 or 66.8% said they received subsidies in the year. If this study had been conducted on a random-sampling basis, it could have been inferred that about two-thirds of the theaters and music halls across the nation

received subsidies in the year. However, unsubsidized theaters and music halls must have refrained from replying honestly, which makes it likely that the rate of subsidy receipt for the 711 theaters and music halls was far lower than two-thirds.

The amount of per-hall revenue from the mainstay theatrical activities averaged 28.2 million yen at the 711 theaters and music halls in fiscal 2016 and the amount of per-hall subsidies averaged 33.7 million yen there in the same year. However, the total of such revenue and subsidies was not disclosed. In addition to getting revenue from the mainstay theatrical activities, theaters, and music halls earn revenue from renting buildings and from business in other categories. If all these revenues are added simply and the combined sum from the addition is weighed by the number of subsidized halls, the total per-hall revenue is calculated as an average 207.14 million yen in fiscal 2016. However, the financial situations of the theaters and music halls which disclosed data in reply to the survey do not necessary reflect the actual situations of nationwide theaters and music halls because the theaters and music halls that disclosed the data are believed to be those with strong capability regarding information disclosure and management. Therefore, the total per-hall revenue shown in the calculation must have reflected the financial standing of financially sound theaters and music halls.

The revenue from the mainstay theatrical activities earned by the 20 theaters and music halls surveyed for this paper was basically flat for four years, from fiscal year 2014 to fiscal year 2017. The amount of their per-hall annual revenue averaged 334 million yen during the period, 11.8 times higher than 28.2 million yen at the 711 theaters and music halls. On the total revenue front, the 20 surveyed theaters and music halls yearly earned an estimated 1,263.5 million yen per hall on average, which is 6.1 times higher than the estimated 207.1 million yen per hall at nationwide theaters and music halls. This means that the mainstay revenue at the surveyed theaters and music halls represented a larger portion of the total revenue. As for the revenue from subsidies, the 20 surveyed theaters and music halls received an average 215 million yen per hall, a sum 6.4 times higher than the 33.7 million yen received by nationwide theaters and music halls. In terms of revenue, especially from the mainstay theatrical business, significant differences are seen between the surveyed theaters and music halls and nationwide theaters and music halls. It is also estimated that differences are significant between both parties regarding revenue from non-mainstay businesses and revenue from subsidies.

A breakdown of the total revenue listed in Table 4 shows that there is a significant difference in the percentage of revenue from the mainstay theatrical activities between the surveyed theaters and music halls and the nationwide theaters and music halls. The percentage of such revenue is 13.6% at nationwide theaters and music halls, about a half of the 26.4% for the surveyed theaters and music halls. The mainstay theatrical business produces 26.4% or

one-fourth of the total revenue at the surveyed theaters and music halls, with 17.0% of the total deriving from subsidies. If revenue in both categories is deducted from the total revenue, the remainder, representing revenue from non-mainstay businesses, is more than a half of the total revenue. The percentage of revenue from the mainstay business at nationwide theaters and music halls is much smaller at one-seventh of the total revenue, which leave them with no choice but to turn to subsidies as well as to revenue from non-mainstay businesses.

The size of the halls is physically limited. Even if halls are filled to their capacity, the revenue from the mainstay theatrical business will not improve at performing events whose unit price (ticket price) is inexpensive. This suggested the need for theaters and music halls to raise their revenue by strengthening non-mainstay businesses. Their total revenue could be boosted by increasing revenue from non-mainstay activities instead of stepping up mainstay theatrical activities. This is compared to efforts at commercial companies to expand overall sales by increasing sales in non-mainstay as well as mainstay fields.

Expenditures

Table 5 shows the comparison between the 20 surveyed theaters and music halls and nationwide theaters and music halls regarding expenditure. The total per-hall expenditure at nationwide theaters and music halls is uncertain. Of the 1,431 theaters and music halls which replied, 711 answered concerning expenditures on the mainstay theatrical business and 582 on personnel expenses. As in the case of revenue, it is technically meaningless to add personnel expenses to expenditures on the mainstay business. However, spending's overall trend can be confirmed.

If the total revenue, explained earlier, is roughly equal to the total expenditures, per-hall spending at nationwide theaters and music halls will

Table 5: Expenditures at surveyed theaters and music halls and their comparison with spending at nationwide theaters and music halls (Unit: 1,000 yen)

	Number of surveyed theaters and music halls	Minimum number	Maximum number	Average	Standard deviation	Number of theaters that replied	National Average
Total expenditures 2014	20	119,792	3,253,887	1,265,728 100	721,661		
Total expenditures 2015	20	117,552	3,407,254	1,271,958.6 100.0	756,978		
Total expenditures 2016	20	123,387	3,033,966	1,267,581.3 100.0	750,583		Unknown
Total expenditures 2017	20	118,436	3,320,441	1,272,365.6 100.0	748,128		
Expenditures on mainstay business 2014	20	72,073	1,864,899	661,249.7 52.2	442,303		
Expenditures on mainstay business 2015	20	71,060	1,968,735	695,920.6 54.7	462,166		
Expenditures on mainstay business 2016	20	76,215	1,795,033	670,797.2 52.9	505,035	711	64,814.0
Expenditures on mainstay business 2017	20	18,222	1,967,439	655,681.6 51.5	483,855		
Personnel expenses 2014	20	42,188	653,378	265,206.5 21.0	147,081		
Personnel expenses 2015	20	40,710	546,662	265,798.6 20.9	137,966		
Personnel expenses 2016	20	41,912	636,414	257,409.6 20.3	145,227	582	40,499.5
Personnel expenses 2017	20	43,941	777,058	278,592.2 21.9	164,408		

(Note) and (Sources) are the same as Table 4

amount to 270 million yen. The primary function of theaters and music halls is holding performing events. The revenue from such events is their revenue from the mainstay business. The revenue from the mainstay theatrical business was 334 million yen at the surveyed theaters and music halls, and their expenditures on the same business amounted to 671 million yen, leaving red ink of 337 million yen. Spending by nationwide theaters and music halls totaled 64.8 million yen per hall and their revenue amounted to 28.2 million yen, producing red ink of a smaller 36.6 million yen. Spending on the mainstay theatrical business at nationwide theaters and music halls was only one-tenth of the spending on the same business at the surveyed theaters and music halls, suggesting that theatrical business has been undertaken without much budget at nationwide theaters and music halls. Spending less on theatrical activities means allotting less money to performing musicians and art groups for their performance and stage-related expenses, possibly affecting the quality of stage performance by musicians and other artists. On the personnel expense front, the surveyed theaters and music halls spent an average of 653 million yen a year while only 40.5 million yen was spent at nationwide theaters and music halls. This is because many working at nationwide theaters and music halls are temporarily dispatched from host municipalities, which shoulder their salaries. According to the study report, 35.3% of the employees in charge of administrative management at theaters or music halls are dispatched from the municipalities that host them, while 47.3% of the employees in charge of managing performing projects come from host municipalities.

Based on the analysis above, it was confirmed that in view of their spending record, the surveyed theaters and music halls are business entities that focus on mainstay theatrical activities. In contrast, nationwide theaters and music halls were found to be entities that earmark most of their budget to salaries being paid to their employees. In addition, the percentage of personnel expenses stood at about one-third of the total budget at national and municipality-run universities in fiscal 2018 and about one-second at private universities, according to government statistics on cultural and educational facilities (Ministry of Education, Culture, Sports, Science and Technology 2016; statistical survey on school employees).

Furthermore, it is assumed that about 100 million is spent on non-mainstay activities, calculated by excluding spending on the mainstay theatrical business and personnel expenses. Among expenditures on non-mainstay businesses are administrative expenses other than personnel expenses, such as expenses for managing facilities and equipment. Other spending on non-mainstay activities include expenditures for running cafes and restaurants, and managing parking facilities.

Relationship between resources of theaters and music halls and output

If theaters and music halls are deemed as a corporate entity, what is produced by them is revenue. Meanwhile, physical capital is regarded as input resources (production elements) while seats in theaters and music halls and human capital are regarded as assets. In addition, money earmarked for supporting regular operations at theaters is deemed as working capital. Such money is divided into personnel expenses, administrative expenses, and expenses for performing activities. The capital invested into human resources is a unit to measure assets. Either total personnel expenses or total hours worked may be used to measure assets. However, which should be used is difficult to decide. Employees at theaters and music halls have professional expertise and knowledge concerning their operations. Given that their

knowledge, deriving from human resources, is inseparably attached to the theaters and music halls, it was decided in this paper that the quality of labor provided to theaters and music halls will be evaluated by per-capita wage (average personnel expenses) in accordance with Keynes' theory (Keynes, 1936; Imai, Uzawa, Komiya, Negishi, Murakami, 1971; Uzawa, 1984). At theaters and music halls, art directors are usually employed for these facilities to ensure a certain level of artistic quality. Generally, their salary is set at extremely high levels. If the total hours worked by employees is used to evaluate their labor quality, the total personnel expenses at theaters and music halls should be divided by the average salary of all the employees to calculate their working hours. However, what may be obtained through this formula is simply a result of calculation. In actual work for theatrical activities, it is most unlikely that the work by a single art director, who may be famous, is worth the combined work of dozens of rank-and-file workers.

Figure 1: Correlation between the number of employees at each theater and the revenue from the mainstay theatrical business

$R^2 = 0.1220$

Figure 2: Correlation between the number of employees at each theater and the total revenue

$R^2 = 0.3471$

Based on this idea, the adjusted number of employees at theaters and music halls was calculated by dividing their total personnel expenses by the average per-capita salary paid at the surveyed theaters and music halls. The calculation took into consideration salary gaps between prefectures, whose data were taken from a basic statistical survey on the wage structure of theaters and music halls for the year under review. This paper compiled the number
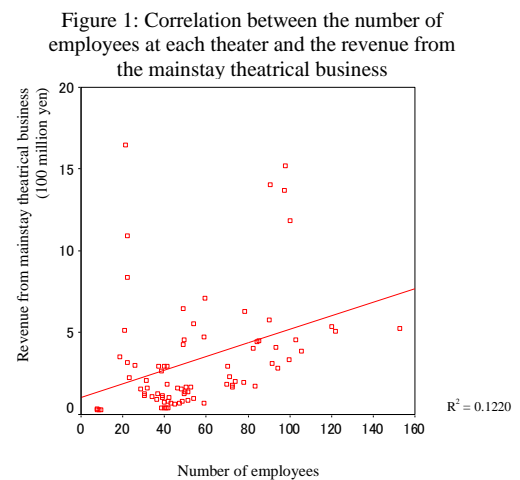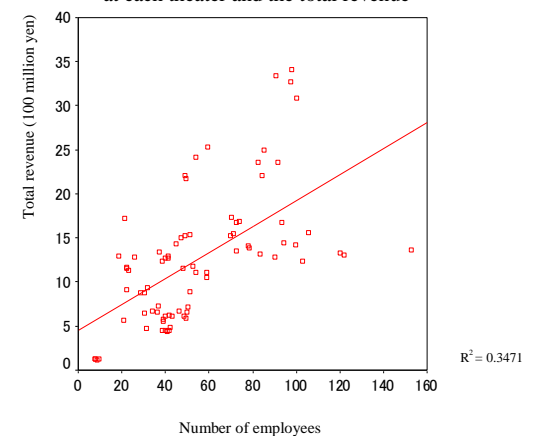
of employees at the surveyed theaters and music halls, their revenue from the mainstay theatrical business and their total revenue, which also includes peripheral businesses, deriving from the mainstay theatrical activities, such as outreach businesses, sales of merchandize, and leasing business using the buildings and other facilities. This paper regards revenue from all these businesses, covering a three-year period, from 2014 to 2017, as output.

Figure 1 shows the correlation between the adjusted number of employees at each theater, calculated above, during the three-year period and the revenue for the same period from the mainstay theatrical business. The correlation coefficient obtained from this figure is 0.349. The straight line in Figure 1 represents a simple linear regression showing the correlation between the adjusted number of employees and the revenue from the mainstay theatrical business. A similar simple liner regression, this

Figure 3: Correlation between the number of seats at each theater and the revenue from the mainstay theatrical business
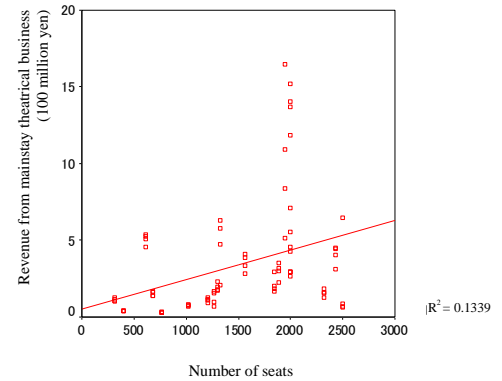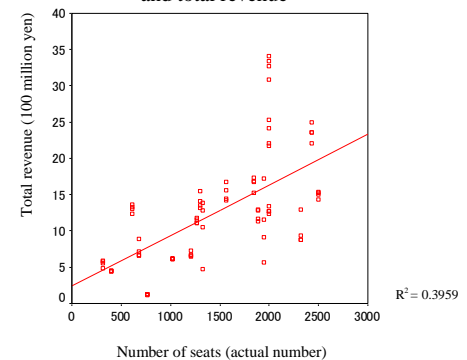

Figure 4: Number of seats at each theater or music hall and total revenue

time showing the correlation between the adjusted number of employees and the total revenue, is drawn in Figure 2. The correlation coefficient was calculated as 0.589, which is higher than the 0.349 for the relationship between the adjusted number of employees and the revenue from the mainstay theatrical business.

Figure 3 shows the relationship between the number of seats at each theater and the revenue from the mainstay theatrical business. From the viewpoint of the X axis, which represents the number of seats, the revenue ranges widely, from about 300 million yen to about 1.4 billion yen, at around 2,000 seats. Meanwhile, from the viewpoint of the Y axis, which represents the revenue from the mainstay theatrical business, the number of seats ranges widely, from 600 to 2,300 seats, at the revenue of 400 to 500 million yen. As in the case of Figures 1 and 2, a simple linear regression showing the correlation between the number of seats and the revenue from the mainstay theatrical business is drawn in Figure 3. Figure 4 shows the correlation between the number of seats at each theater and the total revenue. As in the case of Figure 3, the total revenue at each theater ranges widely, from about 500 million yen to about 3.5 billion yen, at about 2,000 seats. As in the case of Figures 1, 2, and 3, a simple linear regression is drawn in Figure 4, showing the correlation between the number of seats at each theater and the total revenue. The simple linear regression is more apparent in the

correlation between the number of seats and the total revenue than in the correlation between the number of seats and the revenue from the mainstay theatrical business. The correlation coefficient is 0.366 for the relationship between the number of seats and the revenue from the mainstay theatrical revenue. The correlation coefficient is higher at 0.629 for the relationship between the number of seats and the total revenue. At around 2,000 seats, the total revenue is much higher than the simple linear regression line at some theaters and music halls. However, Figure 4 shows that the number of seats is generally correlated to the total revenue.

Production function at theaters and music halls

Recently, the Agency for Cultural Affairs called for evaluating business operations at cultural facilities, including theaters and music halls—a proposal already being implemented at many of these facilities. The government's third basic policy concerning the promotion of art and culture, approved by the Cabinet on Feb. 8, 2011, under the Basic Law for Promotion of Culture and Art, the official name of the 2002 Basic Law for Culture and Art, called for establishing a PDCA (Plan, Do, Check, Action) cycle concerning priority strategies, with the aim of helping the government fulfill its accountability to people and developing an effective evaluation method. The government has maintained this policy even after the enactment of the Basic Law for Culture and Art, with prioritizing business evaluation of subsidized projects by the Agency for Cultural Affairs.

Generally speaking, it will take a very long time for individual projects covered by the government's cultural policy to develop into a stage where evaluation of business operations is possible following the start of their operations. Cultural projects are said to be unfit for quantitative evaluation as it is technically difficult to grasp their outcome or output quantitatively—a challenge already pointed out in the 1993 investigative study on culture-related expenditures in the United States and four major European countries, conducted by the Agency for Cultural Affairs on a consignment basis. This is a long-standing issue in the evaluation of cultural projects (Throsby, 2001). Since the turn of the 21st century, cultural facilities run by the state and municipalities have been reorganized into independent administrative entities, regional independent administrative entities, and entities whose management and operation are entrusted to private businesses. Since the reorganization, whether to grant, increase, or cut state and municipal subsidies to such newly reorganized entities have mostly been decided by their output—revenue and the number of visitors. Under these circumstances, the manager at each cultural facility is doing his or her utmost to raise its revenue and the number of audience. Marketing methods used in business economics have been introduced at commercial companies as a means of expanding their revenue. Know-how of such methods has begun to

be adopted at cultural facilities as well. Meanwhile, sector-by-sector production functions and cost functions have been studied from economic viewpoints to decide input resources and the corresponding optimal production amount (Konishi, Nishiyama, 2009; Matsuura, Hayakawa, Kato, 2007). However, sufficient studies have yet to be conducted on the production function at cultural facilities. This is why the production function at theaters and musical halls will be presented in this paper based on the research on these facilities.

Operating theaters and music halls is one of service industries and a typical labor-intensive industry. The Lentief production function is optimal for the production function for art groups in charge of theatrical performance because there is no substitutability between factors, with persons engaging in theatrical activities not replaceable by robots and other machines. As stated earlier, the operation of theaters and music halls includes the planning of art performance by art groups, implementation of art events, and business management and operation of art events. Facilities at theaters and music halls have been upgraded technologically thanks to the advancement of computer technologies, with multi-purpose halls being utilized as halls having the same functions as halls dedicated to theatrical performance (Ikegami, 2003). Unlike theatrical groups and music bands, there could be a certain range of substitutability between two production factors at theaters and music halls—their employees and facilities. The Cobb–Douglas-type production function was initially used only for the manufacturing industry. Later, however, its applications to other industries including the service industry increased (Hori, Yoshida, 1996; Enya, 2000 & Miyagawa, Takizawa, Kim, 2006). In application to the financial industry, for example, interest revenue is treated as production, personnel expenses as a labor factor, and the balance of lending as capital stock in some studies (Omori, Nakajima, 1999). In application to the retail sector, the number of sales staff is counted as a labor factor, sales value as production, and floor area as capital stock. The Cobb–Douglas-type production function was presented as a method to estimate the production function for manufacturers, wholesalers, and retailers operating in Osaka Prefecture in an appendix of the 2007 study report on the prevention of natural disasters in the region (assumed damage from quake). In the report, the coefficient of determination of the Cobb–Douglas-type production function, which represents its accuracy, was listed as close to 1. The report described the figure as reflecting the good estimation made.

The Cobb–Douglas-type production function is regarded as an analytical method that was first used in the manufacturing industry and later applied to a range of fields in the service industry. Based on the study above, this paper will deal with the Cobb–Douglas-type production function, which has substitutability between human capital and assets, and between physical capital and assets. In application to the retail sector under the service industry, floor area is

treated as an asset factor, this case physical capital. In the banking sector, financial assets are treated so. In the case of theaters and music halls, the number of seats is counted as an asset factor. The adjusted number of employees there, explained earlier, will be used as labor capital. The production function of orchestras, surveyed by the author of this paper, is shown below (Edagawa, 2015). The number of orchestras covered by this survey was only 13, and obtaining relevant time series data was found to be difficult. Therefore, the estimation was made using the ordinary least squares method, with the aggregate of capital share and labor share assumed at 1.
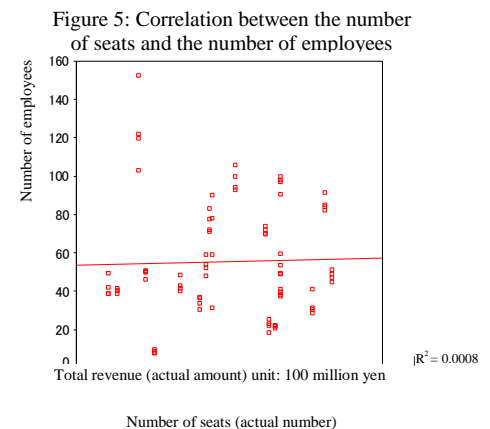
$$\ln(Y) = \alpha \ln(K) + \beta \ln(L) + \gamma \qquad \text{conditional on } \alpha + \beta = 1,$$

Y : revenue from each orchestras performance; K : musical instruments, utensils, fixtures,
and software (music score) owned by each orchestra, lending to purchase musical instruments
The unit of revenue and capital is 1,000 yen.

$$\alpha = 0.249 \,(t = 1.922), \quad \gamma = 7.587 \,(t = 10.769), \text{degree of freedom - adjusted } R^2 = 0.501$$

Date collected from the four-year survey of theaters and music halls, from fiscal 2014 to fiscal 2017 (each year starting in April and ending in March of the following year), are panel data that covered the same theaters and music halls over the period. It is assumed that the management of theaters and musical halls is determined by social and geographical conditions of the regions that host them. Specifically, the revenue of theaters and music halls from the mainstay theatrical business and their total revenue are frequently affected by their locations and the host regions' employment situations. In densely populated urban areas, for example, transportation-related infrastructure has been established solidly, making it easier for people to visit theaters and music halls located in such areas. The situation is totally different in scarcely populated areas. Based on this fact, the paper will statistically examine whether fixed effects uniquely characteristic of each theater exist. This paper will use the number of employees at each theater and the number of its seats as independent variables, with the correlation between the two variables shown in Figure 5. 00Figure 5 represents a simple linear regression showing the correlation between the two variables—the number of employees at each theater and the number of its seats. With the correlation coefficient calculated at 0.028, there is no correlation between the two variables, a judgment that is easy to make even upon one glance. The number of employees and the number of seats are treated as independent variables because there is no multicollinearity

Figure 5: Correlation between the number of seats and the number of employees

Total revenue (actual amount) unit: 100 million yen

Number of seats (actual number)

between them. Therefore, the two variables are adopted as explanatory variables. It is generally believed that the larger the size of a theater, the larger the number of its employees. However, this is not true. In fact, the number of employees at a theater is not determined by its size. In other words, the number of employees at a theater has nothing to do with its operation.

First, this paper will examine whether each theater's characteristic has an impact (effects) on its revenue. For that purpose, pooling estimation and least squares dummy variable (LSDV) will be compared. As pooling estimation is based on the condition that each theater's constant terms are equal in LSDV, meaning that fixed effects do not exist, the F-test will be employed to check whether or not fixed effects exist. Then Lagrange Multiplier test will be conducted to judge if random-effect estimation can be justified in comparison with pooling estimation. Finally, the Hausman test will be conducted to decide which model—a fixed-effect or a random-effect model—should be adopted. Based on the procedure mentioned above, a random-effect model was estimated in two non-explanatory variables, revenue from the mainstay theatrical business and total revenue.

A fixed-effect model for the CobbDouglas-type production function at each theater and music hall is shown below.

$\ln(Y) = \alpha \ln(\text{number of seats}) + \beta \ln(\text{number of employees}) + \gamma$

The above formula is composed of Y: revenue from the mainstay theatrical business or total revenue (unit: 100 million yen); α: capital share, β: labor share, γ: all production factors

The formula for estimating the total revenue is shown below.

$\ln(\text{total revenue}) = 0.671\ln(\text{number of seats}) + 0.773\ln(\text{number of employees}) - 5.443 \ldots\ldots(1)$
$\quad\quad\quad (6.39) \quad\quad\quad (9.66) \quad\quad\quad (6.86)$

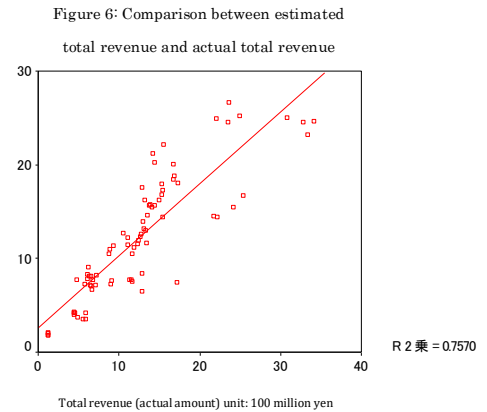degree of freedom-adjusted R^2: 0.653   ( ) represents t.

The formula for estimating the revenue from the mainstay theatrical business is shown below.

$\ln(\text{revenue from the mainstay theatrical business}) = 0.698\ln(\text{number of seats}) + 0.769\ln(\text{number of employees}) - 7.443 \ldots\ldots(2)$
$\quad\quad\quad (2.74) \quad\quad\quad (3.35) \quad\quad\quad (3.52)$

degree of freedom-adjusted R^2: 0.312   ( ) represent t

Under the formula (1) for estimating the total revenue, the aggregate of α and β is 1.444. (α + β = 1.444). Under the formula (2) for estimating the revenue from the mainstay theatrical business, a similar figure is obtained, 1.467. The findings represent increasing returns regarding capital and labor input, meaning that the larger the size of a theater, the higher its revenue. Under the formula for estimating the business from the mainstay theatrical business, the degree of freedom-adjusted coefficient of determination was very low, resulting in the coverage of one-third of the total. The residual under the formula for the random-effect estimation model (formula for estimating the revenue from the mainstay theatrical business) showed a normal distribution under the Kolmogorov–Smirnov test, which makes the estimation formula appropriate. In the theater business, not only theatrical performance but also peripheral businesses are important. In fact, the Theater Law and the system established based on the law to support the revitalization of the theater industry describe the roles of theaters as promoting partnership with local universities, engaging in art management, providing local people with experience-oriented art study opportunities, and holding theatrical events on a roving basis as well as ensuring opportunities for local people to appreciate art performance. Revenue from peripheral businesses is higher at operators of large-size theaters and music halls and theatrical operators playing a central role in each local community, helping expand their total revenue.

Figure 6: Comparison between estimated total revenue and actual total revenue

R^2 乘 = 0.7570

Total revenue (actual amount) unit: 100 million yen

Figure 7-1 Model of two production factors (number of seats and number of employees)
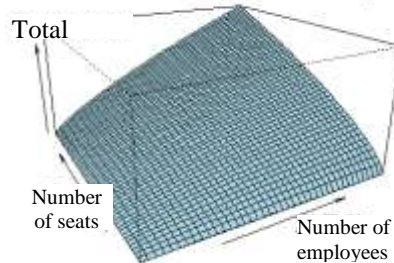
Figure 7-2 Cobb–Douglas-type linear homogeneous model

As Table 4 shows, the revenue earned from the mainstay theatrical business at Japan's top 20 theaters accounts for only about one-fourth of their combined total revenue. Many employees of such theaters engage not only in theatrical events but also in peripheral businesses. Given this fact, their total revenue will be used as a dependent variable (production value) in the analysis below.

Comparison between the estimated production function at theaters and music halls and their actual production function

The estimated total revenues at theaters and music halls, calculated using the two-production-factor random-effect model formula, are compared with their actual total revenues. Figure 6 plots the actual total revenue at each theater and music hall on a horizontal axis and its estimated revenue under the random-effect model formula on a vertical axis. The plotted dots represent statistics for four years from fiscal 2014 to fiscal 2017, which means that data for each theater cover the four-year period. The total revenues estimated through the square of the degree of freedom-adjusted correlation coefficient are slightly higher than the total revenues under the model formula. This is because the total revenues under the model formula are obtained using the logarithmic formula while the estimated total revenues are converted into actual total revenues. Figure 6 shows that significant gaps are seen between the estimated total revenues and the actual total revenues at many theaters and music halls. In particular, the actual total revenues are significantly lower

Table 6: Average number of employees and seats at theaters and music halls during the surveyed fiscal year

Theater		Number of employees	Number of seats	Theater		Number of employees	Number of seats
1	Average	76.2	1300	11	Average	48.1	2500
	Standard deviation	5.5	0		Standard deviation	2.7	0
2	Average	21.7	1944	12	Average	71.6	1848
	Standard deviation	0.7	0		Standard deviation	2.0	0
3	Average	32.9	2317	13	Average	40.3	396
	Standard deviation	5.6	0		Standard deviation	1.3	0
4	Average	124.5	612	14	Average	96.5	2001
	Standard deviation	20.7	0		Standard deviation	4.2	0
5	Average	52.9	1999	15	Average	53.4	1269
	Standard deviation	4.9	0		Standard deviation	4.5	0
6	Average	85.7	2433	16	Average	49.3	680
	Standard deviation	3.9	0		Standard deviation	2.2	0
7	Average	39.2	1997	17	Average	64.7	1330
	Standard deviation	1.7	0		Standard deviation	25.6	0
8	Average	22.3	1890	18	Average	8.5	767
	Standard deviation	3.0	0		Standard deviation	0.8	0
9	Average	43.4	1019	19	Average	34.4	1210
	Standard deviation	3.7	0		Standard deviation	2.9	0
10	Average	42.4	315	20	Average	98.3	1560
	Standard deviation	4.9	0		Standard deviation	5.8	0
				Total	Average	55.3	1469.4
					Standard deviation	29.6	667.5

than the estimated total revenues at many theaters and music halls whose actual total revenue range is between 2 and 3 billion yen. This downtrend at such theaters and music halls is more conspicuous than in theaters and music halls whose actual total revenue is less than 2 billion yen. The total contribution of labor and capital to the production amount tops 1 at theaters and music halls, showing increasing returns to scale. This model's conceptual image is embodied in a three-dimensional curved surface shown in Figure 7-1. This is compared with the linear homogeneous model shown in Figure 7-2.

The discrepancy coefficient is obtained with the estimated total revenues divided by the actual total revenues, followed by looking into why the discrepancy occurred. For that purpose, production factors at theaters and music halls—the number of employees and the number of seats—will be checked first. Table 6 lists the average number of employees and seats at the 20 theaters and music halls for the surveyed fiscal year. According to the

Table 7: Distribution of discrepancy coefficients

Range of discrepancy coefficients	Number of theaters and music halls under the range
0.50~0.75	11
0.75~1.00	36
1.00~1.25	16
1.25~1.50	8
1.50~1.75	7
1.75~2.00	2
Total	80

table, no chronological change was seen in the number of seats. In addition, little change was seen in the number of employees, as shown by the standard deviations listed. The findings indicated that explanatory variables such as the number of employees and seats at theaters and music halls, which represent their inherent characteristics, show the same trend. This can be explained by the fact that coefficients of production factors in the "between" model for estimating the production function of the theaters and music halls altogether is little different from coefficients of production factors in the random model.

Table 7 lists the number of the theaters and music halls surveyed according to the rank of their discrepancy coefficients. Discrepancy coefficients are between 0.75 and 1.25 at 65% of the surveyed theaters and music halls, and between 0.50 and 0.75 or between 1.25 and 2.00 at the rest of the surveyed theaters and music halls. The coefficients are between 0.9 and 1.1 at 38 theaters and music halls, representing about half of the polled theaters and music halls. The total revenue of theaters and music halls, number of seats, and number of their employees are affected by the size of the facilities. The total revenue, number of seats, and number of employees are generally related to the size of theaters and music halls. However, the discrepancy coefficients of theaters and music halls have little correlation with these indexes, with the correlation coefficient standing at 0.38 for the number of seats and 0.23 for the number of employees. This means that there is no correlation between the size of theaters and music halls and their discrepancy coefficients. It is thus assumed that the discrepancy coefficients are affected by other factors.

Factors behind the discrepancy of estimated production function and actual production function at theaters and music halls

The estimated total revenues at theaters and music halls, calculated using the two-production-factor random-effect model formula, are significantly different from their actual total revenues. This discrepancy is different between the surveyed theaters and music halls, suggesting that their total revenues were affected by factors other than the number of employees and the

number of seats. Generally speaking, theaters and music halls, once established, are significantly affected by the social and economic conditions of the local communities that host them. One of such conditions is the type of area the theater or music hall is located, which is regarded as an external condition. If many theaters and music halls are located in the same area, for example, competition for a larger audience will be intensified. Meanwhile, the audience's behavior is mostly determined by the cultural capital in the areas that host the theaters and music halls. Therefore, at theaters and music halls centering on operas, classic concerts, and ballet performances, as is the case of those covered in this paper, attracting visitors is easier if they are located in areas populated by people with high academic background and in high income brackets. According to an analysis made by the American economist William Baumol based on his surveys in the 1960s, being based in areas mostly populated by people with high academic background and in high income brackets is advantageous for theaters and music halls focused on high art performance (Baumol & Bowen, 1968). A similar result was obtained in a survey conducted in Japan on customers of theaters and music halls (Suo, Wakamatsu, 2003).

With this viewpoint taken into consideration, the paper will analyze the relationship between the social and economic characteristics of the prefectures that host theaters and music halls, and discrepancy coefficients. The social and economic characteristics of host prefectures used in this paper as indexes are the following: population, area, population density, per-capita income of residents, gross income of residents, number of students studying at higher academic institutions (university, junior college, vocational school equivalent to junior college), number of residents who completed their studies at higher academic institutions, and percentage of the combined total of such students and residents against the population of each prefecture. Meanwhile, the architectural structurers of theaters and music halls and types of their operations are used as indexes. Both of them are not used as indexes for the production function. Table 8 shows the correlation between each index and the discrepancy coefficient.

Table 8: Correlation between the social and economic characteristics of areas that host theaters and music halls, and discrepancy coefficients

Continuity of same business project	0.48	*
Average number of visitors to theatrical events	0.41	
Average number of visitors per theatrical event	0.39	
Area of prefecture	0.37	
Average spending on holding theatrical events	0.35	
Average subsidy mainly from state	0.33	
Average number of theatrical events	0.23	
Percentage of subsidies received against revenue	0.22	
Number of halls in the same prefecture	0.03	
Number of people who visited theatrical events held by halls in the same prefecture	0.00	
Population in prefecture	-0.03	
Average income in prefecture	-0.04	
Gross income in prefecture	-0.05	
Average number of students attending higher educational institutions	-0.05	
Prefectural population	-0.05	
Population density in prefecture	-0.05	
Combined number of students attending higher educational institutions and people who completed study at higher educational institutions	-0.08	
Average number of people in the prefecture who completed their studies at higher educational institutions (a)	-0.08	
Percentage of (a) against population	-0.25	
Theater's purpose of using a hall	-0.48	*

* 5% level is regarded as statistically meaningful.

(Note) 1. Average represents the simple average of four years covered by the survey.

2. All 47 prefectures are simply called "prefecture."

The index representing the continuity of the same business project is a quantitative variable. As stated earlier, the same business project is defined as a series of business undertakings operating under one program for the same purpose. "Continuity" means the number of fiscal years over which the same business project continued. The continuity of the same business project at each theater and music hall represents the simple average of years over which multiple business projects continued. For "continuity" to be recognized, the same project does not need to continue throughout the 12 months. As shown in the table, the correlation between the continuity and the discrepancy coefficient registered a plus correlation coefficient, meaning the actual figure is larger than the estimated production function.

The purpose of using theaters and music halls is a categorical variable. A hall reserved exclusively for music events is categorized as "1," while a hall reserved for theatrical events is listed as "2." A multi-purpose hall is categorized as "3." The discrepancy coefficient will be the highest at a hall for music events. If a theater or music hall has multiple halls, the largest music hall among all halls possessed by it will be subject to this categorization because such hall has a big impact on its revenue.

Table 8 shows that the correlation coefficients are statistically significant regarding some indexes of theaters and music halls. However, the correlation coefficients are not statistically significant regarding the social and economic conditions of the areas that host theaters and music halls. If a larger number of people with high academic background works favorably for a larger audience, it is assumed that the number of audience visiting theaters and music halls will be larger than the production function estimated based on the number of employees and seats. Moreover, if the audience number is affected by the size of the income, there should be a larger-than-estimated audience as in the case of the number of people with high academic background and the percentage of such people against the population. However, this is not what happened. At theaters and music halls which saw a larger audience than the estimated production function, the main factors affecting their audience were the continuity of the same business project, which is an inherent index for theaters and music halls, the amount of revenue from the mainstay theatrical business, and the purpose of using the halls (hall for music events, hall for theatrical events, multi-purpose hall).

Given the analysis above, it is concluded that at Japan's top 20 theaters and music halls surveyed the audience number (amount of revenue) is determined by their inherent characteristics (fixed effects). On the other hand, the social and economic conditions in the areas that host these theaters and music halls do not correlate with their revenue. This means that regardless of where they are located, theaters and music halls can expect audience and revenue if they undertake unique art activities that reflect their inherent characteristics. The 20

theaters and music halls surveyed are located in political and economic centers of the prefectures whose average population is 7 million and whose population density is 7,100 per km^2 on a simple average basis, a sum compared with an average 535 per km^2 in Japan's urban areas. The 20 theaters and music halls are in a very advantageous position in terms of attracting potential visitors compared with locally based theaters and music halls—a situation that can be confirmed in light of findings in the already explained nationwide survey on theaters and music halls. Of the 20 theaters and music halls, 17 are located in big cities in the Tokyo metropolitan area and other areas whose population is 1 million or more—where transportation access to the theaters and music halls is good. As for theaters and music halls located in other parts of Japan, one cannot deny the correlation between their audience number and the residents' educational background and income, a theory advocated by the American economist Baumol.
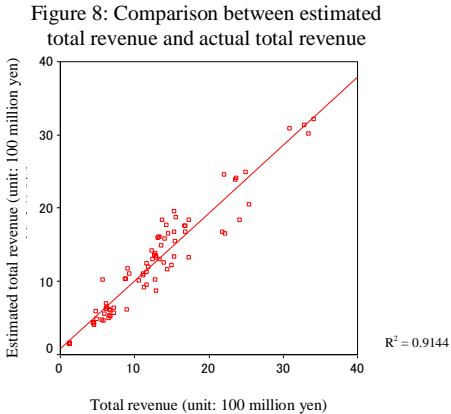
The following is a production function estimated using indexes with statistically significant correlation coefficients among the indexes listed on Table 8 other than labor (number of employees) and capital (number of seats), and other indexes with relatively high correlation coefficients.

$$\ln (\text{total revenue}) = 0.498\ln (\text{number of seats}) + 0.715\ln (\text{number of employees}) + 0.286\ln (\text{continuity of same business project})$$
$$(4.13) \qquad\qquad (9.93) \qquad\qquad (2.58)$$
$$- 0.297\ln (\text{purpose of using a theater hall}) - 4.019 \ldots\ldots\ldots\ldots(3)$$
$$(3.03) \qquad\qquad\qquad (7.39) \quad (\text{) represents t. degree of freedom - adjusted } R^2 = 0.895$$

The variance inflation factor is 5.78, which means that there is no need to take into consideration multicollinearity in each explanatory variable. In addition, the Kolmogorov–Smirnov test conducted on the residual shows that it is distributed normally. In view of an increase of about 0.24 in R^2, the model envisaged in this paper became persuasive. Figure 8 shows the comparison between the estimated production function of theaters and music halls, calculated using the two-production-factor model, and their actual production function. Unlike Figure 6, Figure 8 adds two indexes—continuity of the same business project and purpose of using theaters and music halls—to the two-production-factor model. Compared with Figure 6,

which shows a model for the two production factors, the number of dots distantly located from the 45-degree line (line on which the estimated production function matches the actual production function) is smaller in Figure 8, reflecting the addition of the two explanatory variables.

Comparison of formula (1) and formula (3) shows that the addition of the two indexes mentioned earlier—continuity of

Figure 8: Comparison between estimated total revenue and actual total revenue

Estimated total revenue (unit: 100 million yen)

$R^2 = 0.9144$

Total revenue (unit: 100 million yen)

the same business project and purpose of using theaters and music halls—, both being characteristics of each theater and music hall, to the production function resulted in a decrease in the degree of contribution of capital (number of seats) and labor (number of employees) to the total revenue. Specifically, the contribution by the number of seats fell 0.20 and that by the number of employees 0.05. These findings indicate that the margin of fall was significant for capital contribution while little was changed for labor contribution. The combined contribution of capital and labor to the total revenue was given as 1.213, slightly lower than that obtained with the two-production-factor formula (1), but still staying above 1. As in the case of the production function obtained with the two-production-factor model, increasing returns to scale were confirmed in the production function under the revised model. As stated earlier, the index related to the purpose of using theaters and music halls is categorized as "1" for music halls, "2" for theatrical halls, and "3" for multi-purpose halls. Generally, the number of seats at music halls is larger than that at theatrical halls. Accordingly, it is probable that part of the contribution by capital (number of seats) under formula (1) was distributed to the contribution by the index related to the purpose of using theaters and music halls. It is presumed that little was changed for contribution by labor (number of employees) because such contribution is not directly related to the types of theaters and music halls and the continuity of the same business project.

Under the revised model formula, the continuity of the same business project is a variable on the operational front, including how theaters and music halls are used. Meanwhile, the purpose of using theaters and music halls is a facility-related variable. Both variables are used as indexes showing the inherent characteristics of theaters and music halls. This means that the total revenue at theaters and music halls can be explained by variables that can apply to the entire industry, such as capital and labor, as well as indexes showing the inherent characteristics of theaters and music halls, including types of the halls and how they are operated and types.

In the Cobb–Douglas-type production function, if the production value is fixed in relation to the scale, the substitutability between production factors such as capital and labor is always 1; this production function employs a linear homogeneous equation concerning capital, labor, and production amount. In principle, capital is supposed to be measured in terms of service provided, not stock. However, halls are in full use at the surveyed theaters and music halls. Thus, needless to say that making stock-based change of the percentage of capital equipment against labor is justifiable at such theaters and music halls. However, the percentage of the nationwide use of halls (number of days used yearly/number of days available yearly for use) is about 78%, which is lower than at the theaters and music halls surveyed. This is a point requiring attention when the production function is calculated.

As estimated, the production amount (total revenue) at theaters and music halls can be explained to a significant extent using the Cobb–Douglas-type production function. The combined contribution of capital (number of seats) and labor (number of employees) to the production amount (total revenue) is 1.5, representing a linear homogeneous trend with increasing returns to scale confirmed. Theaters and music halls have equipment that cannot be moved once they are set up. If a certain theater or music hall earns the reputation of being excellent in competing against other theaters and music halls, that theater or music hall will become dominant in the region that hosts it. The labor conditions provided at such a theater or music hall are usually better, giving its employees no reason to move to other theaters or music halls and giving its employer no reason to change their workplaces. This is because the theater or music hall can obtain "rent" by possessing rare resources (reputation, excellent human resources) inseparably attached to the theater or music hall. This kind of rent was theorized by the British economist David Ricardo. According to this theory, the number of customers tend to increase at market-dominant theaters and music halls in proportion to the expansion of their theatrical activities.

Looking into the production functions of theaters and music halls with good reputation, this paper showed that the surveyed theaters and music halls have secured dominant positions in the regions that host them.

HOW THEATERS AND MUSIC HALLS SHOULD BE OPERATED AND THEIR FUTURE DIRECTION

This paper analyzed the relationship between the financial balance of excellent theaters and music halls in Japan and their hall facilities and employees, both credited with producing the excellent financial result. As the production function shows, if the revenue of a certain theater or music hall is determined by the number of seats and employees, how should the quality of its theatrical or music events be evaluated? It is generally difficult to assess the output or outcome of cultural facilities. But it is customary to evaluate the party that sets up the theater or music hall (spender of subsidy and grant) in light of the number of customers and revenue. As analyzed in chapter 2, in view of the production function of excellent theaters and music halls in Japan (highest-ranked theaters under theater support projects stipulated under the Theater Law), it was found that the number of employees contributed more to the output of theaters and music halls (revenue) than capital (number of seats). A figure listed as the number of employees incorporated into the production function does not represent the number of actual employees hired. Instead, the figure represents the gross personnel cost at theaters and music halls divided by the average per-capita personnel cost at the surveyed theaters and music halls. The

number obtained from this calculation will be adjusted considering region-by-region differences in labor conditions. If the gross personnel cost gets higher at theaters and music halls, the adjusted number of employees will rise, suggesting the employment of excellent and capable human resources. When the British economist John Maynard Keynes developed an idea on the aggregate production curve, he hypothesized that there are various types of labor but any labor can be measured using standard simple labor as a measurement unit. According to his hypothesis, which was based on a simple one-product model, there is a certain relationship between the entire amount of employment created for one production factor and the consequent entire output. This relationship is called aggregate production function. This paper monitored the activities of the 20 surveyed theaters and music halls for four years and analyzed the relationship between their output and employment. Subject to the survey were two production factors—the number of employees and the number of seats—and one output.

The two production factors are able to explain appropriately three-quarter of the revenue. To explain the residue, two indexes will be introduced, the length of operation of each theater and music hall, regarded as a management-related index, and the purpose of using a hall, regarded as an index showing a hall type. The addition of these two indexes to the production function will explain about 90% of the revenue. Following the incorporation of the two indexes, the production function at theaters and music halls will consist of four production factors and one output. Even after the addition, nothing will change regarding the degree of contribution to the output by labor (number of employees), as seen in the little change expected, from 0.773 to 0.725. In contrast, a larger fall is expected in the degree of contribution by capital (number of seats), from 0.671 to 0.498, a reduction of about 25%. This finding seems to indicate that the number of seats can play a greater role in changing the revenue. However, it was found that the ability of employees is a greater contributor. This is because if the gross personnel cost at theaters and music halls divided by the average per-capital personnel cost at the surveyed theaters and music halls gets higher, the workers whose personnel cost is higher are employed. This analysis is based on the assumption that capable employees are paid high. This assumption is probably correct.

In another words, at excellent theaters and music halls in Japan, human resources can contribute more to the revenue than seats and other facilities. This can probably be explained through the calculation of the marginal rate of substitution (MRS) between production factors. In a simple production function involving two production factors and one output, shown in formula (1), let's assume that the amount of output is set at a certain level. MRS between two production factors being used for one output is the marginal rate at which the use of one of the two production factors is curtailed and replaced by the use of the other production factor.

$$-\frac{dK}{dL} = \frac{\partial Y/\partial L}{\partial Y/\partial K} = \frac{\beta}{\alpha}\frac{K}{L} \quad \cdots\cdots \quad (4) \qquad \text{Assuming,} \quad Y = AK^{\alpha}L^{\beta} \qquad K: \text{Capital}, \quad L: \text{Labor}$$

$$\text{Under} \quad (1)\text{formula}, \alpha = 0.671 \qquad \beta = 0.773 \qquad MRS = 1.15\frac{K}{L} \qquad \frac{K}{L}: \quad \text{Capital} \quad \text{euipment} \quad \text{ratio}$$

Under formula (4) shown above, MRS is 1.15 times higher than capital equipment ratio. "A" in the formula represents the concept showing the efficiency of the use of capital and labor, which is called total factor productivity. Factors belonging to "A" are regarded as putting upward pressure on the amount of production, which cannot be measured by capital (number of seats) and labor (number of employees including their ability) alone (Uzawa, 1986). In view of formula (3), such concept includes the length of operation of theaters and music halls and types of the halls, both of which belong to their operational know-how, categorized as intangible assets. The existence of what is classified as "A" is shown in a significantly sharper fall in the contribution by capital compared with the contribution by labor, a finding made known in the comparison between formula (1) and formula (3).

Under the two-production-factor model, only the number of seats, a tangible capital, was taken as a production factor to be the input. However, it is possible for the theater and music hall business, a typical service industry, to have intangible assets inherently belonging to each hall that are categorized as capital goods. The same thing can be said of the hotel business, also a service industry, through which people's understanding of intangible assets may be enhanced. If a traditional hotel is compared with a newly opened hotel, for example, the accumulation of operational know-how is quite different between the two even if both are equipped with similar facilities and are staffed with same types of employees. The content of art performance to be presented, admission fees and types of audience must be different between the Paris Opera, for example, and a theater or music hall that imitated its style. This point was examined using a production function. Specifically, the production function based on two production factors applied to Japan's major opera house New National Theatre. With wage data taken into account, the adjusted number of employees at the New National Theatre is 207.2. The combined number of seats at the three halls of the theater is 3,265. Using the two-production-factor model, the total revenue at the New National Theatre is presumed to be 6.11 billion yen under formula (1). The sum is smaller than the 7.06 billion yen actually received by the theater, producing a surplus of about 1 billion yen above the presumed level, calculated for Japan's highest-ranked theaters. The New National Theatre's total revenue of 7.06 billion yen includes 4 billion yen in state subsidy, provided by the central government for its projects being entrusted to the theater. The subsidy accounts for 56.6% of the total revenue. If the total

revenue of Japan's highest-ranked theaters is to be raised, the appropriate amount of a subsidy to them would be about 3 billion yen per theater.

In the manufacturing industry, companies, in order to use new technologies effectively, need to combine them with conventional technologies and know-how, and review their organizational structures and manufacturing methods seamlessly (Penrose, 1959). Key to raising productivity in the manufacturing industry is to introduce innovative factory layout systems and manufacturing methods. At theaters and music halls, however, the use of traditional operational know-how accumulated there is different from the manufacturing industry in approach because there are many different intangible assets, including performance-related know-how and negotiations with art performers. It is likely to take long time for potentially productive intangible assets to reach a certain level of accumulation. At theatres and music halls, the length of their business operations has contributed to their revenue. In other words, they have been able to operate for a long time because there have been the accumulation of intangible assets.

Securing human resources is a necessary measure for theaters and music halls to present high-quality art performance, as pointed out in Ministry of Education, Culture, Sports, Science and Technology guidelines on ways to revitalize the business of theaters and music halls, issued in 2013. The notice described the improvement of the theatrical industry and deployment of necessary human resources as an imperative action to be taken. This paper clarified the contribution of human resources on the revenue side of theaters and music halls by employing a production function. However, this can apply only to the theaters and music halls covered by the latest survey. For similar effects to be produced, nearly 2,000 other theaters and music halls located in regional areas need to foster human resources deemed highly professional.

In the future, theaters and music halls across Japan are likely to take on a host of challenges in response to the rapidly changing cultural environment, including falling public grants, shrinking potential audience amid declining births and aging of society, expensive fees paid to performing artists and art groups, and subsequent raise in admission fees. Under these critical circumstances, it is imperative for the theaters and music halls to unify their domestic and overseas business resources that are sources of competitiveness and establish a system to achieve the unification. The theaters and music halls may be required to take a dynamic capabilities (DC) approach for that purpose (Burgelma, 1983; Eisenhardt & Martin, 2000).

WAY FORWARD

This research examined the productivity of Japan's top 20 theaters and music halls. Specifically, it analyzed their Cobb-Douglas-type production function and productivity. In future, it is planned to examine whether or not the findings in the latest research can be applied universally to other theaters and music halls. In economics, the use of general production functions—those not involving manufacturing industries—has been proposed. However, comprehensive discussion has not yet been made on production functions and productivity of theaters and music halls. The study being planned in the future will cover more theaters and music halls, with attention given to examining to what extent the findings obtained in this paper regarding the top 20, including the findings on their Cobb-Douglas-type production function, can apply to other theaters and music halls. Possible subjects of the future study are 1) about 2,000 theaters and music halls of varying sizes in Japan, and 2) similar theaters and music halls in the United States and Europe.

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