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Working Paper

On the Public Provision of the Performing Arts

Economics Working Paper, No. 2003-02 [rev.]

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Suggested Citation: Traub, Stefan; Missong, Martin (2003) : On the Public Provision of the Performing Arts, Economics Working Paper, No. 2003-02 [rev.], Kiel University, Department of Economics, Kiel

This Version is available at:
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On the Public Provision of the Performing Arts

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Christian-Albrechts-Universität Kiel

Department of Economics

Economics Working Paper

No 2003-02

On the Public Provision of the Performing Arts

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Abstract: In this paper, we present a model in which the performing arts are modelled as congestible public goods. In accordance with empirical evidence, the production of seat capacity is assumed to be subject to fixed costs. We estimate the parameters of the model's demand and cost functions using German data. Using these estimates in a subsequent social choice analysis, we show that the current situation in the German performing arts sector is best described by a directorship that under the influence of a selfish theater lobby maximizes only the welfare of the spectators. Such an equilibrium, characterized by too low ticket prices and too large capacity, is most likely to establish if citizens have a very positive ex ante notion of the performing arts.

Keywords: Performing Arts, Public Facilities, Congestion

JEL Classification: H40, D71, Z10

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1 Introduction

Among the many aspects of the performing arts that have either been or could be modelled economically (for an overview see Blaug, 2001), we focus on three "stylized facts" in this paper: First, in many countries, such as France, Germany and the United Kingdom, the provision of the performing arts is essentially assigned to the public sector. Second, publicly run performing arts organizations (henceforth PAOs) usually have relatively low box–office takings in relation to operating costs. Third, the rate of capacity utilization is far below 100%, i.e., there is a large and persistent excess supply of seats. For example, in the 2001/02 season, Germany's municipalities provided 152 public playhouses, opera houses and musical theaters. Their average box–office takings were only 12.9% of their total operating costs, corresponding to a mean subsidy of 101.79 € per ticket sold. Furthermore, Germany's public theaters could enter a utilization ratio of no more than 72% in the books.[1]

In order to explain these "stylized facts" we proceed as follows. After discussing some basic principles (Section 2), we develop a formal model in the style of Strotz' (1965) road congestion model, in which the performing arts are modelled as congestible public goods (Section 3). Having derived the demand and cost functions, we estimate the model parameters using German data for the 2001/02 season (Section 4). In a subsequent social choice analysis, we introduce three possible types of directorship (welfare maximization, profit maximization, maximization of the welfare of a theater lobby) and test which of them best describes the empirically observed equilibrium (Section 5). The paper ends in Section 6 with some concluding remarks.

[1] Most of Germany's 209 so–called private PAOs received large subsidies by their municipal or state governments, too.

2 Basic Principles

How should the performing arts be modelled? First of all, an adequate output measure is to be determined. While some authors used qualitative output measures,[2] we want to devote our model almost exclusively to the quantitative aspects of the performing arts. As noted by Throsby (1990), the perception of quality certainly plays an important part in demand and supply decisions in the performing arts. However, leaving aside the subjectivity of quality perception, almost all qualitative output measures lack a clear relation to input and, thus, production costs. According to Throsby and Withers (1979) the quantitative aspects of the performing arts are best measured in terms of seats, number of performances and *total seating capacity*.

A theater or a opera house is the typical case of a *congestible* public facility: For a given seating capacity, there is some degree of rivalry, which manifests itself in queues in front of the ticket office or in the noise level of a full house. Furthermore, consumers can easily be excluded at the ticket office or at the front door of the theater. The efficiency conditions for the provision of such goods were studied, for example, by Oakland (1972) and Sandmo (1973). For instance, from transportation economics it is known that the optimum toll for a congested road must equal the marginal congestion externality in the social optimum and that marginal cost pricing will bring in enough returns if capacity can be provided at constant returns to scale (for an overview see, for example, Small, 1992; and Arnott and Kraus, 2003).

[2] Throsby and Withers (1979) compiled a catalogue of qualitative measures such as the source material, the technical standard of a performance and its benefits to the audience, the society and the specific form of art. Throsby (1990) used press reviews to assess the quality of three theater companies in Sydney. See also Globerman and Book (1977) and Abbe–Decarroux (1994).

In principle, due to their excludability, the performing arts could be provided privately. However, from an empirical point of view, fixed costs speak on behalf the public provision of the performing arts. Diminishing average costs in the provision of seat capacity were documented, for example, by Baumol and Bowen (1966) for US symphony orchestras, Globerman and Book (1972, 1977) for Canadian theaters and orchestras, Lange et al. (1985) and Lange and Luksetich (1993) for Australian symphony orchestras, Gray (1992) for Norwegian theaters, Hjorth–Andersen (1992) for Danish theaters and Krebs (1996) for German theaters. In the following, we therefore assume that the production of seat capacity is subject to large *fixed costs*.

Many further reasons have been put forward to justify public provision. Baumol and Bowen (1966) argued the performing arts would suffer from the "cost disease"; but no empirical support was found for their hypothesis (Blaug, 2001, p. 131). According to Musgrave (1957), the performing arts have the character of a merit good which should be provided by the state on paternalistic grounds. Penne and Shanahan (1987) showed that US cities used arts investments as a tool to stimulate city development. Spatial externalities or spillovers could require a money transfer to cities operating PAOs. In this paper, we assume that the market for performance is defined at the level of municipalities. Other externalities than congestion will not be modelled. However, we will come back to possible positive externalities when assessing the efficiency of Germany's performing arts sector in Section 5.5.

3 The Model

We consider a municipality with a continuum of n citizens, where each citizen is characterized by a preference parameter ζ with continuous density function

$f(\zeta)$ and distribution function $F(\zeta)$. ζ encompasses all aspects of attending a play from which a member of the audience can benefit. Individuals are assumed to maximize the same quasi–linear utility function

$$u = x + v\left(z, \Gamma; \zeta\right). \tag{1}$$

As in Strotz (1965, p. 129), three arguments enter the utility function.

First, z is the number of visits to a theater. In order to simplify matters, we focus on a single play and assume that attendance is a binary choice variable, i.e., $z \in \{0, 1\}$.[3]

Second, Γ is a measure of congestion, which is identical for all citizens. Let us denote ticket demand (for a single play) by q and ticket supply or *capacity* by s, where the latter quantity simply is the number of seats offered per performance times the number of performances per staging. We define

$$L \doteq \frac{q}{s} \tag{2}$$

and henceforth call this ratio the *loading* of the theater. It is not too farfetched to assume that the loading of the theater will affect the experience of the performance itself, i.e., $\Gamma = \Gamma\left(L\right)$, with its first derivative denoted by Γ'. On the one hand, a relatively low loading may distract from the festive ambience of the event.[4] Nobody would like to sit in an empty theater. On the other hand, a relatively high loading may involve negative side effects. Anybody who has tried to purchase tickets for a popular production knows what we mean: After having waited in a long queue or having been placed in

[3]This excludes the possibility that a person repeatedly attends the same play. Furthermore, we implicitly assume that inhabitants have perfect foresight as to the perceived quality of the play and, therefore, will not leave the play part way through it. Note that in Strotz (1965), z, more generally is defined as a nonnegative real number, namely the number of trips on a highway.

[4]We thank Richard Arnott for stressing this point.

the waiting loop of a call center, one finds out that the most preferred dates or places are not available any more. Once one has made it to the theater, it is impossible to get a parking lot, the wardrobes are overcrowded and there is no chance of getting a refreshment between two acts. Above all, background noise interferes with artistic enjoyment.

The third argument in the utility function, x, $x \in \mathbb{R}_+$, is consumption of a numeraire good. A tax τ, $\tau \in \mathbb{R}$, is deducted from (exogenous) gross income y, $y \in \mathbb{R}_+$.[5] Note that tax and gross income may differ among citizens, but they do not depend on ζ. p is the price of an admission ticket in terms of the numeraire. Price differentiation with respect to tiers is not taken into account. Hence, the budget constraint of an individual is given by

$$y - \tau = x + p \cdot z. \tag{3}$$

Solving the utility maximization problem (1) with (3) as a constraint yields the demand function $z = z(\cdot, \zeta)$ and the indirect utility function

$$u = y - \tau - p \cdot z(\zeta) + v\left[z(\zeta), \Gamma(L); \zeta\right]. \tag{4}$$

[5]By assuming exogeneity of income, we neglect repercussions of PAOs on income. As noted above, one could argue that a theater is a kind of public input for the tourism industry and related branches, or that the performing arts raise the educational level and, therefore, increase the earning capabilities of the population. Hence, the model is only partial equilibrium. Likewise, separability of the utility function with respect to income and attending a performance is admittedly unrealistic. Empirical studies have shown individual preferences for the consumption of performance to depend positively on income and several characteristics which are linked to income such as education and exposure to the performing arts during childhood (see, e.g., Blaug 2001 and the references stated therein). In fact, in the empirical part of the paper, we will control for income effects. However, in order to keep the model mathematically tractable, we stick to this assumption in the theoretical parts of the paper.

We normalize the v function so that the utility of not attending the performance is zero:

$$v\left[z(\zeta), \Gamma(L); \zeta\right] = \begin{cases} 0 & \text{for } z = 0, \\ \zeta - \Gamma(L) & \text{for } z = 1. \end{cases} \tag{5}$$

If a person visits the theater, the disutility of congestion has to be set off from the positive aspects of attending a performance. Obviously, a person is indifferent as to whether she will attend or forego a performance if $u\left(z = 0\right) = u\left(z = 1\right)$ or

$$\zeta = p + \Gamma(L). \tag{6}$$

In equation (6), ζ has an easy interpretation. It is the reservation price of attending a performance, i.e., the maximum amount a person would be willing to spend on an admission ticket, including congestion costs.

Since the reservation price is distributed with $F(\cdot)$, total ticket demand for a staging is given by

$$q = n\left\{1 - F\left[p + \Gamma\left(\frac{q}{s}\right)\right]\right\}. \tag{7}$$

This is a demand relation that cannot be solved for q without making assumptions about the shape of $F(\cdot)$. Yet, general statements about the impact of changes of the capacity of the theater and the ticket price on ticket demand are possible. Writing (7) as an implicit function Φ and using the implicit function theorem yields

$$\frac{dq}{dp} = -\frac{\Phi_p}{\Phi_q} = -\frac{nf}{1 + nf\Gamma'\frac{1}{s}} \tag{8}$$

and

$$\frac{dq}{ds} = -\frac{\Phi_s}{\Phi_q} = \frac{nf\Gamma'\frac{q}{s^2}}{1 + nf\Gamma'\frac{1}{s}}. \tag{9}$$

According to (8), a price increase unambiguously reduces ticket demand. A positive Γ', i.e., a relatively high loading, attenuates the negative effect of

the price increase since the decrease in the loading positively affects ticket demand. Otherwise, if the loading is relatively low ($\Gamma' < 0$), the effect of a price increase is magnified. Furthermore, the larger the capacity of the theater, the less pronounced is the congestion effect. Equation (9) shows that a capacity increase either stimulates or weakens ticket demand, depending on the sign of Γ'.

On the supply side, we assume the PAOs' cost function to be given by

$$C = C_f + \alpha s, \tag{10}$$

where C_f are the fixed costs and α the marginal provision costs. Costs include maintaining the theater *and* producing the staging. In this respect, our model differs from the road congestion model. Strotz' (1965) considers pleasure trips, i.e., the road converts, say, a nice landscape into utility, where the landscape is obviously not being "produced" as a staging.

4 Empirical Test

4.1 Empirical Model Specification

Solving the demand relation (7) for p yields the inverse demand equation

$$p = F^{-1}\left(1 - \frac{q}{n}\right) - \Gamma\left(\frac{q}{s}\right), \tag{11}$$

where F^{-1} is the inverse of the distribution function of ζ. In order to make the model empirically testable, we assume that preferences are uniformly distributed over the interval $[0, \bar{\zeta}]$, where $\bar{\zeta}$ is the maximum willingness–to–pay (WTP) for an admission ticket.[6] With uniform preferences, we have

[6] We also did robustness checks with exponential and logistic preferences. Since this led to qualitatively and quantitatively similar results, we omit the respective calculations and

$F^{-1} = \bar{\zeta} \cdot (1 - q/n)$. The term $(1 - q/n)$ is simply the share of non–visitors in the total population of the municipality. Mean and Variance of the WTP are given by $\bar{\zeta}/2$ and $\bar{\zeta}^2/12$, respectively.

As the demand for theatrical performance has been shown to depend on income by several authors, we control for income effects by making the parameter for the maximum WTP depend on income, i.e., adding the respective interaction terms between income Y and demand: $F^{-1} = \bar{\zeta}_0 \cdot (1 - q/n) + \bar{\zeta}_1 \cdot Y \cdot (1 - q/n)$. Likewise, other demographic variables that could possibly affect ticket demand can be integrated into the empirical model.

Finally, the congestion function has to be parameterized. A congestion function that has become standard in transportation economics[7] is given by

$$\Gamma(L) = \gamma_0 + \gamma_1 L^{\gamma_2}, \tag{12}$$

where $\gamma_1, \gamma_2 > 0$. Hence, the disutility of congestion is a monotonously increasing function of the loading. In our model, however, this specification has to be replaced by a functional form allowing for a critical loading L_0 which leads to a global minimum of the disutility of congestion, say, $\Gamma(L_0) = \gamma_0$. We use

$$\Gamma\left(\frac{q}{s}\right) = \gamma_0 + \gamma_1 \left(\left|\frac{q}{s} - L_0\right|\right)^{\gamma_2}. \tag{13}$$

The congestion function (13) can be convex ($\gamma_2 > 1$), linear ($\gamma_2 = 1$), or concave ($0 < \gamma_2 < 1$).[8] If $\gamma_0 > 0$, then there are—even if the actual loading is optimal with respect to the critical value—additional subjective costs of

results here. These are reported, however, in an extended working paper version of this article (Traub and Missong, 2003).

[7]See Arnott and Kraus (2003). Alternative functional forms, such as the piecewise linear congestion function, are discussed, for example, in Small (1992).

[8]Note that we assume here that the disutility of congestion is symmetric around the critical loading. In the empirical analysis, we also experimented with non–symmetric specifications. However, we did not find significant indications for non–symmetry.

attending a performance that are not covered by the ticket price. As noted above, these costs comprise the disutility of congestion (i.e. queueing and noise) and a reduction of the festive nature of the performance caused by empty seats. If the actual loading is higher than the critical value, congestion costs increase faster than the latter decrease and vice versa.

4.2 The Data

We used two data sources, the Theaterstatistik, an annual publication of the German association of public PAOs (Deutscher Buehnenverein, 2001/2002), and the statistical yearbook of German municipalities, which is edited by the Deutscher Staedtetag (2000). Except for data taken from the statistical yearbook, all data refer to the 2001/02 season. Inter alia, the Theaterstatistik lists all German public PAOs with their location (municipality), the number of inhabitants of the municipality (as of January 2002), the number and names of stages, and—for every stage—the number of seats offered to the audience (per performance), the number and types (opera, ballet, play, etc.) of performances, including guest performances of external companies. Furthermore, for every stage, the Theaterstatistik shows the total number of visitors (including external guest performances). At the PAO–level, the statistic accounts for operating revenues and expenses, split up into several subcategories.

Table 1 lists the most important data for Germany's public theater sector. In the 2001/02 season, there were 115 locations with at least one PAO.[9] The total seating capacity in the 2001/2002 season reached some 27 million. Given that only about 20 million tickets were sold, the average loading was 72%.

[9]Since 7 PAOs were jointly operated by two municipalities, the actual number of municipalities involved in the provision of the performing arts was 122.

Note that these figures include only tickets sold at the location of the PAO including guest performances of external companies on one of the PAO's stages, while guest performances of one of the PAO's companies at other municipalities had to be omitted since no information about the respective seating capacities, population etc. is available.

Operating revenues were computed as the sum of ticket revenues, wardrobe fees, and program fees. Other sources of revenue such as from TV and radio broadcasts were not taken into account. Operating expenses consist of personnel costs and material costs such as equipment and copyright dues less the costs of guest plays in other municipalities (which do not enter ticket revenues either). As can be taken from Table 1, an average PAO suffered a loss of about 100 € per ticket sold, which had to be set off by subsidies.

Table 2 lists the variables used in the empirical analysis and their means. The prevailing price of a ticket on a location was computed as the ratio of the 2001/02 season's operating revenues and the number of visitors. The table shows that the average ticket price p was 10.98 €. As in the theoretical model, q is the number of tickets sold *per staging* and s is the seating capacity *per staging*, i.e., the number of visitors and the capacity on a location were divided by the number of stagings within the season. The loading L is defined by equation (2). The mean of the population, n is a bit higher than in Table 1, since three relatively small cities dropped out of the sample.[10]

In contrast to demand, where we considered the municipal level (112 locations), in estimating the cost function we focussed on the PAO level since aggregating over different PAOs would not produce sensible estimates for the fixed costs C_f and the marginal cost parameter α. We computed average costs

[10]The three excluded cities are Dinslaken (no box–office returns), Eggenfelden and Landshut (irresolvable data inconsistencies with respect to loading and price).

per staging of some 600,000 €. Note that we included all 152 PAOs as there were no inconsistencies or noticeable problems with the cost–data.

While the basic model as outlined in Section 3 comprises variables p to C, in some of the regressions, we also included an income variable Y in order to control for income effects. Since neither the Theaterstatistik nor the statistical yearbook contain data on incomes at the municipal level, we constructed an index from the *per capita income tax returns* that are shown for every municipality in the statistical yearbook. Y is the yearly per capita income tax returns, centered and normalized by its mean ($Y = (y - \mu_y)/\mu_y$).

In a theater landscape like Germany's there are obvious differences in quality. In the theoretical part of the paper, we could neglect those differences as we derived seat demand and capacity supply for a hypothetical "average" staging. In contrast to this, it is to be expected that empirical prices and quantities reflect a large variance of quality. We therefore attempt to control for quality effects by using a suitable proxy variable. The variable we chose is population size and reflects the authors' opinion that, on average, metropolitan theaters provide qualitatively better performances than provincial theaters. Like income, population size n entered some of the regressions centered and normalized by its mean.

Furthermore, the following dummies and control variables were included in the demand regressions.

- *East*: there may be differences in demand behavior between East and West German municipalities, i.e., less WTP in East Germany.

- *Uni*: the existence of a university on location should lead to higher demand, since the educational level of the population is higher.

- *Age*: econometric demand studies show that young parents cannot af-

ford time and money to regularly attend theatrical performances. Since no information on the age distribution at the municipal level was available, we chose the ratio of places in old people's homes and kindergarden places, centered and normalized by the mean, as a proxy. Both figures are listed in the statistical yearbook.

- *Share*: not only income but also the tax rate enters the budget constraint (3). Share is the proportion of subsidies, necessary to make up for the losses of the PAO(s), which a municipality has to shoulder itself. Data source is the Theaterstatistik. An increase in *share* decreases net income and should therefore reduce demand.

4.3 Estimation and Results

The empirical model consists of the two equations

$$\begin{aligned} p_j &= F^{-1}\left(1-\frac{q_j}{n_j}\right) - \gamma_0 - \gamma_1 \left(|L_j - L_0|\right)^{\gamma_2} + \varepsilon_2 \qquad (14) \\ & \quad j = 1, \ldots, 112 \\ C_k &= C_f + \alpha s_k + \varepsilon_2 \qquad (15) \\ & \quad k = 1, \ldots, 152, \end{aligned}$$

where F^{-1} has to be replaced by the inverse of the uniform distribution function and may also include interaction terms with income and other variables. First, we estimated both equations separately. As the congestion function is nonlinear in its parameters, we used nonlinear least squares (NLSQ) in order to estimate the demand function. Applying NLSQ to our data set led to serious convergence problems, and the results turned out to be very sensitive to the choice of starting values. Hence, we decided to linearize the model and to combine estimation with a grid search algorithm for the best fitting value of the critical loading L_0.

Linearization means that we fixed the parameter value of γ_2 at 2, 1, and 0.5, respectively, which gives the congestion function a u–shape (increasing marginal disutility), a v–shape (constant marginal disutility), or a concave shape (decreasing marginal disutility). Concerning L_0, we used a grid search on the closed interval $[0, 1]$ with a grid size of 0.01. Below, only results shown are those which gave the best fit in terms of maximizing the likelihood function. Throughout estimation, the Breusch–Pagan statistic indicated heteroscedasticity of the residuals. As we were not able to correct for this using transformations of the estimation equation, we account for heteroscedasticity by calculating White's heteroscedasticity consistent estimator of the covariance matrix.

Table 3 contains the results of estimating the demand equation with uniform preferences, Tables 4 and 5 for exponential and logistic preferences, respectively. Model I is the basic model as outlined in Section 3 of the paper. Model II additionally accounts for income as an explanatory variable. In the third model, all variables described above entered the regression at some step of the analysis. At the head of the table, the specification of γ_2 is stated. For models II and III, we only list the results for decreasing and constant marginal disutility, because the u–shaped congestion function always gave the worst fit. The bottom of the tables contain log–likelihood, F statistic, adjusted coefficient of determination, and Breusch–Pagan's test for heteroscedasticity.

We only comment on the linear model with $\gamma_2 = 1$. According to our Model I, the maximum WTP for a ticket is about 32 € and the mean WTP is close to 16 €. As to the congestion function, we record an intercept of 18 € and marginal congestion costs of 12 €. For the critical loading, we get sensible figures. A $\hat{L}_0$ of 0.85 means that spectators feel most comfortable

with the external circumstance of visiting a performance if about 85 percent of all seats are taken.

Adding income to the regression (Model II) shows that the maximum WTP depends positively on the income level of the municipality, where an average city exhibits a $\hat{\bar{\zeta}}$ of 25 € only.[11] Adding income also pushes back the negative influence of congestion on ticket demand. In this regression, $\hat{\gamma}_0$ is insignificant; $\hat{\gamma}_1$ is only 8 €, though still significant at the 10% level. This result may be driven by a slight multi–collinearity problem as, particularly in East Germany, there is a high positive correlation between income and loading.

Model III includes all variables listed in Table 2 except for age and the dummy for East Germany. Age was not significant in any of the regressions and was therefore excluded from further consideration. Using the East dummy together with income involved a huge multi–collinearity problem, since there were only three West German municipalities with comparably low income. As can be taken from Table 3, ticket demand shrunk significantly if the citizen of the municipality had to bear a higher share of subsidies. Note that a higher need for subsidies could also reflect lower performance quality.

In university towns, the WTP for tickets was generally higher. Population size had a positive effect on ticket demand. As argued above, population may be seen as a very crude proxy for quality. Hence, quality had, as expected, a positive impact on the citizens' WTP. Again, however, there is a positive

[11] In the table, we denote this influence by the interaction "Income × Maximum WTP" in order to highlight that the respective coefficient is part of the maximum WTP, i.e., $\bar{\zeta} = \bar{\zeta}_0 + \bar{\zeta}_1 Y$, while the "true" interaction is, of course, between demographic variable and demand term, i.e., $Y \times (1 - q/n)$. The same remark applies to Model III for the other demographic variables. Note also that we implicitly assume that income and the other demographic variables have a linear impact on the maximum (mean) WTP.

mutual correlation between the four variables income, population, university, and loading, which may help to explain the low and insignificant values we obtained for the congestion parameters.

As regards to the costs function, our estimates for the fixed costs and the marginal provision costs are given by about 290,000 € per staging and 35 € per seat (see Table 6), respectively. In columns 2 and 3 of the table, we have listed the same estimates for PAOs with and without competitors at their location. At 14% of all locations more than one PAO was active. Our results suggest that municipalities with multiple PAOs exerted pressure on the marginal costs, while fixed costs were lower if there was no competitor. We also report separate estimates for pure opera houses and theaters in the last two columns of the table.[12] Opera houses were operating with huge fixed costs, about 900,000 €, and small variable costs as compared to theaters, which exhibited fixed costs per staging of not much more than 75,000 €.

To summarize this section, our empirical estimations of the demand function and the cost function generally confirm our theoretical model. The central parameters of the model are significantly different from zero and exhibit the right sign. We attribute the deterioration of the estimates for the congestion function in the models with income and other control variables to multi–collinearity among these variables. Note that we also estimated the empirical model with generalized least squares (GLS) as a system of seemingly unrelated regression equations (SURE). Since the results did not change qualitatively as compared to the single equation regressions and the SURE model did not improve on the efficiency of the parameter estimates, we omit the respective tables.[13]

[12]The remaining 68 PAOs provide a mixed program.

[13]Some of the locations have more than just one PAO. In the SURE model, these location gain a greater weight in the demand equation, proportional to the number of PAOs. This

5 Social Choice Analysis

5.1 Preliminaries

We begin this section with some assumptions and definitions. In Subsections 2 to 4, we theoretically analyze three different potential types of directorship, to wit, welfare maximization, profit maximization and maximization only of the welfare of the theater lobby. Subsequently, we derive for each type of directorship the conditions to be a social choice equilibrium. Completing the section, we use the empirical estimates from the previous section to test which of these equilibria best describes the current situation of the performing arts in Germany.

Since the general theoretical model outlined in Section 3 cannot be solved algebraically, we proceed on the following simplifying assumptions:

- Preferences are uniformly distributed over the closed interval $[0, \bar{\zeta}]$.

- The congestion function[14] is linear and we do not consider the case of a loading of the facility too low, i.e., we restrict our attention to $q/s \geq L_0$, which then yields

$$\Gamma = \gamma_0 + \gamma_1 \left(\frac{q}{s} - L_0 \right). \tag{16}$$

  Obviously, if the loading was too low, a profit or welfare maximizing director would reduce the number of seats, thereby simultaneously saving costs and decreasing the disutility of under–utilization, at least until the lower bound $L = L_0$ is reached.

is in contrast to the single equation analysis, where all locations are treated equally.

[14]Note that the assumption that Γ is identical for all citizens guarantees that the monopoly price exceeds the welfare maximizing price. With heterogeneous congestion costs, the order of prices could be reversed if marginal consumers are sufficiently more averse to congestion than inframarginal consumers (see Edelson, 1971; and Mills, 1981).

- All citizens dispose of the same income which is normalized to zero.

- All citizens are burdened with identical head taxes

$$\tau = -\frac{pq - C}{n}, \tag{17}$$

  i.e., gains and losses of operating the PAO are shared equally by all citizens including those who do not attend performances. Hence, the subsidies that are necessary to make up for the losses of the PAO are taken from general tax money. In the same manner, gains fully benefit the citizens of the municipality. Note that this assumption implies that there are no welfare leakages.

Given these assumptions, the utility of an inhabitant is given by

$$u = \frac{pq - C_f - \alpha s}{n} + \left[\zeta - p - \gamma_0 - \gamma_1 \left(\frac{q}{s} - L_0\right)\right] z \tag{18}$$

with

$$z = \begin{cases} 1 & \text{for} \quad \zeta - p - \gamma_0 - \gamma_1 \left(\frac{q}{s} - L_0\right) \geq 0 \\ 0 & \text{else.} \end{cases}$$

Accordingly, inverse ticket demand is given by

$$p = \bar{\zeta}\left(1 - \frac{q}{n}\right) - \gamma_0 - \gamma_1 \left(\frac{q}{s} - L_0\right). \tag{19}$$

We anticipate subsequent results and note that the optimum loading $L^\star$ is independent of the type of directorship given by

$$L^\star = \begin{cases} 1 & \text{for } \alpha \geq \gamma_1 \\ \sqrt{\frac{\alpha}{\gamma_1}} & \text{for } \gamma_1 > \alpha > \gamma_1 L_0^2 \\ L_0 & \text{else.} \end{cases} \tag{20}$$

As regards to public facilities offering output in terms of discrete indivisible units such as seats, a loading in excess of one is unrealistic. Hence, if marginal provision costs are larger than marginal congestion costs, the optimum

loading is reached at unity. If congestion is more important than provision, then the optimum loading is determined by the ratio of marginal provision and congestion costs. Since the case $L < L_0$ has been ruled out by us for logical reasons, for values of α smaller than $\gamma_1 L_0^2$, any type of director will choose s such that $L = L_0$. As a by–product, ticket demand is proportional to seat supply

$$q^r = s^r L^\star, \quad r = \{W, M, C\}, \tag{21}$$

where W, M, and C stand for welfare maximization, profit maximization and maximization of the welfare of the theater lobby, respectively.

Furthermore, in order to abbreviate mathematical expressions, we define ξ and θ as follows:

$$\xi = \begin{cases} \alpha & \text{for } L^\star = 1 \\ \sqrt{\alpha\gamma_1} & \text{for } 1 > L^\star > L_0 \\ \gamma_1 L_0 & \text{for } L^\star = L_0 \end{cases} \tag{22}$$

and

$$\theta = \gamma_0 + \gamma_1(L^\star - L_0). \tag{23}$$

The former expression, ξ, is the social marginal cost of an additional spectator (i.e. $\partial C/\partial q$). In the intermediate case, it is just the geometric mean of marginal provision and congestion costs. In the two special cases, only marginal provision costs or marginal congestion costs become relevant for society. The latter expression, θ, is the congestion costs experienced by an attendant. It is a constant part in the utility function: by definition $q/s = L$ and we know from above that $L^\star$ is a fixed term determined only by the two different types of private marginal costs. Hence, we arrive at (23) by plugging (20) into the term in brackets in the utility function (18).

5.2 Welfare Maximization

In the case of welfare maximization, the director of the PAO acts as a social planner who chooses price and capacity to maximize the sum of utilities of the municipality's citizens, $\left\{p^W, s^W\right\} = \arg\max_{p,s} W$, where every citizen is given the same weight. The municipality's welfare can be obtained by integrating (18) over ζ which yields

$$W = pq - C_f - \alpha s + n \cdot \frac{\left[\bar{\zeta} - p - \gamma_0 - \gamma_1 \left(\frac{q}{s} - L_0\right)\right]^2}{2\bar{\zeta}}. \tag{24}$$

The first part of the expression is the PAO's losses, while the second part is consumer surplus.

After deriving the welfare function (24) and solving the first order conditions for p and s, we obtain the welfare maximizing price

$$p^W = \xi \tag{25}$$

and capacity

$$s^W = n \cdot \frac{\bar{\zeta} - \theta - \xi}{\bar{\zeta}} \cdot \frac{1}{L^\star}. \tag{26}$$

This result does not harbor any surprises: the efficient ticket price covers the social marginal costs. The optimum seating capacity is just the expected number of attendants adjusted for the optimum loading.

Setting $W = 0$ and solving (24) for n results in the provision threshold

$$n^W = \frac{2C_f\bar{\zeta}}{(\bar{\zeta} - \theta - \xi)^2}. \tag{27}$$

Only cities exhibiting a population of size n^W or larger can operate a PAO without welfare losses. Otherwise, consumer surplus would not suffice to cover the fixed costs.[15]

[15] Provision thresholds have been studied, for example, by Schmandt and Stephens (1960), and may be regarded as an explanation of the high degree of congestion of local public goods found in empirical studies. On the so–called "zoo effect" see Oates (1988).

5.3 Profit Maximization

Next, we consider the laissez–faire equilibrium. With diminishing average costs in the long run only a single theater will survive at each municipality. Hence, its director behaves as a monopolist, and she will choose price and capacity to maximize her institution's profit, i.e., $\left\{p^M, s^M\right\} = \arg\max_{p,s} \Pi$, where

$$\Pi = pq - C_f - \alpha s. \tag{28}$$

Solving the maximization problem, the monopolist's profit maximizing price is given by

$$p^M = \frac{1}{2}\left(\bar{\zeta} - \theta + \xi\right), \tag{29}$$

and the capacity supplied is exactly half of that in the social optimum:

$$s^M = \frac{1}{2} \cdot n \cdot \frac{\bar{\zeta} - \theta - \xi}{\bar{\zeta}} \cdot \frac{1}{L^\star}. \tag{30}$$

Comparing (25) with (29) shows that the monopoly price is larger than the welfare maximizing price if the maximum WTP for a ticket exceeds the social marginal costs of a ticket plus the individual congestion costs, i.e., if there is demand for tickets under welfare maximizing directorship. The monopolist will operate the facility only if the condition

$$n^M \geq \frac{4C_f\bar{\zeta}}{(\bar{\zeta} - \theta - \xi)^2} \tag{31}$$

holds. Accordingly, private provision of the performing arts requires twice the population as compared to (welfare maximizing) public provision.

5.4 Lobby Welfare Maximization

The theater lobby is composed of the citizens who attend performances. Under the influence of the theater lobby, the director chooses p and s to

maximize the welfare of the spectators only, $\{p^W, s^W\} = \arg\max_{p,s} W^C$. It is assumed that the director draws on the non–members, too, for financing the PAO.[16] As many public facilities are partly financed by the community as a whole but frequented only by an interest group which additionally pays user charges or membership fees (for example, swimming pools, libraries, and gymnasiums), we believe that we can make a good case for this assumption.

The theater lobby's welfare is given by

$$W^C = (pq - C_f - \alpha s) \cdot \frac{q}{n} + n \cdot \frac{\left[\bar{\zeta} - p - \gamma_0 - \gamma_1 \left(\frac{q}{s} - L_0\right)\right]^2}{2\bar{\zeta}}. \tag{32}$$

Solving the first order conditions results in the lobby's optimum ticket price

$$p^C = \frac{1}{6}\left[3\bar{\zeta} - 4\theta + 2\xi - \sqrt{\left(3\bar{\zeta} - 2\theta - 2\xi\right)^2 - 12\frac{\bar{\zeta}}{n}C_f}\right] \tag{33}$$

and capacity

$$s^C = \frac{1}{6} \cdot n \cdot \frac{\left[3\bar{\zeta} - 2\theta - 2\xi + \sqrt{(3\bar{\zeta} - 2\theta - 2\xi)^2 - 12\frac{\bar{\zeta}}{n}C_f}\right]}{\bar{\zeta}} \cdot \frac{1}{L^\star}. \tag{34}$$

Equation (32) cannot be solved algebraically for n in order to compute the provision threshold for the lobby in general. However, as an attendant will be interested in a lobby "membership" only if $u^C(z = 1) > u^W(z = 1)$, such a type of directorship can establish itself only if the condition

$$n^C > \frac{\bar{\zeta} C_f}{(\bar{\zeta} - \theta - \xi)(\theta + \xi)} \tag{35}$$

holds. For a population of n^C or larger, the lobby ticket price is smaller and the lobby seating capacity is greater than the welfare maximizing. Furthermore, it is easy to show that n^C is greater than (equal to, smaller than) n^W

[16] In this respect the PAO differs from what is usually considered as a club in local public finance (Buchanan, 1965). See also Reiter and Weichenrieder (1999).

if $\bar{\zeta}$ is greater than (equal to, smaller than) $3 \times (\theta + \xi)$. In the latter case, $n^C < n^W$, where the maximum WTP for attending a performance is relatively low, the lobby would operate the PAO even though it should be shut down completely due to welfare losses. For the remainder of this section, we assume that condition (35) is fulfilled.

5.5 Equilibrium

Let us assume that, in an original state where the citizens of the municipality neither know their own preferences nor the distribution of preferences, they have to decide on the provision mode of the performing arts. Which type of directorship will emerge?

Result 1 (Profit Maximization) *If citizens are pessimistic, i.e., they believe that they will not be interested in the performing arts, the social consensus will be the provision of the performing arts by private monopolists.*

The argument is based on Rawls (1971) difference principle. If people have to decide from under a veil of ignorance, by lack of distributional information, they choose the mode of provision where the worst outcome in that mode of provision is better than the worst outcome in any alternative mode. Hence, the worst case (to be assumed) would be no interest in theaters at all.

Under welfare maximizing directorship, the indirect utility of a person not attending a staging is given by her share of fixed costs of that staging

$$u^W(z = 0) = -\frac{C_f}{n}, \tag{36}$$

while monopolistic directorship additionally gives her a share in the PAO's profits

$$u^M(z = 0) = -\frac{C_f}{n} + \frac{1}{4}\frac{(\bar{\zeta} - \theta - \xi)^2}{\bar{\zeta}}. \tag{37}$$

Under the lobby solution, the utility of a non–attendant is given by

$$u^C(z=0) = -\frac{2}{3}\cdot\frac{C_f}{n} - \frac{1}{18}\frac{(\theta+\xi)\left[3\bar{\zeta}-2\theta-2\xi+\sqrt{(3\bar{\zeta}-2\theta-2\xi)^2-12\frac{\bar{\zeta}}{n}C_f}\right]}{\bar{\zeta}}, \tag{38}$$

which is smaller than (36) by condition (35). Hence, we have $u^M(z=0) > u^W(z=0) > u^C(z=0)$ which closes the argument.

Result 2 (Welfare Maximization) *If citizens are uncertain whether they will be interested in the performing arts, then the social consensus will be the public provision of the performing arts by a welfare maximizing social planner.*

The argument is based on Bernoulli's and Laplace's principle of insufficient reason (see Luce and Raiffa, 1957): there is a continuum of mutually exclusive events ζ, the possibilities of which are unknown. Hence, the citizens assume that all ζ's are equally likely, and they base their decision on the provision mode on the expected utility of the alternatives at hand.

Due to the linear structure of preferences, computation of a citizen's expected utility is straightforward:

$$EU^W = -\frac{C_f}{n} + \frac{1}{2}\cdot\frac{(\bar{\zeta}-\theta-\xi)^2}{\bar{\zeta}}, \tag{39}$$

$$EU^M = -\frac{C_f}{n} + \frac{3}{8}\cdot\frac{(\bar{\zeta}-\theta-\xi)^2}{\bar{\zeta}}, \tag{40}$$

and

$$EU^C = -\frac{5}{6}\cdot\frac{C_f}{n} + \frac{1}{36}\cdot\frac{(3\bar{\zeta}-2\theta-2\xi-\sqrt{(3\zeta-2\theta-2\xi)^2-12\frac{\bar{\zeta}}{n}C_f})(3\bar{\zeta}-4\theta-4\xi)}{\bar{\zeta}} \tag{41}$$

Obviously, we have $EU^W > EU^M$. Furthermore, $EU^W > EU^C$ if condition (35) holds, which closes the argument.

Result 3 (Lobby Welfare Maximization) *If citizens are optimistic, i.e., they believe that they will be interested in the performing arts, then the performing arts will be provided publicly by a director who maximizes the welfare of theater lobby only.*

This result is based on the assumption that citizens follow a maximax strategy, i.e., they opt for that mode of provision where the best outcome in that mode of provision is better than the best outcome in any alternative mode. Hence, they are extremely optimistic to attend performances. Setting $\zeta = \bar{\zeta}$, the utility of a citizen is given by

$$u^W(z=1) = -\frac{C_f}{n} + \bar{\zeta} - \theta - \xi, \tag{42}$$

$$u^M(z=1) = -\frac{C_f}{n} + \frac{1}{2}(\bar{\zeta} - \theta - \xi), \tag{43}$$

or

$$u^C(z=1) = -\frac{C_f}{n} + \frac{1}{18} \cdot \frac{(3\bar{\zeta} + \theta + \xi)(\sqrt{(3\zeta - 2\theta - 2\xi)^2 - 12\frac{\bar{\zeta}}{n}C_f})}{\bar{\zeta}}, \tag{44}$$

respectively. Obviously, we have $u^W(z=1) > u^M(z=1)$. $u^C(z=1) > u^W(z=1)$ follows from condition (35), which closes the argument.

5.6 Empirical Assessment

In the previous subsection, we have shown that the more likely the citizens presume that they will benefit from the performing arts, the higher the probability that the performing arts are publicly provided under the influence of a selfish theater lobby. Here, we test which of the three social choice equilibria

best describes the German performing arts sector. In line with the linearized theoretical model, we resort to the empirical Model I with uniform preferences and $\gamma_2 = 1$. Hence, the following parameter values enter the analysis: the maximum WTP is $\hat{\bar{\zeta}} = 31.68$, the parameters of the congestion function are $\hat{\gamma}_0 = 17.66$ and $\hat{\gamma}_1 = 12.19$, the critical loading is $\hat{L}_0 = 0.85$, and the marginal and fixed costs are $\hat{\alpha} = 35.25$ and $\hat{C}_f = 288,465$, respectively (see Tables 3 and 4). Since the marginal provision cost exceed the marginal congestion costs, we have to set $\hat{L}^\star = 1$, otherwise every seat would have to be occupied 1.7 times. Accordingly, we get $\hat{\theta} = 19.49$ for the congestion costs experienced by a spectator and $\hat{\xi} = 35.25$ for the social marginal costs of an additional spectator.

The first puzzling observation to be highlighted here, is that the actual average loading of Germany's PAOs was only 0.7162 (std. error 0.0090) while the optimum loading had been $L^\star = 1$. A one–tailed t test rejects the null hypothesis of the mean to be one ($n = 112$, $t = 31.533$, $p < .01$). Since the marginal congestion costs were distinctly smaller than the average provision costs, any type of director would have been better off with decreasing the capacity of the PAO. Though the model predicts that a loading below unity can be optimal if congestion is just important enough, the model cannot explain this empirical observation. Hence, there must be other reasons for the average loading of German PAOs being so low. A possible explanation might be that the capacity of the facility is not as variable as assumed in the model.[17]

A further important observation is that the maximum WTP for a ticket

[17]Capacity adjustment may not only be restricted by edificial and technical reasons but also by labor law. The "Normalvertrag Buehne", the collective labor agreement between all German actors and PAOs also contains very detailed working time regulations that may prevent PAOs from reducing the number of performances of the same staging.

is very small as compared to attendance costs, i.e., the condition $\bar{\zeta} - \theta - \xi > 0$ is not fulfilled. Unfortunately, this aggravates further computations. In particular, we cannot compute $\hat{p}^M$, $\hat{s}^M$, $\hat{s}^W$, $\hat{p}^C$ and $\hat{s}^C$ in order to perform the test which of the three social choice equilibria best describes the current situation in the German performing arts sector. We are able, however, to compute the welfare maximizing ticket price, which according to equation (25) must equal the social marginal cost: $\hat{p}^W = 35.25$ € (std. error: 5.18). Given the actual average ticket price of $p^{act} = 10.98$ € (std. error: 0.43), a one–tailed t test clearly rejects the null hypothesis of equality of the two means ($n = 112$, $t = 4.669$, $p < .01$). Hence, since (i) actual ticket prices are significantly smaller than the welfare maximizing ones, (ii) citizens on average have to subsidize each seat with about 100 € (see Table 1), and (iii) our theoretical model suggests that lobby ticket prices are smaller than the social marginal costs, it seems plausible to assume that Germany's performing arts sector is best described by a directorship that maximizes the utility of the members of the theater lobby only.

According to Result 3, such a directorship emerges if people have a very positive ex ante notion of the performing arts. In most countries where the provision of the performing arts is a public task, this is clearly the case. Advocates of public provision of the performing arts put forward the multiple benefits, merits, and positive externalities that are usually attributed to the performing arts in order to justify the huge amount of subsidies flowing into the sector. From our study, we obtain a crude estimate of the lower bound of the size of the externality necessary to justify public provision at all:[18] The ticket price that would be necessary to just cover both individual

[18] Alternatively, one could integrate an "externality parameter" into the model and try to estimate it. We shy at doing so, as we would hardly be able to quantify the size of the externality due to the lack of suitable data. A possible back door could be a cross country

congestion and social marginal costs is in total 54.74 € while the estimated maximum WTP is only 31.68 €. As the provision threshold of welfare maximizing directorship (i.e., efficient provision) is given by (27) there must be additional benefits for the society of 23.06 € due to the person with the highest preference for theater attending a staging.

6 Conclusion

In many countries the provision of the performing arts is essentially assigned to the public sector. Due to their low box–office takings in relation to production costs, publicly run PAOs are usually highly subsidized by their municipalities. Furthermore, there is a large and persistent excess supply of seats. In order to explain these "stylized facts", we developed a model in the style of Strotz' (1965) road congestion model, in which the performing arts are modelled as congestible public goods. In accordance with empirical evidence, the production of seat capacity is assumed to be subject to fixed costs. We estimated the parameters of the model's demand and cost functions using German data. Using these estimates in a social choice analysis, we showed that the current situation in the German performing arts sector is best described by a directorship that under the influence of a selfish theater lobby maximizes the welfare of the spectators only. This equilibrium, characterized by too low ticket prices and too large capacity, is likely to establish if citizens have a very positive ex ante notion of the performing arts.

This—rather negative—result for Germany's performing arts sector should not be overrated. The analysis hinges on a number of simplifying assumpti-

study that should establish a positive relationship between the output of the performing arts sector on the one hand and certain economic and non–economic variables, such as the profits of the tourism sector and education level, on the other hand.

ons. Furthermore, we do not take into account any of the positive externalities that are usually put forward to justify public financing of the performing arts. But it should also be noted that these externalities have, to our knowledge, never been quantified empirically and that it is hardly possible to do so (though there are attempts; see Penne and Shanahan 1987).

The paper does not intend to challenge the public provision of the performing arts in general; rather we would like to pinpoint some of the problems that are involved with public operation of a congestible facility. An obvious way to improve the economic performance of the sector is to bring down the costs and to reduce the operating losses of the PAOs. Our empirical results suggest that total seating capacity should be reduced by about one third. By decreasing the number of seats offered to the optimum level, ceteris paribus, the performing arts sector as a whole could save 267 € million (13.67 € per visitor). In turn, this would cause current attendants a utility loss of not more than 4.8 € million (0.25 € per visitor) due to higher congestion.

Acknowledgements

We thank Richard Arnott and three anonymous referees for very helpful comments and suggestions. The paper has much benefited from discussions with Christos Koulovatianos and seminar participants at the University of Cyprus, the EPCS conference in Berlin and the IIPF conference in Prague. We also would like to thank Christian Seidl and Gerald Willmann for their comments, and Sibylle Franz for improving our English writing style. Some of the data used in this paper was made available by the Deutsches Institut fuer Urbanistik.

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Table 1 The German Theater Sector in the 2001/02 Season

	Sum	Min[a]	Max[a]	Mean[a]
Locations	115	—	—	—
Population	25,894,295	11,606	3,388,434	225,168
PAOs[b]	152	1	9	1.32
Stages	721	1	34	6.27
Stagings	4,415	5	213	38
Performances	62,574	60	3,782	544
Seats	269,537	171	18,903	2,343
Capacity	26,977,804	6,633	2,657,617	234,590
Visitors	19,534,076	2,724	1,853,070	169,861
Loading[c]	—	0.47	0.94	0.72
Op. revenues[c] mill. €	298.581	0.040	46.505	2.666
Op. expenses[c] mill. €	2,319.854	0.574	237.788	20.713
Op. losses[c] mill. €	2,021.273	0.333	191.283	18.047
–"– per ticket[c] €	—	7.99	327.32	101.79
–"– per seat[c] €	—	6.31	222.59	71.83
–"– per inhabitant[c] €	—	5.38	628.28	99.21

Table notes. [a]Refers to locations. [b]Opernhaus Duesseldorf, Deutsche Oper am Rhein are pooled. [c]w/o Dinslaken, Eggenfelden, Landshut.

Table 2 Description and Means of Variables Entering the Regressions

	Variable	Description	Mean
p	price	average ticket price on a location	10.98 €
q	demand	average number of tickets sold *per staging*	4,309
s	capacity	average seating capacity *per staging*	6,027
L	loading	q/s	0.72
n	population	number of inhabitants	229,920
C	costs	average operating expenses *per staging*	607,065 €
y	income	yearly per capita income tax returns	489.50 €
	east	dummy for East Germany	0.31
	uni	dummy for university	0.54
	age	age profile: places in old people's homes over kindergarten places	0.28
	share	relative share of subsidies borne by municipality itself	0.53

Table 3 Estimation of the Demand Function Using OLS with White's Heteroscedasticity Correction — Uniform Preferences

	Model I			Model II		Model III	
γ_2	0.50	1.00	2.00	0.50	1.00	0.5	1.0
Maximum WTP	31.96***	31.68***	31.60***	25.69***	24.96***	10.32*	9.64*
	(9.63)	(9.45)	(9.22)	(8.39)	(8.02)	(5.23)	(5.19)
Income ×	—	—	—	3.86***	3.89***	2.45***	2.50***
Maximum WTP				(1.06)	(1.08)	(0.85)	(0.87)
Share ×	—	—	—	—	—	−1.90**	−1.98**
Maximum WTP						(0.96)	(0.99)
Population ×	—	—	—	—	—	1.44***	1.45***
Maximum WTP						(0.33)	(0.34)
Uni ×	—	—	—	—	—	2.17***	2.22***
Maximum WTP						(0.65)	(0.66)
Mean WTP	[15.98]	[15.84]	[15.80]	[12.85]	[12.48]	[5.24]	[4.90]
Variance WTP	[85.14]	[83.64]	[83.21]	[55.00]	[51.92]	[9.15]	[7.99]
γ_0	16.39*	17.66**	18.25**	11.25	11.82	2.46	2.20
	(8.82)	(8.77)	(8.61)	(8.82)	(7.35)	(4.43)	(4.44)
γ_1	9.25***	12.19***	24.26**	6.59*	7.59*	4.36*	4.50
	(3.44)	(4.60)	(9.85)	(3.44)	(4.66)	(2.48)	(3.39)
L_0	0.85	0.85	0.90	0.86	0.86	0.86	0.86
log–likelihood	−318.23	−319.23	−320.12	−310.54	−311.47	−279.76	−280.66
F	11.22***	10.05***	9.03***	13.80***	12.98***	24.45***	23.78***
$\bar{R}^2$	0.156	0.140	0.126	0.275	0.265	0.559	0.552
Breusch–Pagan χ^2	10.23***	10.41***	9.92***	11.37***	11.18***	25.29***	26.05***

Table notes. Endogenous variable: average ticket price (p) in Euros. $N = 112$. *$p \leq .10$, **$p \leq .05$, ***$p \leq .01$. Standard errors in parentheses. Imputed parameters in brackets.

Table 4 Estimation of the Demand Function Using OLS with White's Heteroscedasticity Correction — Exponential Preferences

	Model I			Model II		Model III	
γ_2	0.50	1.00	2.00	0.50	1.00	0.5	1.0
Mean WTP	2.42***	2.39***	2.40***	2.01***	2.02***	0.83	0.80
	(0.53)	(0.53)	(0.53)	(0.48)	(0.48)	(0.59)	(0.60)
Income ×	—	—	—	1.00***	1.02***	0.75***	0.77***
Mean WTP				(0.26)	(0.26)	(0.23)	(0.24)
Share ×	—	—	—	—	—	−0.51*	−0.53*
Mean WTP						(0.31)	(0.32)
Population ×	—	—	—	—	—	0.20***	0.20***
Mean WTP						(0.05)	(0.05)
Uni ×	—	—	—	—	—	0.65***	0.67***
Mean WTP						(0.19)	(0.19)
Variance WTP	[5.86]	[5.71]	[5.76]	[4.05]	[4.05]	[0.83]	[0.79]
γ_0	−5.56***	−4.14**	−3.80**	−5.84***	−4.78***	−8.95***	−8.18***
	(1.68)	(1.62)	(1.65)	(1.52)	(1.43)	(1.47)	(1.41)
γ_1	8.92***	11.52***	15.70**	6.14*	7.38*	4.18*	4.27
	(3.10)	(4.29)	(6.52)	(31.6)	(4.42)	(2.51)	(3.46)
L_0	0.86	0.86	1.00	0.86	0.86	0.86	0.86
log–likelihood	−310.63	−311.61	−312.55	−301.49	−302.34	−281.66	−282.49
F	20.77***	19.47***	18.24***	22.53***	21.65***	23.04***	22.45***
$\bar{R}^2$	0.263	0.250	0.237	0.368	0.358	0.544	0.537
Breusch–Pagan χ^2	33.78***	33.57***	32.302***	28.99***	27.99***	28.14***	28.02***

Table note. Endogenous variable: average ticket price (p) in Euros. $N = 112$. *$p \leq .10$, **$p \leq .05$, ***$p \leq .01$. Standard errors in parentheses. Imputed parameters in brackets.

Table 5 Estimation of the Demand Function Using OLS with White's Heteroscedasticity Correction — Logistic Preferences

	Model I			Model II		Model III	
γ_2	0.50	1.00	2.00	0.50	1.00	0.5	1.0
$(a_0 - \gamma_0)$	6.14***	4.70***	4.37***	6.62***	5.42***	11.03***	10.28***
	(1.59)	(1.51)	(1.53)	(1.51)	(1.40)	(1.31)	(1.22)
Income	—	—	—	3.26***	3.29***	2.42***	2.45***
				(0.91)	(0.94)	(0.81)	(0.83)
Share	—	—	—	—	—	−1.88*	−1.94*
						(0.99)	(1.02)
Population	—	—	—	—	—	1.39***	1.41***
						(0.36)	(0.37)
Uni	—	—	—	—	—	2.14***	2.19***
						(0.63)	(0.63)
Variance WTP	[17.28]	[16.84]	[15.88]	[12.25]	[11.88]	[0.45]	[0.36]
b	2.29***	2.26***	2.27***	1.93***	1.90***	0.37	0.33
	(0.50)	(0.50)	(0.50)	(0.48)	(0.46)	(0.44)	(0.44)
γ_1	8.96***	11.56***	15.88**	6.77**	7.84*	4.20*	4.31
	(3.11)	(4.30)	(6.54)	(3.30)	(4.51)	(2.52)	(3.46)
L_0	0.86	0.86	1.00	0.86	0.86	0.86	0.86
log–likelihood	−310.85	−311.83	−312.77	−303.92	−305.02	−280.01	−280.86
F	20.47***	19.17***	17.94***	20.05***	18.96***	24.26***	23.62***
$\bar{R}^2$	0.260	0.247	0.234	0.340	0.327	0.557	0.550
Breusch–Pagan χ^2	32.64***	32.50***	31.32***	30.78***	29.67***	27.74***	28.29***

Table note. Endogenous variable: average ticket price (p) in Euros. $N = 112$. *$p \leq .10$, **$p \leq .05$, ***$p \leq .01$. Standard errors in parentheses. Imputed parameters in brackets. Interactions between variance term and control variables were not determined due to multicollinearity.

Table 6 Estimation of the Cost Function Using OLS with White's Heteroscedasticity Correction

	All PAOs	Non–Competing	Competing	Opera	Theater
Fixed costs	288,465***	139,300.21	478,108***	904,364***	75,624***
	(40025)	(44791)	(77,933)	(176,773)	(27,708)
Marginal costs	35.25***	44.75***	34.26***	31.72***	46.22***
	(5.18)	(8.68)	(5.03)	(4.52)	(7.46)
log–likelihood	−2,182.24	−1,325.59	−783.04	−301.80	−857.91
F	715.45***	96.04***	274.29***	104.64	49.89****
$\bar{R}^2$	0.826	0.492	0.840	0.845	0.437
Breusch–Pagan χ^2	357.54***	46.52***	48.45***	5.70**	13.00***
N	152	99	53	20	64

Table notes. Endogenous variable: costs per staging (C) in Euros. *$p \leq .10$, **$p \leq .05$, ***$p \leq .01$. Standard errors in parentheses.