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DEMAND FOR PERFORMING ARTS: THE EFFECT OF UNOBSERVED QUALITY ON PRICE ELASTICITY

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DEMAND FOR PERFORMING ARTS: THE EFFECT OF UNOBSERVED QUALITY ON PRICE ELASTICITY[3]

This paper studies behavior patterns among theater attendees in the process of ticket purchasing. Since the theater attempts to balance between a high occupancy and affordable prices, the purpose of the study is to reveal the effects of changes in prices on attendance. This project is conducted conjointly with the Perm Tchaikovsky Opera and Ballet Theater. Data are taken from the sales information system of the theater for four seasons 2011-2012/2014-2015. The data are disaggregated to the level of the seating area and performance and consist of the attendance rate, the set of prices and the performance characteristics. The research explores the determinants of demand using a censored quantile regression which accounts for the heterogeneity of effects on different levels of attendance rates and censoring. We estimate the parameters of the demand function and show that the aggregated demand is elastic by price, at the same time the elasticity varies across different seating areas. Moreover, demand for the more popular seats and performances is less elastic.

JEL Classification: Z11, D12, C24.

Keywords: performing arts, demand, price elasticity, heterogeneity, censoring, quantile regression.

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Introduction

The performing arts market is a subject of intense study by economists as the market is characterized by a heterogeneity of suppliers and consumers and an increasing number of studies are devoted to performing arts research. Some of them investigate issues of effective pricing and price discrimination in the market. Another area of research is consumer preferences and behavior. In this study, we focus on identifying patterns of demand price elasticity for theater performances.

There are two fundamental approaches to assessing demand. The first approach accesses audience preferences through a questionnaire of theater goers using the method of stated preferences. These studies depict utility function, the willingness-to-pay (WTP) and the patron (Levy-Garboua & Montmarquette, 1996; Bille-Hansen, 1997; Schulze & Rose, 1998; Petrin & Train, 2003; Grisolia & Willis, 2012). The second approach, the method of revealed preferences, uses attendance data, tickets sold, ticket prices and other determinants to estimate the demand function (Moore, 1966; Throsby & Withers, 1979; Throsby, Withers, Shanahan, Hendon, Hilhorst & van Straalen, 1983; Schimmelpfennnig, 1997; Zieba, 2009).

The data for this research are provided by the sales information system of the Perm Tchaikovsky Opera and Ballet Theater. The data contain information on performances for four seasons 2011-2012/2014-2015 and includes the occupancy rate, ticket price and the rich set of performance characteristics. Since the house of theater is divided into seating areas, the sales data are disaggregated to the level of a particular seating area. As distinct from the previous studies which employed aggregated data, the data structure of this research allows us to separately estimate the demand for each seating area and avoid problems concerning an excessive level of data aggregation and the average measures of attendance and prices. The methodology of the research also allows us to deal with the censored nature of demand that arises from the limited capacity of a house. In addition, the set of performance characteristics allows us to control for consumer preferences across performances.

There is empirical evidence that demand is weekly elastic by price in general. The price elasticity changes for different performances and the more popular performance the less elastic the demand. Theater attendees prefer new productions by Russian authors. Among the different types of productions, consumers value ballets, especially well known ones. The number of awards—used as a measure of quality—is a significant determinant of demand. The results indicate that family productions are better attended than others. These results are consistent with the findings of previous studies.

The paper is structured as follows. Section 2 provides a literature review. Section 3 describes the data employed in the research. The methodology applied is discussed in Section 4. Sections 5 and 6 display and discuss the results. Section 7 concludes.

Literature Review

Since art is often seen as a status good, a number of papers have been devoted to the estimation of price elasticity (Seaman, 2006). Studies based on aggregated data show that demand is generally inelastic by price (Moore, 1966; Houthakker & Taylor, 1970; Touchstone, 1980; Gapinski, 1984; Bonato, Gagliardi & Gorelli, 1990). Some studies have found empirical evidence of negative elasticity (Throsby & Withers, 1979; Withers, 1980; Greckel & Felton, 1987; Felton, 1989; Krebs & Pommerehne, 1995). Krebs and Pommerehne (1995) found the demand to be inelastic in the short-run and elastic in the long-run. The presence of omitted variable in a model may cause signs of positive elasticity (Jenkins & Austen-Smith, 1987). If a higher price means a higher quality of performance, then a higher price results in greater attendance. The direct relationship between price and demand shows that a theater performance is a Veblen good. People demand Veblen good to demonstrate a specific status allowing to acquire costly goods inaccessible for the mass consumer.

More sophisticated studies based on disaggregated data demonstrate different elasticity indicators for subgroups of the population (Levy-Garboua & Montmarquette, 1996; Lange & Luksetich, 1984). Pommerehne and Kirchgassner (1987) reveal lower price elasticity for consumers with higher income. Elasticity may vary for different seats in a theater (Schimmelpfennig, 1997). Demand for seats in the stalls, the circle and the back-end of the tiered stalls is elastic but inelastic in the central part of the tiered stalls. Throsby (1994) divided art into immediately accessible and higher arts and found demand for higher arts to be less elastic relative to immediately accessible. Thus, demand estimated on aggregated data is typically inelastic. However, demand for particular segments of consumers or regions may be elastic. There are some economic arguments concerning demand inelasticity such as the absence of close substitutes, consumer impatience and a lower share of expenditure on culture in the total consumer expenditure.

Research, underlining the fact that a theater performance is a differentiated product in addition to the price, includes the characteristics of performance in the demand function. Numerous attempts have been made to estimate the effect of the performance's quality (Hansmann, 1981; Throsby, 1990; Luksetich & Lange, 1995; Krebs & Pommerehne, 1995).

Earliest studies used the expenditure on costumes, theatrical scenery as a measure of quality (Hansmann, 1981). A number of quality measures have been proposed in Throsby (1990), who distinguished objective and subjective ones. Objective measures include the capacity of the theater (Greckel & Felton, 1987), the rating of performance popularity (Felton, 1989), the expenditure on performance (Luksetich & Lange, 1995). Other researchers proposed the reputation of the theater as a subjective measure (Urrutiaguer, 2002), the reputation of the director (Urrutiaguer, 2002; Willis & Snowball, 2009), and reviews (Corning & Levy, 2002; Colbert & Nantel, 1989).

Throsby (1983) proposed evaluating the quality of the production by type. He suggested including the variables for the classification of the repertoire (classic/modern) and the type of performance (a play, a musical, a concert) into the model. Further studies expanded production classification offered by Throsby (1983). Corning and Levy (2002) divided productions into four groups of repertoire classification: a classical performance, a new show, a modern performance, an atypical performance; by time the performances may be referred to as matinee, evening; preview, opening or regular. Summarizing these papers assessing demand, attendance essentially depends on price, performance and production characteristics and quality.

There is one more issue that should be discussed in the context of demand estimation. The demand equation is a relation between the volume of tickets purchased and tickets prices and performance characteristics. Demand can be measured by the number of tickets sold per performance or per unit of time, the percent of theater occupancy or the volume of household expenditure on cultural activities. The majority of early studies based on aggregated data did not take into account the censoring character of demand. In this case, the number of tickets sold for the performance or a particular seating area is only observed demand, while potential demand may exceed the capacity of a house. Dropping the distinction between potential and observed demand may affect the estimates of parameters and lead to estimates bias. Some papers included house capacity in the model in an attempt to take into account the censoring of demand. The problem of censored demand estimation was solved in Laamanen (2013). He estimated the demand equation through censored quantile regression at median using the method proposed by Powell (1986). In our research, we extended the study by Laamanen (2013) and estimated demand at various quantiles in order to capture the difference in the elasticity of demand for various performances. The method employed for the estimation is the censored quantile regression proposed by Chernozhukov and Hong, (2011) and it will be discussed in detail in Section 4. In the next section, we discuss and analyze the available data. The preliminary analysis of the data motivates the method employed in the research.

Data

The data for research are taken from the Perm Opera and Ballet Theater, which is considered the best regional theater in Russia. It is noted for its modern musical productions, nonstandard classical performances, and unconventional festival projects. It is also a major Russian center for opera and ballet, where the quality of the musical performance is paramount. Every year the theater performs fifty regular productions and three to five new productions.

The Perm Opera and Ballet Theater is a noncommercial organization and as such is lossmaking. Its main source of funding is a Perm state budget. As a noncommercial venture the goal of the theater is to make ballet and symphonic art available for all Perm residents. The theater does have to, at least partially, recoup the expenses with production revenue in order to produce new ones. Consequently, the theater constantly tries to balance between being affordable and covering costs.

The data cover all performances for four seasons between August 2011 and July 2015. There were 985 performances out of 170 productions at the main venue. The data include information on the name of production, the date and time of play (season, year, month, the day of week and time of day), the price of a ticket and the seat in an auditorium. The auditorium of the theater is divided into sectors: loges, the stalls, tiered stalls, the circle and the upper circle. In the sectors, the seats are identified by row and place. Further, the auditorium is divided into nine seating areas according to the distance from the stage (Figure 1). The seats in different seating areas vary by the quality of view and sound, prestige and price. Whereas the seats located in one seating area are considered as homogeneous in terms of price and quality. The theater also has a system of discounts. The discounts are divided into permanent, provided for special segments of the population (students, students of the ballet school, retired people) and for partners or theater employees. Thus, for every ticket purchased we have information on the basic price charged by the theater and on the factual price of a sale with discount. We use only the basic price of the ticket as a measure of the price considering that the administration of the theater may vary the basic price.

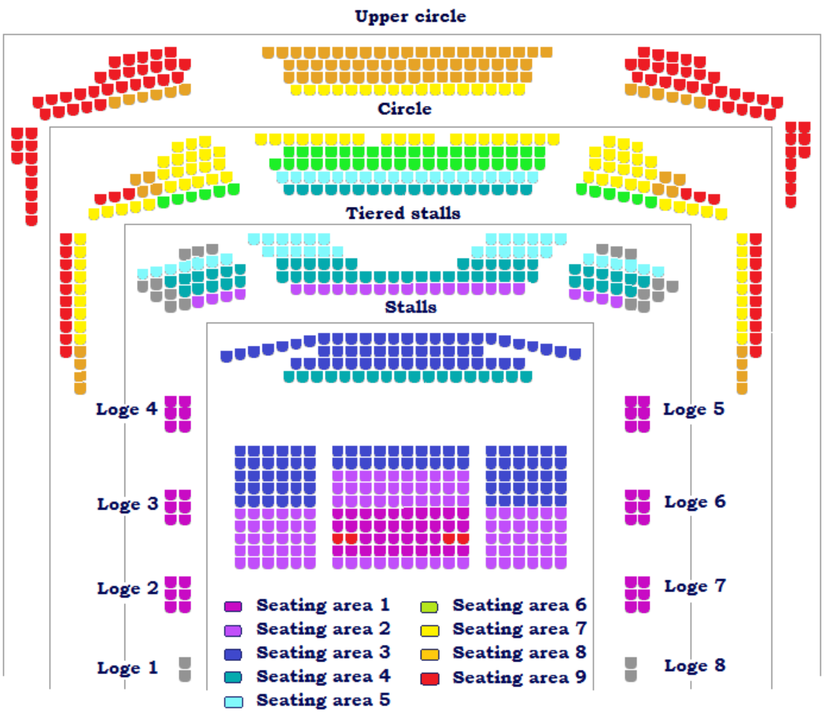

Fig. 1. The scheme of an auditorium

In addition to the information provided by the theater, we collected information on performance characteristics from different data sources. The type of production is an important determinant of demand. We classified productions into opera and ballet. Productions were divided into classical (written before 1900) and modern (written after 1900). We also have information on the author and construct dummy responsible for the nationality of the author (Russian/foreign). The dummy on whether the year is the first for the production allows distinguishing these from longer running productions. Since the productions vary by length, we include the variable for the duration of performance. We classified performances according to the age recommended for attendance: children (without restriction), family (12+) and adult (16+). Information on conductors allows us to estimate the contribution of a particular person. Among conductors, we identified three persons that are especially successful and in-demand. Since 1998 the Perm Opera and Ballet Theater has been regularly nominated for the prestigious Russian theater award ‘Golden Mask’. For every production, we have information on the number of nominations and awards won. In order to measure the quality of the production, we include information on the worldwide popularity of the work. For operas we use data from the worldwide rating of operas and their composers (operabase.com). Since there is no similar source for ballets, we employ data from another rating that chose and range ten best ballets from all over the world (listverse.com). Descriptive statistics of data are presented in Tables 1 and 2.

Tab. 1. Descriptive statistics categorical variables

Variable	Total	Share
Seasons	2682	
2011/2012	828	30.9
2012/2013	819	30.5
2013/2014	711	26.5
2014/2015	324	12.1
Day of week	2682	
Working days	1440	46.3
Weekend	1242	53.7
Time of day	2682	
Before 2 am	342	12.8
After 2 am	2340	87.2
Type of performance	2682	
Ballet	954	35.6
Opera	1728	64.4
Date of creation	2682	
Before 1990	2304	54.1
1990 and later	1953	48.9
Language	2682	
Foreign	378	14.1
Russian	2304	85.9
Recommended age	2682	
Without restrictions	1107	41.3
From 12 y.o.	1170	43.6
From 16 y.o.	405	15.1
Awards	2682	
Presence	144	5.4
Absence	2538	94.6
The nationality of author	2682	
Russian	1521	56.7
Foreign	1161	43.3
Band director	2682	
Valeriy Platonov	1422	53.0
Vitaliy Polonskiy	72	2.7
Teodor Currentzis	279	10.4
Other	909	33.9

Tab. 2. Descriptive statistics for continuous variables

Variable	Obs.	Mean	SD	Min	Max
Basic price (rubles)	2682	387.1	366.9	100	2000
Seating area 1	298	868.1	496.6	300	2000
Seating area 2	298	578.4	380.2	250	1400
Seating area 3	298	486.5	351.6	210	1300
Seating area 4	298	427.7	323.5	180	1200
Seating area 5	298	349.6	265.8	160	1000
Seating area 6	298	277.5	211.3	140	800
Seating area 7	298	224.4	151.1	120	600
Seating area 8	298	171.4	89.9	110	400
Seating area 9	298	100	0	100	100
Attendance rate (%)	2682	0.80	0.26	0.00	1
Seating area 1	298	0.86	0.15	0.24	1
Seating area 2	298	0.90	0.13	0.35	1
Seating area 3	298	0.89	0.14	0.35	1
Seating area 4	298	0.90	0.15	0.11	1
Seating area 5	298	0.84	0.22	0.11	1
Seating area 6	298	0.8	0.26	0.06	1
Seating area 7	298	0.67	0.34	0.02	1
Seating area 8	298	0.63	0.35	0.02	1
Seating area 9	298	0.72	0.31	0.01	1
1/Rating of opera	2682	0.08	0.22	0.01	1
1/Rating of composer	2682	0.09	0.21	0.01	1
1/Rating of ballet	2682	0.09	0.22	0.01	1

Tab.3. Theater schemes of pricing

Number of scheme	Obs.	Mean	SD	Min	Max
Scheme 1	126	174.4	64.2	100	300
Scheme 2	900	196.7	116.8	100	500
Scheme 3	27	247.8	148.1	100	600
Scheme 4	459	284.4	169.4	100	700
Scheme 5	225	358.9	223.0	100	800
Scheme 6	540	472.6	291.2	100	1000
Scheme 7	54	922.2	458.3	100	1500
Scheme 8	351	900.9	562.0	100	2000

Since the research question assumes the study of attendance rates of a particular seating area, we aggregated data on sales and prices by areas. For each seating area we calculated the attendance rate as a percentage of the total number seats in the area and assign the basic price in accordance with 1 of 8 theater pricing schemes (Table 3). The pricing scheme is the set of prices for 9 seating areas. Table 3 shows that the pricing ranges from 300 to 2000 rubles. This structure of data aggregated by zones allows us to control for the quality of seats depending on their location in the auditorium and estimate the heterogeneity of effects for different zones.

Apart from the seats in the auditorium the productions may also be heterogeneous. Figure 2 shows that most observations are over 80%. The remaining seating areas show less demand which tells us about the heterogeneity of productions by popularity. To analyze the patterns of attendance with price changes we divided performances according to the level of attendance. If the attendance rate exceeds the mean level (80%) then the production is attributed to "popular", otherwise to "unpopular". According to the price in the first seating area, the observations were divided into "expensive", when the price exceeds 700 rubles, and "cheap", if less. We also classified the seating areas into prestigious (the first three zones) and "of no prestige" (the last three zones) (Figure 3).

The attendance of "popular" and "expensive" is as high for the first three as for the last three seating areas. If the performance is "popular" and "cheap", then the attendance is high in both groups of seats. But in the case of "cheap" performance, the demand for "prestigious" seats is slightly higher compared to "expensive" performance. This effect holds for "unpopular" performances: in the case of falling prices customers switch from the last seats to the first. If we analyze only "expensive" performances, we notice that the fall in popularity leads to a decrease in the attendance, especially in the last seating areas. This is also true for "cheap" performances. The preliminary data analysis suggests that consumers are elastic by price. Moreover, the price elasticity may vary for different performances and for different seating areas. In the next section we discuss the methodology of the study.

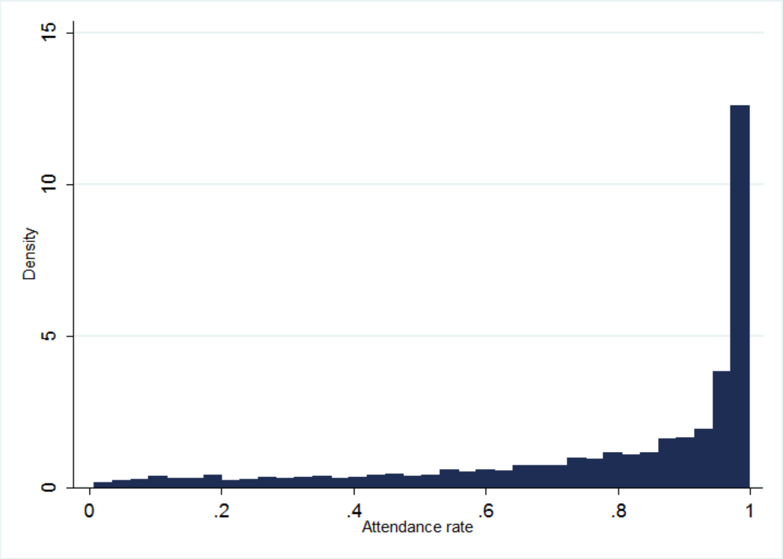

Fig. 2. Density of attendance rate

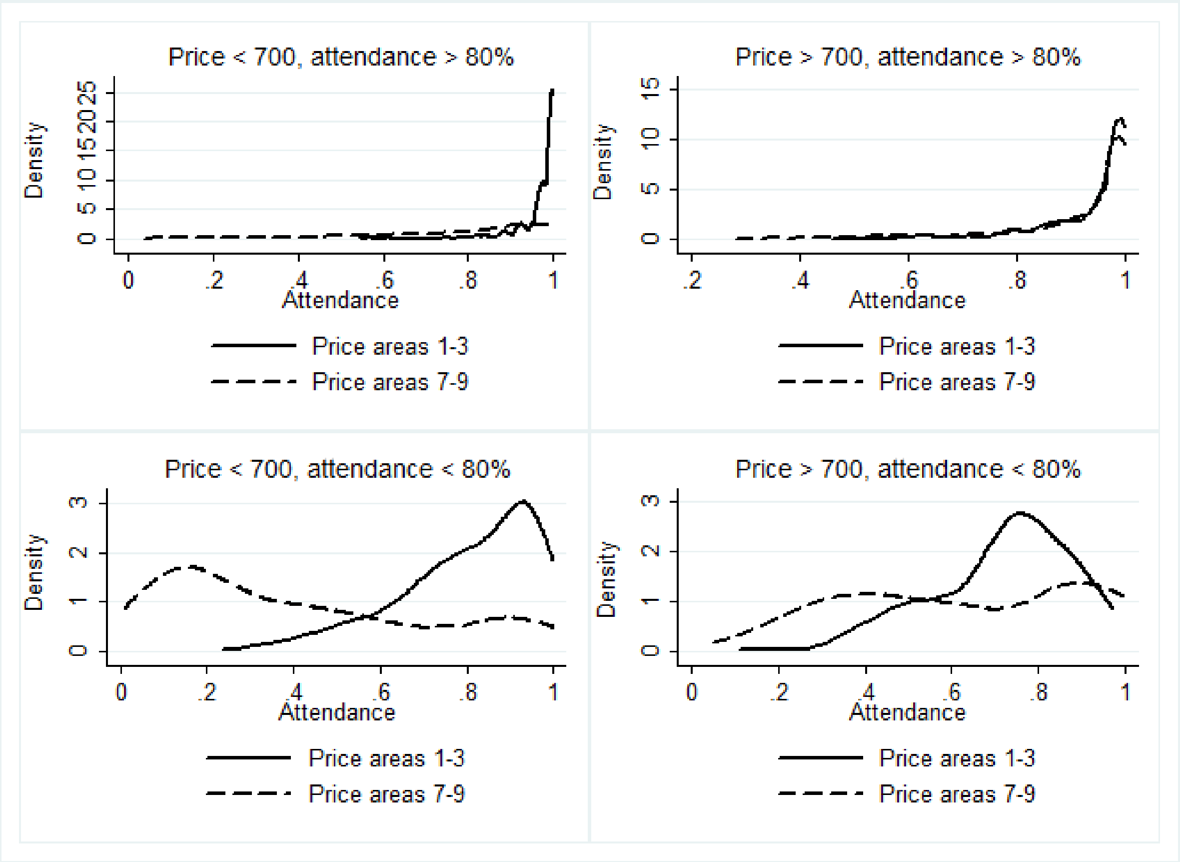

Fig.3. Attendance rate distributional plots by price and popularity

Methodology

Since the effect of price and performance characteristics may vary over the seating areas and the performances of different quality, we apply the quantile regression approach to capture the heterogeneity of effects on the different levels of the attendance distribution. Quantile regression gives parameter estimates at each level of the dependent variable quantile while the OLS estimates give the mean effect of the dependent variable. We should also account for the censoring of the attendance rate since nearly the third of the seating areas in the sample are fully occupied. Ignoring the censoring leads to inconsistent and underestimated effects of price and other performance characteristics on the attendance rate because the potential demand for a particular seating area may exceed the observed one. The attendance rate is bounded by 0 and 1 but only 4 observations on seating areas have a zero attendance rate. This means that ignoring the censoring at the lower bound may only produce a negligible bias in estimates. The model of demand for theater productions then may be represented by quantile regression with upper censoring:

$$Q_{y^*|x}(\alpha) = x\beta(\alpha) + p\gamma(\alpha),$$
$$Q_{y|x}(\alpha) = \begin{cases} Q_{y^*|x,p}(\alpha), & y^* \leq 1 \\ 1, & y^* > 1 \end{cases}, \tag{1}$$

where

$Q_{y^*|x,p}(\alpha)$ is the level α conditional quantile of potential attendance rate for a seating area,

$Q_{y|x,p}(\alpha)$ is the level α conditional quantile of observed attendance rate for a seating area,

y^* is the potential attendance rate of a seating area,

y is the observed attendance rate of a seating area,

x is the vector of performance characteristics and seating area dummies,

$\beta(\alpha)$ is the effect of the vector of characteristics on the attendance quantile level α,

p is the price of a ticket in a seating area,

$\gamma(\alpha)$ is the effect of price on the attendance rate on the attendance quantile level α.

We apply Chernozhukov and Hong's (2002) three-step procedure to obtain the estimates of the parameters β and γ of censored quantile regression. This procedure accounts for the heterogeneity the effects of price and characteristics on different levels of attendance rate distribution quantiles and accounts for the censoring of the potential demand to 1 while it exceeds 1. Another crucial assumption for the consistent estimation of the demand function parameters is the exogeneity of tickets price and performance characteristics. This may be violated if the ticket price is set by the theater dependent on the observed and unobserved performance characteristics (for instance, performance quality). Then the theater's prediction of potential demand shock may lead to an increase of the ticket price for some seating areas. One way to avoid the possible endogeneity problem is by Laamanen (2013) who relied on the assumption that the price is set only as a function of observed characteristics, which leads to the independence of price and error term conditional on the performance characteristics. An alternative way is to find proper instrumental variables for ticket prices and perform the test on the difference of estimates between the two models with and without instrumental variables. We apply the latter approach in the robustness check section and found the conditional independence between price and unobserved performance quality which allows us to rely on the estimates obtained in the next section.

Results

We tested the estimates to see whether it is necessary to use the censored quantile regression compared to OLS and quantile regression on the median attended performance. The estimation results are presented in Table 4. The effects of explanatory variables vary over the three specifications. The difference in the first two specifications is explained by the fact that OLS estimates the value of the average effect, but the median regression at the median. The estimates of the second specification compared to the third are smaller in absolute value suggesting that the median regression without censoring underestimates the values of the effects. Estimate bias for a different level of attendance quantiles in the case of price elasticity is shown on Figure 4.

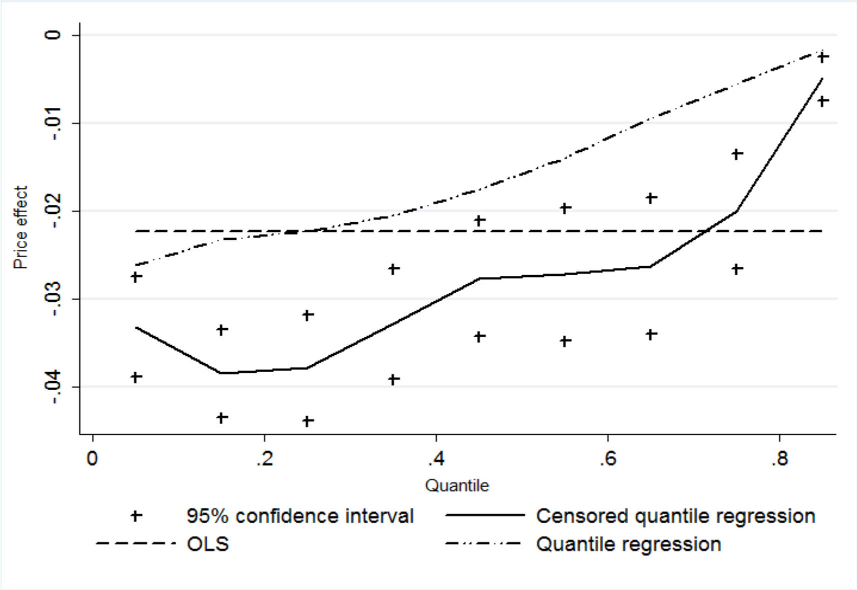

Fig.4. Estimate bias for the different level of attendance quantile

Then we estimated the censored quantile regressions on different levels of quantile (Table 5). The results indicate that the price elasticity estimates range from 0.036 to 0.012 which shows that the demand is weekly elastic by price. The results cohere with the results of previous papers (Seaman, 2006). With an increase in the attendance quantile the price effects become smaller and significant at lower significance level. The demand for better attended productions is less elastic than the demand for poorer attended productions. Since the most expensive areas have better attendance that means these areas belong to a higher quantile. Then the audience of expensive seats should be expectedly less elastic compared with the audience of other seating areas. The decrease of the price effect for popular productions and seats indicates that the theater should differentiate ticket prices as an effective strategy to increase box-office revenue without reducing the attendance rate. In addition, the negative sign of price elasticity rejects the hypothesis that theater performance is a Veblen good.

The estimates of the effects of other explanatory variables are intuitively clear. Demand is higher for productions by Russian authors. New productions are also better attended than old. Theater goers on average prefer ballet to opera, which is consistent with the fact that ballet is a more understandable cultural product than opera. The number of Golden Mask awards is a significant determinant of demand and impacts on the demand positively. The demand for the family productions is higher than for children's and less than for adult productions. If the difference in attendance for family and children's productions may be explained by the distinction in content, then the less popularity of adult productions arises from the narrowing of the range of potential visitors.

Tab.4 Results of OLS, median and censored median regression

Variable	(1) OLS	(2) Median regression	(3) Censored median regression
Price/100	-0.022***	-0.015***	-0.028***
	(0.002)	(0.003)	(0.004)
Russian author	0.060***	0.052***	0.090***
	(0.010)	(0.017)	(0.018)
Premiere	0.110***	0.112***	0.154***
	(0.014)	(0.023)	(0.026)
Rating of opera	0.034	0.068	0.020
	(0.027)	(0.044)	(0.044)
Rating of ballet	0.107***	0.072*	0.252***
	(0.023)	(0.038)	(0.054)
Ballet	0.333***	0.257***	0.414***
	(0.013)	(0.021)	(0.024)
Number of awards	0.045***	0.053***	0.059***
	(0.011)	(0.019)	(0.020)
Band director: Platonov	-0.046***	-0.034*	-0.074***
	(0.011)	(0.019)	(0.020)
Band director: Polonskiy	0.267***	0.260***	0.316***
	(0.031)	(0.052)	(0.056)
Band director: Currentzis	0.039**	0.020	0.054*
	(0.019)	(0.031)	(0.032)
Age recommended: from 12 y.o.	0.039***	0.007	0.043**
	(0.011)	(0.018)	(0.019)
Age recommended: from 16 y.o.	-0.078***	-0.128***	-0.098***
	(0.018)	(0.030)	(0.030)
Time of day: after 2 pm	-0.028**	-0.010	-0.026
	(0.014)	(0.023)	(0.026)
Constant	0.793***	0.813***	0.847***
	(0.025)	(0.041)	(0.047)
N	2682	2682	2105
k	35	35	35
R^2	0.467		

Notes: bootstrap standard errors based on 100 replications in parenthesis.
N is a number of observations, *k* is a number of estimated parameters.
We also control for year, month, day of week and seating area effects.
*** indicates significance at 10% level, ** at 5% level, * at 1% level.

Tab.5. Results of censored quantile regression on different levels of quantile

	(1) α = 0,2	(2) α = 0,4	(3) α = 0,6	(4) α = 0,8
Price/100	-0.036***	-0.031***	-0.026***	-0.012***
	(0.003)	(0.003)	(0.004)	(0.002)
Russian author	0.104***	0.107***	0.086***	0.046***
	(0.016)	(0.016)	(0.020)	(0.011)
Premiere	0.182***	0.174***	0.135***	0.056***
	(0.022)	(0.023)	(0.029)	(0.017)
Rating of opera	0.105***	0.071*	0.018	0.013
	(0.040)	(0.040)	(0.049)	(0.029)
Rating of ballet	0.267***	0.195***	0.233***	0.157***
	(0.045)	(0.046)	(0.060)	(0.049)
Ballet	0.533***	0.466***	0.363***	0.135***
	(0.021)	(0.022)	(0.028)	(0.015)
Number of awards	0.063***	0.074***	0.030	0.015
	(0.017)	(0.017)	(0.021)	(0.016)
Band director: Platonov	-0.088***	-0.090***	-0.081***	-0.036***
	(0.017)	(0.018)	(0.022)	(0.012)
Band director: Polonskiy	0.363***	0.333***	0.220***	0.104***
	(0.050)	(0.049)	(0.061)	(0.039)
Band director: Currentzis	0.009	0.036	0.008	-0.004
	(0.029)	(0.029)	(0.035)	(0.021)
Age recommended: from 12 y.o.	0.049***	0.038**	0.048**	0.017
	(0.017)	(0.017)	(0.022)	(0.012)
Age recommended: from 16 y.o.	-0.095***	-0.117***	-0.046	-0.030
	(0.027)	(0.027)	(0.033)	(0.019)
Time of day: after 2 pm	-0.068***	-0.018	-0.018	-0.003
	(0.022)	(0.023)	(0.029)	(0.016)
Constant	0.674***	0.795***	0.891***	0.973***
	(0.040)	(0.042)	(0.053)	(0.029)
N	2343	2170	2008	1985
k	35	35	35	35

Notes: bootstrap standard errors based on 100 replications in parenthesis.
*** indicates significance at 10% level, ** at 5% level, * at 1% level.
N is a number of observations, *k* is a number of estimated parameters.
We also control for year, month, day of week and seating area effects.

As with price elasticity, a rise in the attendance quantile means the effect of every explanatory variable declines. This pattern gives evidence that a particular attribute has a greater effect on less popular productions. As the popularity of performance increases, the contribution of each attribute falls but the quality unexplained by the observed explanatory variables grows.

However, better seats in an auditorium may attract consumers with lower price elasticity and consumers of a higher quality performances may have a lower price effect on demand.

Robustness check

The exogeneity of ticket prices is a crucial assumption for the correct estimation of demand function parameters. If the process of setting ticket prices is dependent on the prediction of future attendance then the price is endogenous in the model of demand. For the proper estimation we need to rely on the independence between the price and error term conditional on the observed characteristics of performance or find instrumental variables for the ticket prices with the conditional independence on the error term property.

Luckily, the panel structure of the data allows us to construct instruments without employing outside data. Since most of the productions were performed several times (86% were performed 5 times or more) with enough variation of ticket prices within the production, we use a within production price deviation for a seating area as an instrumental variable for the actual ticket price:

$$\tilde{p}_{ijk} = p_{ijk} - \bar{p}_{.jk}, \qquad (2)$$

where

$\tilde{p}_{ijk}$ is the price deviation (price "within") for seating area j for performance i for production k from a mean price over performances of production k for seating area i,

p_{ijk} is the price for seating area j for performance i for production k,

$\bar{p}_{.jk}$ is the price of tickets for seating area j for production k averaged over all performances.

This way of constructing instruments was proposed by Hausman and Taylor (1981) for dealing with the unobserved individual effect correlation with the observed variables. With the presence of unobserved production quality, only the mean price for the production may be correlated with it since both are fixed over time. The deviation of the price from the mean is only determined by the characteristics of a particular performance (time of a day, the day of the week, the month of year) that is captured in a model. This allows us to rely on the validity of price "within" as an instrument for the price. We also checked the price "within" to explain the variation of the total price.

In order to compare the censored quantile regression results with those controlled for possible endogeneity of ticket prices, we apply Chernozhukov, Kowalski, and Fernandez-Val’s (2015) model of censored quantile regression with instrumental variables. An estimation of the demand model includes the preliminary step of regressing the price on price “within” and production characteristics and then including residuals of price as a control variable for the quantile model of demand with censoring. This method is very similar to the widely used 2SLS instrumental variable method and nonparametric IV methods (Newey, 2013).

Formally, the estimation procedure starts with estimation of

$$\hat{p}_{ijk} = Q_{p_{ijk}|\tilde{p}_{ijk}, x_{ijk}}(\alpha), \tag{3}$$

where $\hat{p}_{ijk}$ is a prediction of the ticket price for performance *i* in seating area *j* for production *k*.

Next we need to predict the price residuals $\hat{e}_{ijk} = p_{ijk} - \hat{p}_{ijk}$ and estimate the censored quantile regression model of attendance rate conditional on production characteristics, ticket price and price residuals.

$$\hat{y}_{ijk} = Q_{y_{ijk}|x_{ijk}, p_{ijk}, \hat{e}_{ijk}}(\alpha). \tag{4}$$

Using estimates of the censored quantile regression with instrumental variables we performed two tests for the exogeneity of the price. The first is a Hausman test for the difference in estimates between censored quantile regressions with and without instrumental variables. Estimates results are reported in Table 6. The insignificant difference means that there is no need to use IV and the price is exogenous conditionally on the observed performance characteristics.

The second is a Durbin-Wu-type test for the significance of the parameter behind the price residuals $\hat{e}_{ijk}$. This parameter reflects the covariance between the price and attendance rate equation error terms. The test also shows that there is no correlation between error terms and, consequently, no correlation between shocks of attendance rate and ticket price. Tests allow us to rely on the assumption of the exogeneity of ticket price and the consistency of the censored quantile regression results discussed above.

Tab.6. Comparison of results with and without instrumental variables

	α = 0.3 CQIV	α = 0.3 CQR	α = 0.5 CQIV	α = 0.5 CQR	α = 0.7 CQIV	α = 0.7 CQR
Basic price/100	-0.040***	-0.041***	-0.038***	-0.037***	-0.031***	-0.030***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
$\hat{e}$	-0.000		0.000		0.000	
	(0.000)		(0.000)		(0.000)	
N	1931	2221	1737	1998	1563	1798
k	35	35	35	35	35	35

Note: bootstrap standard errors based on 100 replications in brackets.
CQR is a censored quantile regression, CQIV is a censored quantile regression with instrumental variables.
*** indicates significance at 10% level, ** at 5% level, * at 1% level;
N is a number of observations, *k* is a number of estimated parameters.
We also control for seasonal, monthly and daily dummies, time of play, seating area dummies, type of performance, band director, year of premier, nationality of author, performance rating, wins of Golden Mask, recommended age.

Conclusion

Theater performance studies address various issues ranging from price discrimination at the theater, to the identification of theater patrons. Among them several studies are devoted to the empirical study of demand. The literature shows that demand identification can be implemented on different data structures. Early studies were mostly conducted on aggregated data. In recent papers, authors employ data disaggregated to the level of population or production subgroups. Our research uses data disaggregated to the level of performance price zones which allows us to test the heterogeneity of performances and seats in an auditorium.

We estimate the demand function for operas and ballets using tickets sales data from the Perm Opera and Ballet Theater and find empirical evidence that demand is weakly elastic by price. In deciding to buy tickets, consumers are guided by the set of performance characteristics apart from the ticket price. Attendees are more likely to visit productions written by Russian. Visitors prefer new productions. Demand is higher for ballets, especially ballets with worldwide popularity. In addition, the audience of the Perm Theater favors certain conductors. Since the capacity of a n auditorium is limited, the potential demand may exceed the observed. A comparison of median and censored median regression reveals a bias in estimates and persuades us to account for censoring. Censored quantile regression allows us to avoid the estimate bias caused by the censored nature of demand. Methods used in previous papers allow the estimation of the effects on the average: for average performance or for the average visitor. Censored quantile regression helps to capture the heterogeneity of performances depending on the level of attendance. This is the first attempt to develop quantile regression on different levels of quantile in the estimation of the demand for performing arts. Finally, our results show that performing arts is not a Veblen good. Some preceding studies found empirical evidence on conspicuous consumption of stage productions. However, we suppose that this fact may result from omitting unobserved prestige or quality. Controlling for a rich set of characteristics including seats and performance quality gives evidence that the price has negative effect on demand. However, an increase in the popularity of the production and the seats leads to the demand that is less elastic by price.

References

Bonato, L., Gagliardi, F., & Gorelli, S. (1990). The demand for live performing arts in Italy. *Journal of Cultural Economics*, 14(2), 41-52.

Chernozhukov, V., & Hong, H. (2011). Three-step censored quantile regression and extramarital affairs. *Journal of the American Statistical Association*.

Chernozhukov, V., Fernández-Val, I., & Kowalski, A. E. (2015). Quantile regression with censoring and endogeneity. *Journal of Econometrics*, *186*(1), 201-221.

Colbert, F., & Nantel, J. (1989). The market for cultural activities: New approaches for segmentation studies. *Cultural Economics '88: A Canadian Perspective*, 133-140.

Corning, J., & Levy, A. (2002). Demand for live theater with market segmentation and seasonality. *Journal of Cultural Economics*, 26(3), 217–235.

Felton, M. V. (1989). Major influences on the demand for opera tickets. *Journal of Cultural Economics*, *13*(1), 53-64.

Gapinski, J. H. (1984). The economics of performing Shakespeare. *The American Economic Review*, 74(3), 458-466.

Greckel, F. R., & Felton, M. V. (1987). Price and income elasticities of demand: A case study of Louisville. *Economic efficiency and the performing arts*, 62-73.

Grisolía, J.M. and Willis, K.G., 2012. A latent class model of theater demand. *Journal of Cultural Economics*, *36*(2), pp.113-139.

Hansen, T. B. (1997). The willingness-to-pay for the Royal Theater in Copenhagen as a public good. *Journal of cultural economics*, 21(1), 1-28.

Hansmann, H. (1981). Nonprofit enterprise in the performing arts. *The Bell Journal of Economics*, 341-361.

Hausman, J. A., & Taylor, W. E. (1981). Panel data and unobservable individual effects. *Econometrica: Journal of the Econometric Society*, 1377-1398.

Houthakker, H. S., & Taylor, L. D. (1970). Consumer Demand in the United States. Harvard University Press, Cambridge.

Jenkins, S., & Austen-Smith, D. (1987). Interdependent decision-making in non-profit industries: A simultaneous equation analysis of English provincial theater. *International Journal of Industrial Organization*, *5*(2), 149-174.

Krebs, S., & Pommerehne, W. W. (1995). Politico-economic interactions of German public performing arts institutions. *Journal of Cultural Economics*, *19*(1), 17-32.

Laamanen, J. P. (2013). Estimating demand for opera using sales system data: the case of Finnish National Opera. *Journal of Cultural Economics*, *37*(4), 417-432.

Lange, M. D., & Luksetich, W. A. (1984). Demand elasticities for symphony orchestras. *Journal of Cultural Economics*, 8(1), 29-47.

Levy-Garboua, L., & Montmarquette, C. (1996). A microeconometric study of theater demand. *Journal of Cultural Economics*, 20(1), 25–50.

Luksetich, W. A., & Lange, M. D. (1995). A simultaneous model of nonprofit symphony orchestra behavior. *Journal of Cultural Economics*, *19*(1), 49-68.

Moore, T. G. (1966). The demand for broadway theater tickets. *Review of Economics and Statistics*, 48(1), 79–87.

Newey, W. K. (2013). Nonparametric instrumental variables estimation. *The American Economic Review*, *103*(3), 550-556.

Petrin, A., & Train, K. (2003). Omitted product attributes in discrete choice models (No. w9452). *National Bureau of Economic Research*.

Pommerehne, W., Kirchgassner, G. (1987). The impact of television on the demand for cinema and theater performances. In: Grant, N.K., et al. (Eds.), Economic Efficiency and the Performing Arts. Association for Cultural Economics, Akron, pp. 44–61.

Powell, J. L. (1986). Censored regression quantiles. *Journal of econometrics*, *32*(1), 143-155.

Schimmelpfennig, J. (1997). Demand for ballet: a non-parametric analysis of the 1995 royal ballet summer season. *Journal of Cultural Economics*, *21*(2), 119-127.

Schulze, G. G., & Rose, A. (1998). Public orchestra funding in Germany – an empirical investigation. *Journal of Cultural Economics*, *22*(4), 227-247.

Seaman, B. A. (2006). Empirical studies of demand for the performing arts. In V. Ginsburgh & C. D. Throsby (Eds.), *Handbook of the economics of arts and culture* (Chap. 14) (pp. 415–472). NorthHolland: Elsevier.

Throsby, C.D., Withers, G.A. (1979). The Economics of the Performing Arts. St. Martins, New York.

Throsby, D. (1994). The production and consumption of the arts: A view of cultural economics. *Journal of economic literature*, *32*(1), 1-29.

Throsby, C. D. (1990). Perception of quality in demand for the theater. *Journal of Cultural Economics*, 14(1), 65–82.

Throsby, C. D., Withers, G. A., Shanahan, J. L., Hendon, W. S., Hilhorst, I. T. H., & van Straalen, J. (1983). Measuring the demand for the arts as a public good. In *Economic support for the arts.[Volume 3, Proceedings of the Second International Conference on Cultural Economics and Planning, May 26-28, 1982, Netherlands]*. (pp. 37-52). Association for Cultural Economics, University of Akron.

Touchstone, S. K. (1980). The effects of contributions on price and attendance in the lively arts. *Journal of Cultural Economics*, *4*(1), 33-46.

Urrutiaguer, D. (2002). Quality judgements and demand for French public theater. *Journal of Cultural Economics*, 26(3), 185-202.

Willis, K. G., & Snowball, J. D. (2009). Investigating how the attributes of live theater productions influence consumption choices using conjoint analysis: The example of the national arts festival, South Africa. *Journal of Cultural Economics*, 33(3), 167–183.

Withers, G. (1980). Unbalanced growth and the demand for the performing arts: An econometric analysis. *Southern Economic Journal*, 46, 735–742.

Zieba, M. (2009). Full-income and price elasticities of demand for German public theater. *Journal of Cultural Economics*, 33(2), 85–108.

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