ACEI working paper series

Demand for performing arts: the effect of unobserved quality on price elasticity

Alina Buzanakova Evgeniy M. Ozhegov

AWP-05-2016 Date: June 2016

Demand for performing arts: the effect of unobserved quality on price elasticity[1]

Alina Buzanakova[2], Evgeniy M. Ozhegov[3]

Abstract

This paper studies the behavior patterns among the theatre's attendants in the process of ticket's purchase. Since the theatre attempts to balance between the high rate of occupancy and the affordable prices for the spectator, the purpose of the study is to reveal the effects of changes in prices on attendance rate on different levels of attendance. This project is conducted conjointly with the Perm Tchaikovsky Opera and Ballet Theater. Data is taken from the sales information system of the theater for four seasons 2011-2012/2014-2015. The data is disaggregated to the level of the seating area and performance and consists of the attendance rate, the set of prices and the performance characteristics. The research explores the determinants of demand using censored quantile regression that accounts for the heterogeneity of effects on different levels of attendance rates and censoring. We have estimated the parameters of demand function and revealed 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 expectedly turns out to be the less elastic.

Keywords: performing arts, demand, price elasticity, heterogeneity, censoring, quantile regression.
JEL codes: Z11, D12, C24

[1] The article was prepared within the framework of the Academic Fund Program at the National Research University Higher School of Economics (HSE) in 2016 (grant 15-05-0063) and supported within the framework of a subsidy granted to the HSE by the Government of the Russian Federation for the implementation of the Global Competitiveness Program.

[2] A. Buzanakova
National Research University Higher School of Economics,
Research Group for Applied Markets and Enterprises Studies, young research fellow,
Lebedeva, 27, Perm, Russia,
Tel.: +7-908-242-16-32,
Email: arbuzanakova@hse.ru

[3] E.M. Ozhegov
National Research University Higher School of Economics,
Research Group for Applied Markets and Enterprises Studies, research fellow
Lebedeva, 27, Perm, Russia,
Tel.: +7-952-652-45-25,
Email: eozhegov@hse.ru

1 Introduction

Performing arts market is a subject of intense study by economists, thus, the market is characterized by the heterogeneity of suppliers and consumers. An increasing amount of publications is 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's preferences and behavior. In this study, we focus on identifying patterns of demand price elasticity for theatre productions.

The remarkable developments have been brought about by a number of scholars in the field of demand estimation. There are two fundamental approaches to assessing demand. Advocates of the first approach access audience preferences through a questionnaire survey of theatregoers using the method of stated preferences. These studies depict utility function, willingness-to-pay (WTP) and the patron (Levy-Garboua & Montmarquette, 1996; Bille-Hansen, 1997; Schulze & Rose, 1998; Petrin & Train, 2003; Grisolia & Willis, 2012). Papers applying the second approach of revealed preferences employ the data of attendance, tickets sold, ticket price 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 the research is provided by the sales information system of Perm Tchaikovsky Opera and Ballet Theater, one of the famous opera theatre in Russia. Data contains 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 theatre is divided by seating areas, the sales data is disaggregated to the level of a particular seating area. Thus, the information on attendance is available in terms of seating areas. As distinct from the previous studies with the related research questions that 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 rich set of characteristics permits to control on the consumers preferences over the various performances.

We found empirical evidence that the 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. Attendants of theatre prefer premiere performances produced by the Russian author. Among different types of performances, consumers value ballets, especially with the global fame. The number of awards that we perceive as a measure of quality is a significant determinant of demand. Our results indicate that family performances are better attended than others. The

results obtained are consistent with the findings of previous studies and prove the initial hypotheses.

The remaining of the paper is structured as follows. The next Section 2 summarizes the earlier studies of demand for theatre productions. Section 3 describes the data employed in the research. The methodology applied is discussed in Section 4. Next Sections display and discuss the results. Section 7 concludes.

2 Literature Review

A considerable amount of valuable work has been done in the field of demand estimation that provides a solid grounding for further study with respect to the level of data aggregation. Since this research employs data on factual sales of tickets, the overview is concerned with the investigations that are found on the revealed preferences. The analysis of literature is focused on research questions that were considered in the previous papers.

Since art is often seen as a status good, a number of papers were devoted to the estimation of the price elasticity (Seaman, 2006). Studies based on the aggregated data showed that the demand is generally inelastic by price (Moore, 1966; Houthakker & Taylor, 1970; Touchstone, 1980; Gapinski, 1984; Bonato, Gagliardi & Gorelli, 1990). At the same time, some studies found empirical evidence of negative elasticity (Throsby & Withers, 1979; Withers, 1980; Greckel & Felton, 1987; Felton, 1989; Krebs & Pommerehne, 1995). In the paper (Krebs & Pommerehne, 1995) authors found the demand to be inelastic in short-run period and elastic in long-run. The presence of omitted variable in a model may cause the positive sign of elasticity (Jenkins & Austen-Smith, 1987). If the higher price testifies the higher quality of performance, then the higher level of price results in the higher level of attendance. The direct relationship between price and demand appears that the theatre 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 demonstrated different elasticity indicators for the subgroups of the population (Levy-Garboua & Montmarquette, 1996; Lange & Luksetich, 1984). In research (Pommerehne & Kirchgassner, 1987) authors reveal lower price elasticity for consumers with higher income. Elasticity may vary for different seats in a house (Schimmelpfennig, 1997). Demand for seats in the stalls, circle and back-end of tiered stalls is elastic but inelastic in a central part of 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 an absence of close substitutes, consumer's impatience and the lower share of expenditure on culture in the total expenditure of consumer.

The most advanced papers underlining the fact that the theater performance is a differentiated product in addition to the price included in the demand function the characteristics of performances. Numerous attempts have been done 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 the paper (Throsby, 1990). The author offered to distinguish objective and subjective ones. Objective measures include the capacity of a house (Greckel & Felton, 1987), the rating of performance popularity (Felton, 1989), the expenditure on performance (Luksetich & Lange, 1995). Other researchers proposed to use as a subjective measure the reputation of the theatre (Urrutiaguer, 2002), the reputation of the director (Urrutiaguer, 2002; Willis & Snowball, 2009), reviews (Corning & Levy, 2002; Colbert & Nantel, 1989).

In the paper (Throsby, 1983) the author proposed to evaluate the quality of the production through the type of performance. He suggested to include the variables responsible for the classification of the repertoire (classic/modern) and the level of performance (performance, musical, playing an instrument) into the model. Further studies expanded the performances' classification offered by Throsby (1983). In a study (Corning & Levy, 2002) the authors divided the performances into four groups of repertoire classification: a classical performance, a new show, a modern performance, an atypical performance. In classification by the time presenting to the public performances may be referred to the matinee, evening, preview, opening or regular.

Taking into account the considered papers assessing the demand, we can summarize that the attendance of the theatre essentially depends on price, performance characteristics and quality. There is one more issue that should be discussed in the context of demand estimation. Demand equation is a relation between the volume of tickets purchased and tickets prices and performance characteristics. Demand has some measures as a number of tickets sold on performance or per unit of time, the percent of theatre occupancy or the volume of household expenditure on cultural activities. The majority of the early studies based on aggregated data did not take into account 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. In some papers authors included a capacity of a house in the model in an attempt to take into account censoring of demand. The problem of

censored demand estimation was solved in the study (Laamanen, 2013). Author has estimated demand equation through censored quantile regression at median using a method proposed by Powell (1986). In the 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 estimation is the censored quantile regression that proposed in the paper (Chernozhukov & Hong, 2011) and will be in detail discussed in Section 4. In the next section, we discuss and analyze the available data. Preliminary analysis of the data motivates the method employed in the research.

3 Data

The data for research is taken from the sales reports of Russian opera and ballet theatre located in the city of Perm. Currently, the Perm Opera and Ballet Theatre is considered as the best regional theatre in Russia. The theater outstands by the modern musical productions, nonstandard classical performances, unconventional festival projects. At the same time, the Perm Theatre remains a major Russian center of opera and ballet, where the quality of the musical performance is paramount. Every year the theatre demonstrates fifty regular productions and three to five premieres.

The Perm Opera and Ballet Theatre is a noncommercial organization. Therefore, the goal of the theatre differs from the goals of commercial organizations. The basic goal of the theatre is involving of Perm local residents in ballet and symphonic art. Thus, the theatre strives to make a visit to the theatre accessible to all segments of the population. By the way, Perm Opera and Ballet Theatre is lossmaking. The main source of funding is a Perm territorial budget. At the same time, the theatre has at least partially to repay the expenses on performances on account of revenue from the performances to produce new ones. Consequently, the theatre constantly tries to balance between these requirements and charge prices more effectively.

The data provided covers all performances for four seasons between August 2011 and July 2015. For four seasons artists have presented 985 performances at the main venue, 170 of which are unique productions. The data includes information on the name of performance, 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 seat in an auditorium has some ways of identification. The main auditorium of the theatre is divided into sectors: loge, the stalls, tiered stalls, circle and upper circle. In the sector, the seat is identified by row and place. Besides, the auditorium is divided by nine seating areas according to the distance from the scene (Figure 1). The seats in different seating areas vary by the quality of view and sound, the prestige and, consequently, by the price. Whereas

the seats located in one seating area are considered as homogeneous in terms of price and quality. The theatre also has a system of discounts for the attendants. The discounts are divided into permanent, provided for special segments of the population (students, students of the ballet school, retired people) and random available for partners or theatrical employees. Thus, for every ticket purchased we know information on the basic price charged by the theatre and on the factual price of a sale with discount. In the research, we employ only the basic price of the ticket as a measure of the price considering that the administration of the theatre may manage exactly the basic price.

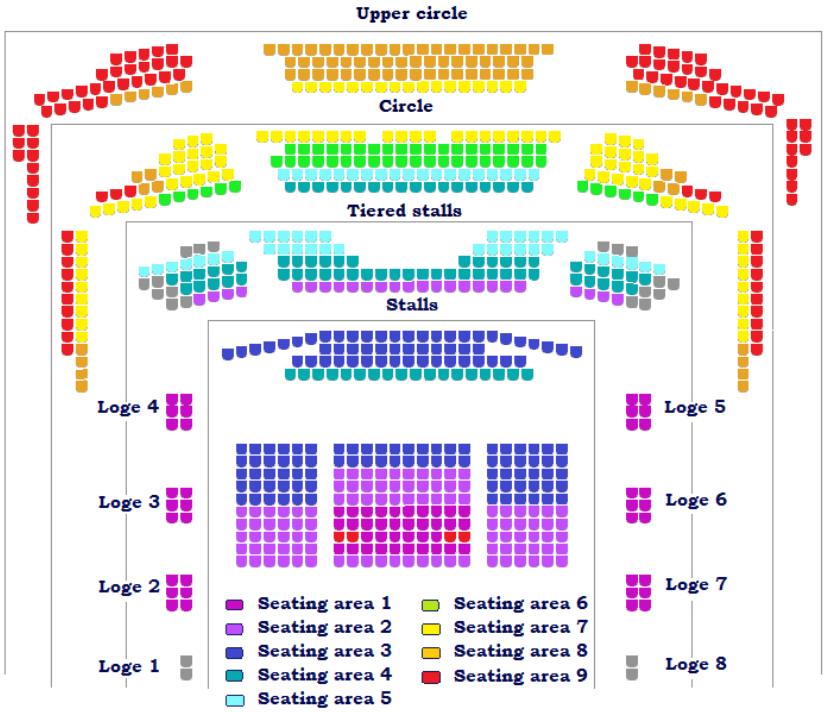


Figure 1 The scheme of an auditorium

In addition to the information provided by the theatre, we have collected information on performance characteristics from different data sources. Type of performance is an important determinant of demand. According to the style of presentment, we have classified performances into opera and ballet. The time of writing allows us to divided performances into classical (written before 1900) and modern (written after 1900). We also have information on the author of performance and construct dummy responsible for the nationality of the author (Russian/foreign). The dummy on whether the year is premiere for the performance allows distinguishing the premiere and non-premiere performance. Since the performances vary by the length, we include the variable for the duration of performance. According to the age recommended for attendance, we classified performances on children (without restriction), family (starting from 12 years old) and adult (recommended from 16 years old). Information on band-director allows us to estimate

the contribution of a particular person. Among band directors, we identified three persons that are especially successful and in-demand. Since 1998 Perm Opera and Ballet Theatre is regularly nominated for Russian prestigious theatre award Golden Mask. For every performance, we have information on the number of nominations and awards taken. In order to catch the quality of performance, we include information on the popularity of the performance in the world. 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 Table 1.

Table 1 Descriptive statistics categorical variables

Variable	Total	Share
Seasons	4257	
2011/2012	1296	30.4
2012/2013	1260	29.6
2013/2014	1053	24.7
2014/2015	648	15.2
Day of week	4257	
Working days	2169	51
Weekend	2088	49
Time of day	4257	
Before 2 am	495	11.6
After 2 am	3762	86.4
Type of performance	2682	
Ballet	954	35.6
Opera	1728	64.4
Date of creation	4257	
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	4257	
Presence	1719	40.4
Absence	2538	59.6
The nationality of author	4257	
Russian	1521	35.7
Foreign	2736	64.3
Band director	2682	
Valeriy Platonov	1422	53.0
Vitaliy Polonskiy	72	2.7
Teodor Currentzis	279	10.4
Other	909	33.9

Since the research question assumes the study of attendance rate of a particular seating area, then we aggregated data on sales and prices by areas. For each seating area we calculated the

attendance rate as a percentage of total number seats in the area and assign the basic price in accordance with one out of 8 theatre schemes of pricing (Table 3). This structure of data aggregated by zones allows to control on the quality of seats depending on their location in an auditorium and estimate the heterogeneity of effects for different zones.

Table 2 Descriptive statistics for continuous variables

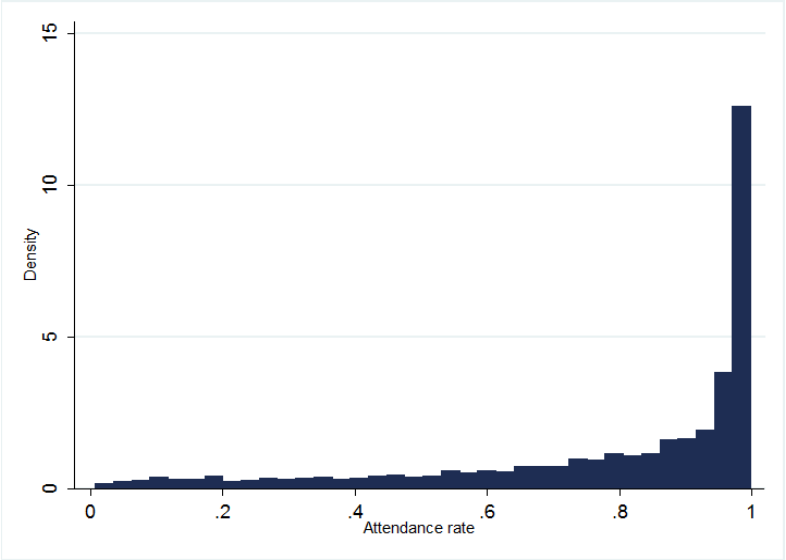
Variable	Obs.	Mean	SD	Min	Max
Basic price (roubles)	4257	412.0	381.0	100	2000
Seating area 1	473	903.4	503.2	300	2000
Seating area 2	473	619.8	655.1	200	1400
Seating area 3	473	525.2	364.8	210	1300
Seating area 4	473	462.1	336.9	180	1200
Seating area 5	473	378.1	278.3	160	1000
Seating area 6	473	299.4	222.2	140	8000
Seating area 7	473	239.9	158.6	120	600
Seating area 8	473	180.4	94.5	110	400
Seating area 9	473	100	0	100	100
Attendance rate (%)	4257	0.80	0.25	0.00	1
Seating area 1	473	0.85	0.16	0.11	1
Seating area 2	473	0.89	0.14	0.35	1
Seating area 3	473	0.89	0.15	0.35	1
Seating area 4	473	0.90	0.15	0.11	1
Seating area 5	473	0.84	0.21	0.11	1
Seating area 6	473	0.8	0.25	0.06	1
Seating area 7	473	0.70	0.32	0.02	1
Seating area 8	473	0.65	0.34	0.00	1
Seating area 9	473	0.72	0.31	0.00	1
Antracts	1971	1.6	0.60	1	3
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

Apart from seats in an auditorium the performances may also be heterogeneous. The Figure 2 shows that a senior part of observations is filled with more than eighty percent. The remaining seating areas are demanded to lesser extent that allows judging about the heterogeneity of performances by popularity.

Table 3 Theatre schemes of pricing

Scheme	Max price (roubles)	Frequency	Share
1	300	261	6,1
2	500	1170	27,5
3	600	27	0,6
4	700	684	16,1
5	800	423	9,9
6	1000	945	22,2
7	1500	180	4,2
8	2000	567	13,4

Figure 2 Density of attendance rate



To analyze patterns of the reaction of attendance on price change we divided performances according to the level of occupancy. If the attendance rate exceeds mean level (eighty percent) than the performance 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 in an auditorium into prestigious (the first three zones) and “of no prestige” (the last three zones) (Figure 3). The attendance on “popular” and “expensive” is high as 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 on “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 pay attention only to “expensive” performances, we notice that the fall in popularity leads to the decrease in the attendance of seats, especially in the case of the last seating areas. This is also true for “cheap” performances. Thus, the preliminary data analysis prompts us 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.

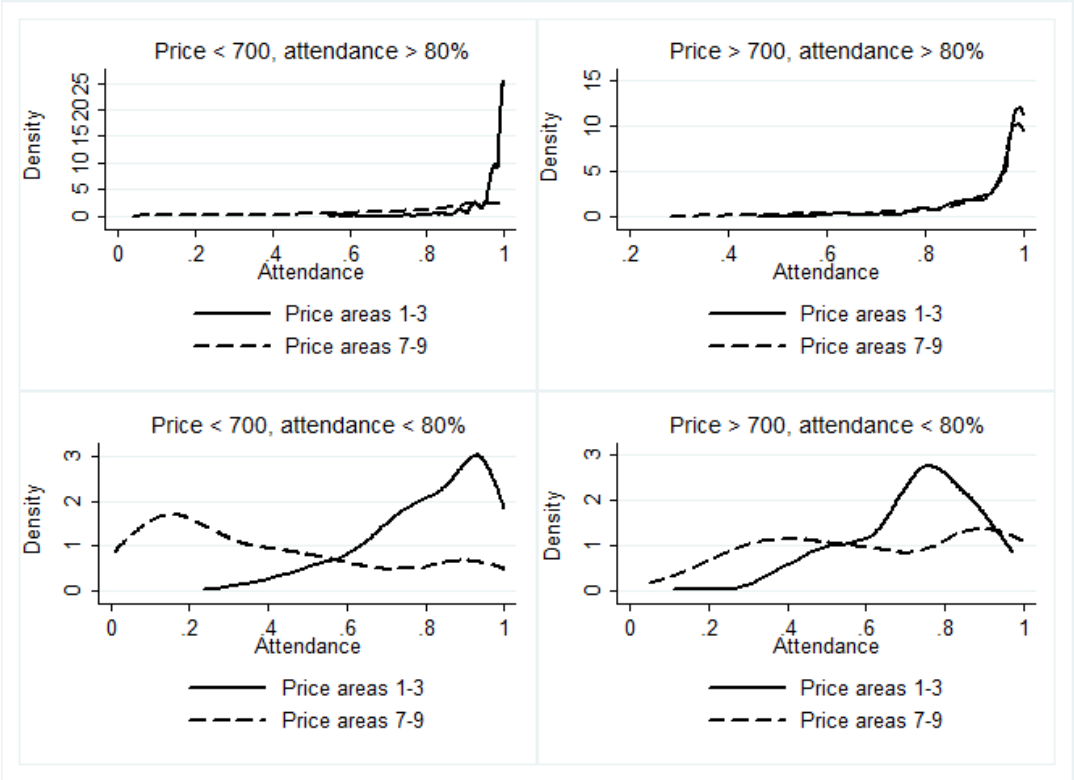


Figure 3 Attendance rate distributional plots by price and popularity

4 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 allows to obtain parameters estimates at each level of the dependent variable quantile while the OLS estimates the mean effect of the dependent variable. We also should account for 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 on the particular seating area may exceed the observed one. The attendance rate is bounded by zero and one but only 4 observations on seating areas have zero attendance rate. This means that ignoring the censoring at the lower bound may only produce the negligible bias in estimates. The model of

demand for theatre productions then may be represented by quantile regression with upper censoring:

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

where

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

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

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

y is an observed attendance rate of a seating area,

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

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

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

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

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

5 Results

Initially, we decided to test the estimates on the necessity to use the censored quantile regression comparing with the linear regression (OLS) and quantile regression at 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 the OLS estimates the value of average effect, but median regression at the median. The estimates of the second specification compared with the third are smaller in absolute value suggesting that the median regression without censoring underestimates the values of effects. Estimate bias for a different level of attendance quantiles in the case of price elasticity is shown on Figure 4.

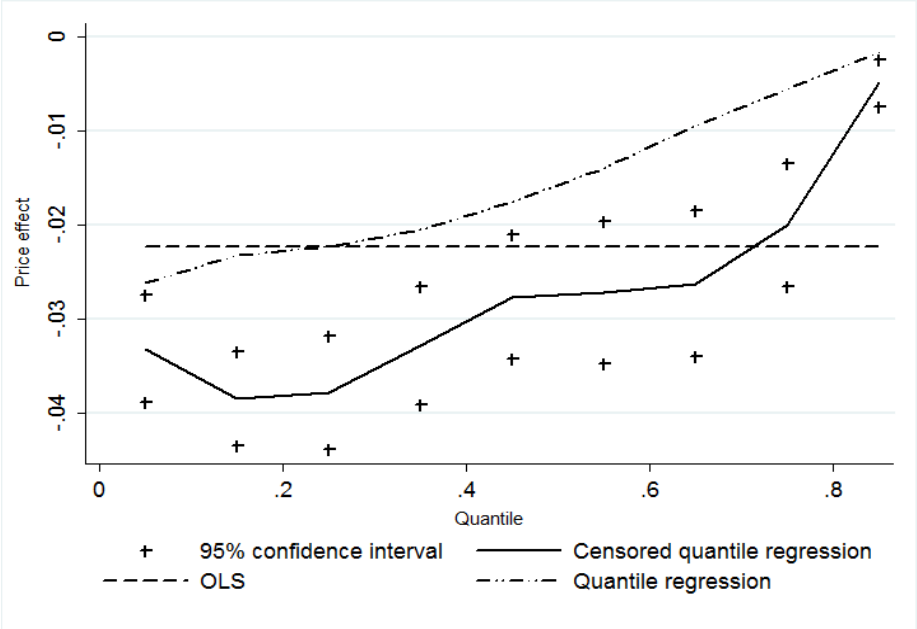


Figure 4 Estimate bias for the different level of attendance quantile

Further, we have 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 that testifies that the demand is weekly elastic by price. With the increase in attendance quantile the effects of price and other explanatory variables become smaller or even insignificant. This pattern gives evidence that a particular attribute has a greater effect on less popular performances. And as the popularity of performance increases, the contribution of each attribute falls but the quality unexplained by observed explanatory variables grows. In addition, the negative sign of price elasticity denies the hypothesis that the theatre performance is a Veblen good. However, the decrease of price effect for popular performances signals that theatre may charge the price more effectively to increase a box-office revenue without reducing the attendance rate.

Table 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		

Note: 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 seasonal, monthly and daily dummies and seating area dummies.

Table 5 Results of censored quantile regression on different levels of quantile

	(1)	(2)	(3)	(4)

	α = 0,2	α = 0,4	α = 0,6	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

Note: 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 seasonal, monthly and daily dummies and seating area dummies.

The estimates of other explanatory variables' effects are intuitively clear. Demand is higher on performances of Russian authors compared to foreign. Performances in premiere year are also more attended. Theatregoers on average prefer to attend ballets than operas, that consistent with the fact that ballet is more understandable cultural product than opera. The number of awards in Golden Mask is a significant determinant of demand and impacts on the demand positively. The demand for the family performances is higher than on children's and less than on adult

productions. If the difference in attendance on family and children performances may be explained by the distinction in content, than the less popularity of adult performance arises from the narrowing of potential visitors range.

6 Robustness check

Exogeneity of tickets price is a crucial assumption for the correct estimation of demand function parameters. If a process of setting a ticket price is dependent on the prediction of future attendance then the price is endogeneous 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 tickets price with the conditional independence on error term property.

Luckily, the panel structure of the data allows to construct instruments without employing the outside data. Since most of the performances are played several times (86% of performances was played 5 times and more up to 14) with enough variation of ticket price within the performance, we use a within performance 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 a price deviation (price «within») for a seating area j on a play i for a performance k from a mean price over plays of a performance k for a seating area i,

p_{ijk} is a price for seating area j on a play i for a performance k,

$\bar{p}_{.jk}$ is a price of tickets for a seating area j on a performance k averaged over all plays.

This way of constructing instruments was proposed by Hausman and Taylor (1981) for dealing with the unobserved individual (performance) effects correlation with the observed variables. With the presence of unobserved performance quality, only mean price for the performance may be correlated with it since both are fixed over time. The deviation of the price from the mean one is only determined by the characteristics of a particular play (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 enough variation of the total price.

In order to compare the censored quantile regression results with those controlled for possible endogeneity of a ticket price, we apply Chernozhukov, Kowalski, Fernandez-Val (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 performance

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 spread 2SLS instrumental variables method and nonparametric IV methods (Newey, 2013).

Formally saying, the estimation procedure starts with estimation of

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

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

On the next step 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 performance characteristics, ticket price and price residuals.

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

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 estimates difference between censored quantile regressions with and without instrumental variables. Estimates results are reported in Table 6. 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 price and attendance rate equations 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 to rely on the assumption of the exogeneity of ticket price and consistency of censored quantile regression results discussed above.

Table 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.

7 Conclusion

Theatre performances studies address various issues ranging from price discrimination at the theatre, ending with the identification of theatre patron. Among them several studies are devoted to the empirical study of demand. Literature review shows that demand identification can be implemented on different data structure. Early studies were mostly conducted on aggregated data. In recent papers, authors employ data disaggregated to the level of population or performance subgroups. This research uses data disaggregated to the level of performance price zones that allows to test the heterogeneity of performances and seats in an auditorium.

We estimate the demand function for opera and ballets using tickets sales data from Perm Opera and Ballet Theatre and find empirical evidence that demand is weakly elastic by price. Making decision about the sale of ticket consumers are guided by the set of performance characteristics apart from the ticket price. Attendants are more likely to visit performance written by the Russian author. Visitors prefer premiere performances. Among performances demand is higher on ballets especially ballets with the world popularity. In addition, the audience of Perm Theatre has a knack for band directors and has some favorite ones. Since the capacity of an auditorium is limited, the potential demand may exceed the observed. Comparison of median and censored median regression reveals the bias in estimates and persuades to account for censoring. Model of censored quantile regression allows us to avoid the estimate bias caused by the censored nature of demand. Methods used in previous papers allow to estimate 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 field of estimating the demand for performing arts. Finally, our results prove 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 *ceteris paribus*. However, an increase in the performance and seats popularity leads to the demand that is lower elastic by price. This implies that the quality has the effect on price elasticity remaining it negative.

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 theatre demand. *Journal of Cultural Economics*, *36*(2), pp.113-139.

Hansen, T. B. (1997). The willingness-to-pay for the Royal Theatre 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 theatre. *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 theatre 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 theatre 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 theatre. *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 theatre. *Journal of Cultural Economics*, 26(3), 185-202.

Willis, K. G., & Snowball, J. D. (2009). Investigating how the attributes of live theatre 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 theatre. *Journal of Cultural Economics*, 33(2), 85–108.