European Journal of Operational Research 229 (2013) 124–131

Contents lists available at SciVerse ScienceDirect

European Journal of Operational Research

journal homepage: www.elsevier.com/locate/ejor

Stochastics and Statistics

Forecasting accuracy of behavioural models for participation in the arts

Victoria Ateca-Amestoy [a], Juan Prieto-Rodriguez [b,*]

[a] Department of Economic Analysis II, Universidad del País Vasco/Euskal Herriko Unibertsitatea, Avda. Lehendakari Aguirre, 83, 48015 Bilbao, Spain
[b] Department of Economics, Universidad de Oviedo, Avda. Del Cristo, s/n, 33006 Oviedo, Spain

ARTICLE INFO

Article history:
Received 11 January 2012
Accepted 2 February 2013
Available online 16 February 2013

Keywords:
Forecasting
Count data
Brier scores
Bootstrapping
Cultural participation

ABSTRACT

This paper assesses the forecasting performance of count data models applied to arts attendance. We estimate participation models for two artistic activities that differ in their degree of popularity – museums and jazz concerts – with data derived from the 2002 release of the *Survey of Public Participation in the Arts* for the United States. We estimate a finite mixture model – a zero-inflated negative binomial model – that allows us to distinguish between "true" non-attendants and "goers" and their respective behaviour regarding participation in the arts. We evaluate the predictive (in-sample) and forecasting (out-of-sample) accuracy of the estimated model using bootstrapping techniques to compute the Brier score. Overall, the results indicate the model performs well in terms of forecasting. Finally, we draw certain policy implications from the model's forecasting capacity, thereby allowing the identification of target populations.

1. Introduction

Cultural economics has contributed to our knowledge on participation in the arts by proposing and estimating economic models to explain the determinants of demand for cultural goods and services. Art managers have focused their interest on an understanding of their participants in order to design and implement effective programming and marketing strategies for different artistic goods. This paper seeks to relate both types of contributions by estimating a participation model and assessing its properties in terms of the forecasting of cultural participation in jazz concerts and museum visits. Participation in the arts, together with the consumption of cultural goods, corresponds to the last stage of the cultural process, as defined by UNESCO (2009). It includes the activities of audiences and participants in consuming cultural products and taking part in cultural activities and experiences. Traditionally, this participation has been divided into three categories, depending on the way in which it takes place: attendance, active practice and the consumption of cultural content through the media. The research interest of the field of cultural participation has gone through several stages, with each one providing different types of knowledge on audience composition and motivation, which has added to previous contributions.

First, a general description was made of the socio-economic characteristics of the audiences with respect to non-audiences. As noted in Seaman (2005) and McCarthy et al. (2001), the initial interest involved determining who was participating in the arts, and initial studies thus provided a description of which social groups participate more in relative terms, shedding light on the composition of audiences. That set of initial studies (participation studies, such as those reported in Seaman (2005)) confirmed certain common traits of cultural audiences: they are more educated and enjoy a higher income, there is evidence of a certain degree of feminisation, and attendance is a mostly urban phenomenon. Those studies also reported that no particularities were found for different countries.

In a second step, a different set of studies (econometric studies, such as the survey by Seaman (2005)) began to incorporate individual decision-making models to understand why people participate in the arts and why differences arise. When information is available on individuals (such as income) and markets (such as the price of the cultural goods and other complements and substitute goods), studies of that nature can be used to estimate demand functions (see, e.g., Prieto-Rodriguez et al., 2005). Own-price elasticity, income (full-income) elasticity and the degree of complementarity–substitutability were investigated. When modelling and estimating the demand for cultural goods, economists consider that factors other than prices and income determine the choice set of the cultural consumer and, subsequently, consumer demand. Additionally, the determinants of underlying tastes and their possible evolution are taken into account by some of those models. Notably, the presence of a certain stock of personal capital in terms of the ability to interpret and enjoy the symbolic characteristics of goods is considered. With this in mind, early exposure to the arts and artistic instruction are introduced in those individual decision models.

When data on prices and/or personal income are not available, participation equations are estimated to determine how personal

* Corresponding author. Tel.: +34 985 10 37 68; fax: +34 985 10 48 71.
E-mail address: juanprieto@uniovi.es (J. Prieto-Rodriguez).

0377-2217/$ - see front matter
http://dx.doi.org/10.1016/j.ejor.2013.02.005

constraints – in the form of personal capital/education, income, household burdens and so on – shape the observed choice of attendance. Participation equations, with the first equations in the form of probit/logit regression models, quantify the effect marginal changes in the explanatory variables have on the probability of being an attendee over a specific period of time (Gray, 2003). The intensity of participation has sometimes been modelled by means of ordered probit/logit models (Borgonovi, 2004). The unobserved heterogeneity that may induce different behavioural patterns in the observed choice of the population has been addressed by latent class models (Ateca-Amestoy, 2008; Fernández-Blanco et al., 2009; Grisolía and Willis, 2012). The testable hypotheses derived from the economic approach to cultural participation have thus been tested by estimating those types of behavioural econometric models using a wide variety of information on the cultural habits of the general population. Behavioural models not only assess the correlates of participation but also explain the determinants of those observed choices based on individual decision-making models. With the exception of Grisolía and Willis (2012), the aforementioned papers use microdata from surveys conducted on samples that are representative of the overall population. However, when participation equations are estimated in the absence of personal data on income, education or any other relevant independent variable, the analysis must rely on the central tendency or dispersion measures of the aggregated community values of these variables, sometimes retrieved from administrative data, such as the percentage of the adult population with a university degree in a given geographic or administrative unit (Brook et al., 2010 or Willis et al., 2012). The analysis can further account for the location of the individuals, as in travel cost studies (Collins et al., 2005 and Willis et al., 2012).

Despite the diversity of approaches, the forecasting properties of those behavioural estimated participation models have rarely been assessed. For instance, little attention has been devoted to the appropriateness of the models to describe what happens outside the sample used in the estimation: do people not included in the survey really behave as the estimated models establish? Moreover, the accuracy of the models is often not even assessed for those in the sample; researchers were hitherto more concerned with determining the relevant characteristics of participants rather than fully predicting their behaviour with regard to cultural participation. This can be thought of as an additional step in a study programme that has already systematically analysed behaviour, as a model is needed to contrast it against reality in terms of its forecasting power; that is, its capacity to predict the behaviour of those individuals not included in the sample used to estimate the model. Taking this further step is interesting not only for researchers in cultural economics but also for cultural managers who seek a better understanding of the characteristics not only of their own audiences but also of the general population. We believe that greater knowledge may contribute to improving the targeting of audiences and lead to the more efficient programming and promotion of cultural activities.

Future attendance in the area of cultural goods and services has been forecasted using different methods in the field of cultural management. What's more, contributions from operational research for studying the supply and/or demand determinants of cultural activities have appeared in recent years, notably related to the availability of more data (arising from new channels of commercialisation and the consumption of digital cultural goods). Most of the studies reviewed focus on the movie industry, with some addressing the two areas of interest here: performing arts and museums and heritage institutions.

Regarding the forecasting of attendance, one method corresponds to a consumer-oriented approach (Andreasen and Belk, 1980; National Endowment for the Arts, 1981; Holbrook and Schindler, 1994). This approach is based on the correlates of attendance, including attitudinal values, determinants of lifestyles and early exposure. However, because this approach does not always deal properly with endogeneity problems and causation, the usefulness of the findings for policy making cannot be addressed. A second approach focuses on the characteristics of the cultural event to forecast its audience. Some studies have taken a "manipulative approach to check the declared effect on future participation of a change in the attributes of the event" (National Endowment for the Arts, 1981). Potential sales equations can be estimated, and the results are compared with expert forecasts (Putler and Lele, 2003). Expert forecasts are part of the "managerial approach". Based on combinations of different techniques, such as the Delphi approach or forecasts based on managers' expertise, the potential audience of a particular event is estimated. This is one of the methods explored in the *ARTS PLAN* program (Weinberg, 1986; Weinberg and Shachmut, 1978).

A different approach to those studies has involved the exploration of time series to forecast attendance or box-office revenue based on theatrical distribution models for the movie indndez-Blanco & Baños-Pino (1996)' has been changed to 'Fernández-Blanco & Baños-Pino (1997)'.ustry (Fernández-Blanco and Baños-Pino, 1997 and Eliashberg et al., 2008). Jones et al. (2007) use goal programming models to identify whether or not an individual ever goes to the cinema, using UK data.

The availability of new datasets based on individual or aggregate information gathered by online ticketing services, internet searches and social networks has recently introduced the possibility of estimating new models to be used to forecast attendance (as in Hand and Judge, 2012), investigate the influence of social networks on cultural consumption (Carrer-Neto et al., 2012), determine the individual and social value of a particular institution (see, e.g., Grisolía and Willis, 2012), identify and characterise market segments (Willis et al., 2012), or assess the performance of promotion websites (Plaza, 2011). At the same time, there have been recent developments in decision support-models based on the design of stochastic simulation models for the cinema (as in Ferrer-Martí et al., 2012) or for museum exhibitions (e.g., Lee and Lin, 2010). Other studies on the cultural goods that benefit from the increasing availability of data range from those that consider the strategic management of cultural supply and the efficiency of cultural organizations (orchestras, as in Boyle and Throsby, 2012, or cultural heritage institutions, as in Fernández-Blanco et al., 2013), to studies on the segmentation of cultural tourism demand (in a sample of visitors, as in Serrato et al. (2010), or in a general population survey, as in Nicolau (2010)).

As mentioned before, in an attempt to assess the suitability of behavioural models we explore the possibility of using such models to gain further knowledge on consumers of art and assess the predictive and forecasting performance of behavioural participation models applied to arts attendance. If behavioural models perform well in terms of forecasting, they will be useful for predicting potential and future attendance. To verify the robustness of our findings, we have decided to analyse two different cultural activities: attendance at jazz concerts and visiting art museums and art galleries. There are obvious differences between these activities, as one is a performing arts activity and the other one is related to the appreciation of cultural heritage. The dependent variables are defined as the number of times a particular individual attends a museum or a live jazz performance. Due to the nature of those variables, we estimate finite mixture models that allow distinguish between "true" non-attendants and "goers" (even if they do record zero-corner behaviour). We use data derived from the 2002 release of the *Survey of Public Participation in the Arts* (SPPA) for the United States. Finally, we evaluate the predictive (in-sample) and forecasting (out-of-sample) accuracy of the estimated models using bootstrapping techniques and computing Brier scores.