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Batabyal, Amitrajeet and Yoo, Seung Jick

Department of Economics, Rochester Institute of Technology, Sookmyung Women's University

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by

Amitrajeet A. Batabyal[2]

and

Seung Jick Yoo[3]

1

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Department of Economics, Rochester Institute of Technology, 92 Lomb Memorial Drive, Rochester, NY 14623-5604, USA. Internet aabgsh@rit.edu
3

Graduate School of International Service, Sookmyung Women's University, 100 Cheongpa-ro 47-gil, Yongsan-gu, Seoul, Republic of Korea. Internet sjyoo@sookmyung.ac.kr

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Abstract

We provide the *first* theoretical analysis of the working of an agency that provides guided tours in multiple foreign languages to tourists. We begin by delineating a simple model of the functioning of such an agency. Our model accounts for the fact that this agency is operating in an environment of uncertainty because the demand for guided tours in foreign languages is probabilistic. Next, we compute the probability that in the next day, the agency under study will receive a total of $n \in \mathbb{N}$ requests for guided tours. Finally, we ascertain the probability density function of the amount of time it takes to complete a requested guided tour in an arbitrary foreign language.

Keywords: Foreign Language Guided Tour, Tourist Agency, Uncertainty

JEL Codes: L83, D81

1. Introduction

Guided tours are routinely demanded by and hence provided to tourists visiting new locations in general and art galleries, museums, and heritage sites in particular. Therefore, a sizeable literature has now analyzed the provision of guided tours from a variety of perspectives. For instance, Weiller and Xu (2007) have shown that tour guides play an important "mediating" or "cultural brokering" role in enhancing the travel experiences of Chinese tourists in Australia. Similarly, Lugosi and Bray (2008) have argued that an entrepreneurial tour company's culture and the learning opportunities it provides have a great bearing on the efficacy with which tour guides perform their functions. Diekmann and Maulet (2009) have concentrated on the African quarter of Brussels (Matonge) in Belgium and have pointed to the important role played by local tourism authorities in encouraging the growth of private guided tour programs in this quarter. Finally, Petr (2009) has argued that as far as national heritage sites are concerned, the fame of a particular site is not positively correlated with the consumption of guided tours in this site.

With the onset of the phenomenon that we now call globalization, many more individuals than before are venturing out of their native countries and visiting places where they do not speak the local language. Therefore, to provide a meaningful educational experience to tourists and to promote tourism more generally, an agency that provides guided tours must account for the fact that it will frequently be necessary to provide such tours in one or more foreign languages.

The work of Jacobson and Robles (1992), Ap and Wong (2001), Paz (2008), and Quetel-Brunner and Griffin (2014) tells us that the need for providing guided tours in foreign languages has been widely recognized in the tourism literature. Even so, to the best of our knowledge, there are *no* theoretical studies of the functioning of an agency that provides guided tours in multiple foreign languages to tourists. Given this lacuna in the literature, our objective in this research note is to conduct the *first* theoretical analysis of the working of an agency that provides guided tours in multiple foreign languages to tourists. Our analysis breaks new ground in the literature because we explicitly model the fact that the agency under study is operating in an environment of *uncertainty*. There is uncertainty because the demand for guided tours in foreign languages by tourists is *probabilistic* and hence not known with certainty.

The rest of this note is organized as follows. Section 2.1 delineates our stochastic model of the functioning of an agency. Section 2.2 calculates the probability that in the next day, the agency under study will receive a total of $n \in \mathbb{N}$ requests for guided tours where $\mathbb{N}$ is the set of positive integers. Section 2.3 first determines the probability density function of the amount of time it takes to complete a guided tour in an arbitrary foreign language and then discusses the connection between our findings and the efficient provision of foreign language guided tours. Section 3 concludes and then discusses two extensions of this note's research.

2. The Theoretical Framework

2.1. The stochastic model

Consider an agency that provides foreign language guided tours to arriving tourists. The structure of our model is easiest to comprehend when the focus is on two foreign languages. Therefore, in what follows, we concentrate on the case in which the probabilistic demand is for guided tours in one of two possible foreign languages. Let us call these two languages A and B. Now, the demand for guided tours in languages A and B occur in accordance with stationary Poisson processes---see Tijms (2003, pp. 1-32)---with respective rates $\zeta_A > 0$ and $\zeta_B > 0$ per day.[4]

[4]

The Poisson model is, in many ways, the natural model to go to when one is studying phenomena involving counts such as the

The time it takes to provide guided tours in the two languages A and B is given by exponentially distributed random variables with means $1/\mu_A > 0$ and $1/\mu_B > 0$. We now ascertain the probability that in the next day, the agency under study will receive a total of $n \in \mathbb{N}$ requests for guided tours.

2.2. The probability

Let us denote the probability we seek by $Prob\{n\ requests\ for\ tours\ in\ next\ day\}$. Now, we use two well-known results about Poisson processes. First, from theorem 1.1.3 in Tijms (2003, p. 6), we conclude that the sum of two independent Poisson processes is itself a Poisson process. Second, from theorem 1.1.2 in Tijms (2003, pp. 3-4), we infer that this summed Poisson process has the so called memoryless property.[5] Putting these two results together, we deduce that

$$Prob\{n\ requests\ for\ tours\ in\ next\ day\} = \exp\{-(\zeta_A + \zeta_B)\}\frac{(\zeta_A+\zeta_B)^n}{n!}, n = 0,1,2 \ldots \quad (1)$$

We now determine the probability density function of the amount of time it takes to complete a guided tour in either one of the two foreign languages under consideration.

arrival of tourists. In addition, this model and its variants are generally tractable and hence relatively straightforward to work with. These two points explain why the Poisson model and its variants have been used frequently in the past by researchers such as Anaman and Looi (2000), Hellstrom (2002), Eugenio-Martin (2003) and Martin-Cejas (2006) to analyze a variety of research questions in the context of tourism. So, a clear precedent exists in the literature for our use of the Poisson process in this note. We would now like to emphasize the following four points. First, we are working not with the Poisson distribution *per se* but with a stationary Poisson process. In other words, we are working with a collection of Poisson distributed random variables over time. Second, it is true that for a Poisson distributed random variable, the mean equals the variance. As such, if we were interested in analyzing the impact that *seasonality* has on the arrival of tourists in a particular location then it would not be a good idea to use the stationary Poisson process to model the arrival of tourists. Instead, we would want to use, for instance, a nonhomogeneous Poisson process to study the arrival of tourists in a model of seasonal tourism. We say this because by using a nonhomogeneous Poisson process, we would be explicitly accounting for the dependence of the Poisson parameter or rate ζ on time. That said, it is difficult to obtain closed-form results with the nonhomogeneous Poisson process. Third, our model is best viewed as a model of the provision of guided tours in multiple foreign languages to tourists in a particular season. Finally, the results we obtain in this note depend on our use of the stationary Poisson process and the use of either a nonhomogeneous Poisson process or, more generally, a renewal process will substantially complicate the analysis we undertake in this note.

[5] Let Y be an exponentially distributed random variable that represents the lifetime of a device. Then Y is memoryless means that the residual life of this device has the *same* exponential distribution as the original lifetime, regardless of how long the device has already been in use.

2.3. Time to complete tour in either language

Let X be the random variable which denotes the amount of time it takes to complete a guided tour in either language and let $F(x)$ denote the density function of X. Now, given the "Poisson-exponential" structure of our model, the probability that the next requested guided tour is for a language A tour is $\zeta_A/(\zeta_A + \zeta_B)$. Similarly, the probability that the next requested guided tour is for a language B tour is $\zeta_B/(\zeta_A + \zeta_B)$. Combining these two pieces of information, we can determine the closed-form expression for the density $F(x)$. We get

$$F(x) = \frac{\zeta_A}{\zeta_A+\zeta_B} f_A(x) + \frac{\zeta_B}{\zeta_A+\zeta_B} f_B(x), \tag{2}$$

where $f_i(x) = \mu_i \exp(-\mu_i x)$ for $i = A, B$. Inspecting (2), the probability density function of the amount of time it takes to complete a guided tour in either one of the two possible languages is a weighted sum of two exponential distribution functions and the weights are the probabilities that there will be a request for either a language A or a language B guided tour.

The agency under study can use the two results we have obtained to provide foreign language guided tours in an efficient manner. Specifically, because (1) tells us the likelihood that there will be n requests for foreign language tours in a certain time period (a day), this result can be used to determine *effective staffing* levels, i.e., how many A and B language speaking tour guides to hire and have on staff in a particular time period. Similarly (2) can be used to *schedule* foreign language tours so that, for instance, the wait time of tourists looking for a particular foreign language guided tour is minimal. In these ways, our theoretical analysis can provide practical guidance to an agency that provides foreign language guided tours to tourists.

3. Conclusions

We provided the first theoretical analysis of the working of an agency that offered guided tours in two foreign languages to tourists. We began by describing a straightforward model of the functioning of such an agency. This model accounted for the fact that the agency was operating in an uncertain environment because the demand for foreign language guided tours was probabilistic. Next, we calculated the probability that in the next day, the agency would receive a total of $n \in \mathbb{N}$ requests for guided tours. Finally, we ascertained the probability density function of the amount of time it took to complete a guided tour in either one of the two foreign languages.

Here are two suggestions for extending the research described in this note. First, one can generalize the analysis by studying the provision of guided tours to tourists in any finite number of foreign languages. Second, it would be helpful to postulate an objective function for the agency under study and to then use the results of this note to optimize this function. Studies of the provision of guided tours in foreign languages to tourists that incorporate these aspects of the problem into the analysis will provide further insights into research questions in tourism economics that have both theoretical and practical ramifications.

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