



Hotel location when competitors may react: A game-theoretic gravitational model

Pedro Godinho^{a,*}, Paul Phillips^b, Luiz Moutinho^c

^a CeBER and Faculty of Economics, University of Coimbra, Av. Dias da Silva, 165, 3004-512, Coimbra, Portugal

^b Kent Business School, University of Kent, Canterbury, UK

^c University of Suffolk, UK and University of South Pacific, Fiji

ARTICLE INFO

Keywords:

Tourism site location
Game theory
Genetic algorithms
Spatial interaction models

ABSTRACT

This paper presents a hotel location model that incorporates concepts from both game theory and gravitational site location models. We consider a hotel chain intending to build new hotels in a given region. Customers travel to the region to visit some specific points, termed “attractions”, and they choose a hotel according to room price, location and hotel attractiveness. Competitor hotels react to the new hotels by changing prices, in order to maximize their own profits, so the final set of prices will be a Nash equilibrium. We propose an iterative procedure for finding the equilibrium prices and a genetic algorithm-based procedure for finding the optimal strategy, in terms of new hotels to be built and respective typologies. Using a mini case, we illustrate and analyse the influence of several parameters. Then, we present computational experiments, concluding that the proposed procedures are effective in finding good solutions for the model.

1. Introduction

Location remains a potential source for competitive advantage for the accommodation sector (Adam & Amuquandoh, 2014; Yang, Luo, & Law, 2014) with location decision-making gaining increasing attention from academic and business community in the past two decades (Chou, Hsu, & Chen, 2008). Moreover, the financial crisis of 2008 has led to a subsequent global economic downturn marking the beginning of the “new normal”, characterised by fundamental changes in the appetite for risk taking (Phillips & Moutinho, 2014). Hotels remain a key element of the tourism industry, so new approaches to enhance strategic decision-making of hotel investors will benefit the growth and development of the tourism industry.

Geographic location is important to a diverse range of retailers. For example, Wal-Mart operations in rural markets generate on average higher returns than its operations in more competitive urban markets (Ghemawat, 1986). Hotel location decisions may be quite problematic, especially in regions in which the market is mature and a significant supply already exists. In such cases, hotel chains must assume that competitors already in place will react to new hotels, which in the past led to room rate reduction in order to avoid losing customers. Given the scale and level of investments and maturity of the global hotel sector, opportunities exist for a more diverse range of methodological, philosophical and theoretical approaches. Williams and Baláz (2015)

contend that there is a need for stronger theoretical understanding of the different concepts of tourism risks.

This study considers a game-theoretic approach to address the hotel location problem. In this paper we consider that hotels will set prices in order to maximize their profits. We also assume that demand takes into account not only the hotel price but also other attributes of the hotel.

A paucity of prior game theory research in the context of hotel location (see Yang, Huang, Song, & Liang, 2008) provides a stimulant for this hotel location study. We aim to define an operational model that can be used both to find the optimal decisions in realistic and complex situations, and to analyse the outcome of such situations, particularly the impact of specific parameters on the outcome. To achieve this, we moved away from simplified models that would lead to closed-form mathematical solutions and define a more complex model that can be used in regions with different characteristics.

This study has some links to the operational component of the work of Arenoe, van der Rest, and Kattuman (2015), by extending it in several areas. First, similarly to Arenoe et al. (2015), we assume that customers may choose not to be lodged in any of the alternatives explicitly included in the model. But, while Arenoe et al. consider a utility threshold, we assume that there is an alternative that consists of not choosing any of the modelled hotels and which has an attractiveness to the customer. Second, we explicitly model the places that the hotel guests wish to visit, allowing different customer segments to have

* Corresponding author.

E-mail addresses: pgodinho@fe.uc.pt (P. Godinho), P.A.Phillips@kent.ac.uk (P. Phillips), luizamoutinho@gmail.com (L. Moutinho).

different visitation patterns. Other authors (e.g., Hung, Shang, & Wang, 2010) use proxies like the city centre to identify the places that attract visitors, but those will be just rough approximations in polycentric cities or when attractions are very far apart in a city. Another difference from the work of Arenoe et al. (2015) is the goal of the model. Determining the equilibrium prices is the final goal of Arenoe et al., but it is only the intermediate goal for this study. We assume that the hotel chain we are considering intends to build some new hotels, keeping the investment expenditure within a predefined budget. We want to find the optimal strategy (sites and hotel typology) for opening new hotels, in order to maximize the total profit of the chain. After the new hotel or hotels are built, new competition makes all hotels rethink their prices, and the set of prices becomes a game-theoretic Nash equilibrium.

2. Related works

Yang et al. (2014) classify prior hotel location research into theoretical, empirical and operational models. Their analysis covers a diverse mix of academic disciplines from hospitality and tourism, geography, economics, marketing, finance and urban planning. The authors delve into the literature and identify four theoretical categories, six empirical categories, and three operational categories. The authors also recognise that some of the models do not fit these categories, since there are some diverse models concerning hotel location.

Most models in the theoretical category and several models in the empirical category try to explain the spatial location or room pricing choices of the hotels. Since we take the perspective of defining the best locations based on the ability to attract demand, it is of interest to us to analyse models aiming to explain how customers make their choices. Masiero, Heo, and Pan (2015) notice that there are limited studies focusing on the relationship between hotel attributes and room pricing from a customer perspective. The authors propose a new discrete choice model for determining the customer's willingness to pay based on a set of room attributes. Lee, Kim, Kim, and Lee (2010) evaluate the importance of different factors in the satisfaction of frequent individual traveller/foreign independent traveller guests of five-star hotels in Korea. The authors consider six factors – tourism attraction, convenience, safety, surrounding environment, traffic and accessibility – and they consider several attributes for each factor. They conclude that tourism attraction is the most important factor in explaining the satisfaction of hotel guests.

Such empirical studies might provide a solid foundation for operational models, but in fact there are very few operational models based on detailed quantitative definition of customer behaviour. For example, the operational categories defined in Yang et al. (2014) – checklists, statistical prediction models and Geographic Information Systems-based models – do not consider a direct model of customer behaviour.

Among the authors considering a model of customer behaviour as the foundation for operational decisions, we can find Moutinho and Paton (1991). Moutinho and Paton propose a spatial interaction model for tourism site selection and analysis, the LOCAT model, based on the probability that tourists will patronise a given site location. It attempts to measure the total attractiveness of a particular site location taking into account the impact of the degree of accessibility, total catchment population and level of product uniqueness.

Arenoe et al. (2015) consider a model of customer behaviour based on conjoint analysis. The authors assume that buyers respond both to price and non-price differences, so the price charged by a hotel manager must take into account the prices charged by other hotels, as well as the characteristics of the different hotels. Any realistic operational model must consider that competitors will not remain indifferent to decisions that may affect them – in the case of Arenoe et al., they will be affected by the price decisions made by other hotels, so they will react to them. To incorporate these reactions, Arenoe et al. define a game-theoretic model of hotel pricing.

From an economics' perspective competitiveness within a sector can

be viewed through various lenses. Since the pioneering work of Von Neumann and Morgenstern (1945), which provided greater insights into game theory and economics, economists and mathematicians use the approach to assess decision-making in uncertain situations. Game theory remains an active area of research in economics and is particularly useful for studying interactions among large numbers of participants (Cheung, 2014). Rubinstein (1990) posits that game theory is a key tool for the construction of the modern theory of industrial organisations. Behaviour of firms can be modelled in either continuous strategy (e.g., Awaya & Krishna, 2016; Laraki, Solan, & Vieille, 2005) or discrete strategy sets (e.g. Ciliberto & Tamer, 2009; Godinho & Dias, 2013; Seim, 2006). A behaviour model of the firm will incorporate informational and computational assumptions and relate to more complex phenomenon (Prietula & Watson, 2008). Knowing how rational players behave in a strategic context has appeal to business and management scholars. Niou and Ordeshook (2015) stress the importance of game theoretic decision-making, which provides insight for the managers as one assumes that other decision-makers are not fixed targets, and that they take into account their knowledge of the manager, and that the manager knows that they know. More recently, the ability to identify and predict behaviours to capture value in intense competitive markets is an emerging theme in the value capture theory (Gans & Ryall, 2017). Research that enables scholars to rethink fundamental ideas in competitive environments will provide academic as well as practical benefits which can flow through to the bottom line. Kuechle (2014) does highlight that entrepreneurial activity varies across regions and the phenomenon persists over time, and this impacts choice of hotel location.

Game theory can amplify the interaction of competition from a behavioural modelling perspective (Clarke-Hill, Li, & Davies, 2003). Moreover, the field of game theory provides a lens through which hotel location decision-making can be analysed. Game theory-based models have been used in the context of hotel competition, but mostly within very simplified models of price or quantity competition (e.g., Baum & Mudambi, 1995; Chung, 2000; Gu, 1997; Guo, Ling, Dong, & Lian, 2013; Song, Yang, & Huang, 2009; Yang et al., 2008). The goal of such studies is often to determine the equilibrium prices, and revenue maximization strategies, which are primary objectives of hoteliers. This is in part due to the cost structure of hotels. If fixed costs are high and variable or operating costs are low, revenue maximization may be a sensible objective (Friesz, Mookherjee, & Rigdon, 2005). However, profit maximization is a more general objective since it does not rely on such an assumption and is more attractive to financially motivated stakeholders.

A factor that many studies consider to determine customer patronage is the closeness to the destinations that customers intend to visit. For example, Kimes and Fitzsimmons (1990) state that eighty percent of the customers of La Quinta Motor Inns visited destinations within four miles of the inn. In this paper we consider the special importance of this factor, which we model explicitly. In order to do it, we incorporate a spatial interaction perspective in the model.

There are few spatial interaction models applied to tourism. Hurley, Moutinho, and Witt (1998) propose a spatial interaction model for tourism site location. The model follows the site location approach proposed by Penny and Broom (1988), considering two attributes: distance and a subjective measure of attraction. The authors show that Genetic Algorithms (GAs) perform quite well in obtaining solutions for the model. Godinho, Silva, and Moutinho (2015) also propose a hotel location model based on Penny and Broom (1988) and Hurley et al. (1998), including a cost structure and a budget constraint. In both cases, the spatial component is based on the origin of the visitors, and not on the closeness of the hotel to the intended destinations.

3. A model for tourism site location under competition

In this paper we consider that hotels will define prices in order to

Download English Version:

<https://daneshyari.com/en/article/7420757>

Download Persian Version:

<https://daneshyari.com/article/7420757>

[Daneshyari.com](https://daneshyari.com)