Tourism Management 59 (2017) 171–181

Contents lists available at ScienceDirect

Tourism Management

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

Metrics to measure the geographic characteristics of tourism markets: An integrated approach based on Gini index decomposition

Pong-Lung Lau [a], Tay T.R. Koo [a, *], Larry Dwyer [b, c, d]

[a] School of Aviation, University of New South Wales, Kensington, 2052, Australia
[b] Faculty of Economics, University of Ljubljana, Slovenia
[c] Griffith Institute for Tourism (GIFT), Griffith University, Australia
[d] School of Marketing, Australian School of Business, University of New South Wales, Australia

HIGHLIGHTS

- Paper aims to develop Gini-based metrics to measure geographic dispersal of visitors.
- Dispersal metrics introduced have desirable properties based on well-established statistical principles.
- Analytically and graphically show how the dispersal ratio is embedded in the Gini index.
- Considering one dispersal measurement method in isolation increases the risk of incorrect conclusion.
- Outcomes aid tourism researchers and managers wanting to widen their repertoire in spatial measurement methods.

ARTICLE INFO

Article history:
Received 2 October 2015
Received in revised form
24 July 2016
Accepted 25 July 2016

Keywords:
Geographic concentration ratio
Spatial measurement approaches
Gini decomposition
Lambert and Aronson
Tourist dispersal
Australia

ABSTRACT

Compared to the metrics of tourism seasonality or tourism income distribution, metrics of tourism spatiality remains under-explored. Our principal aim is to enhance the way we measure the geographic dispersal of visitors by developing a Gini index–inspired dispersal metric. We discuss the theoretical criteria for an ideal spatial metric and use these criteria to highlight the important links and differences between Gini and the common ratio approach. Applying the methods to inbound Australian tourism data, we find that considering only one method in isolation not only increases the risk of incorrectly measuring the spatial performance of markets but also ignores interesting, and often offsetting, heterogeneous influences in the data. We expect the outcomes to aid tourism researchers and managers wanting to widen their repertoire in spatial measurement methods, and aid the choice of most appropriate method based on criteria firmly grounded in theory.

1. Introduction

The geographic distribution of visitors is interesting to study for a variety of reasons. It reveals complex decision-making processes associated with visitors' multi-destination choices. Moreover, the spatial configuration of visitor movement is important for understanding the impacts of tourism (Hall & Page, 2010; Lew & McKercher, 2006; McKercher & Lew, 2004), and thus can be important for a more complete assessment of tourism sustainability in a given region. Arguably, at a wider regional or national level, the geographic pattern of visitor movements is one of the important determinants of the flow-on effects of tourism development because it determines the location of tourist spending and its broader economic impacts. In some regions such as Galapagos in Ecuador, tourism is such an important contributor to economic development that its dispersal or enclave pattern has direct and indirect implications for developmental inequalities, including migration patterns of the population as well as the distribution of wealth and poverty (see, for example, Taylor, Hardner, & Stewart, 2008).

It is understandable then that these considerations can inform government policy. Committing significant public resources to tourism management requires metrics of key performance indicators aligned with the goals and implementation plans of the programs. Metrics are essential for tracking progress and

* Corresponding author.
E-mail addresses: p.lau@unsw.edu.au (P.-L. Lau), t.koo@unsw.edu.au (T.T.R. Koo), l.dwyer@unsw.edu.au (L. Dwyer).

http://dx.doi.org/10.1016/j.tourman.2016.07.019
0261-5177/

evaluating the economic, social and environmental performance of projects and policies. Simply put, one cannot effectively manage performance without measuring it (e.g., Tonchia & Quagini, 2010). Metrics aid objective inter-regional and inter-industry comparisons, useful for assessing the efficacy of tourism as one of many potential pathways for sustainable development. Additionally, in the context of the geographic dispersal of visitors, a robust measurement of the geography of tourism is also in the interest of the scientific understanding of visitors' spatial choice behaviour. Thus, developing spatial measurement approaches in tourism is of interest to researchers, industry and governments at all levels.

The dominant mode of practice in the spatial measurement of tourism is to use ratio-based approaches; for instance, Trip Index (Pearce & Elliott, 1983) or Main Destination Ratio (Leiper, 1989). The Australian government, for example, uses a dispersal ratio, which is the proportion of total visitors or visitor nights in rural regions (Tourism Research Australia, 2015). The ratio-based approaches are akin to proportions, percentages or fractions, and are also known as concentration (or dispersion) ratios. As discussed in Koo, Wu, and Dwyer (2012), this approach has its advantages – the key being its simplicity. The approach requires destination groups (k) to be divided into two mutually exclusive groups (i.e., $k = 1$ = rural regions, $k = 2$ = urban regions). If X_1 is visitor nights in the rural regions group, then

$$\text{Dispersal Ratio (DR)} = X_1 \Bigg/ \left(\sum_k X_k\right) \quad (1)$$

However, DR is also limited in that it ignores rich information available within the dataset, capturing only a snapshot of the variation one wishes to encapsulate in an ideal metric. Focusing on the comparison of the ratio (or fraction) of two groups of destinations (e.g., urban destinations and rural regions) essentially means that any information about the way tourists spatially distribute *within* each destination group (i.e., within the 'rural' and the 'urban' group) are ignored. However, within group information can be used to produce more robust dispersal measurements. Thus, a natural extension to the ratio-based approach is to adopt an approach that also analyses the information within-groups, as well as information about the extent to which each group (e.g., k in equation (1)) precisely links to the overall dispersion.

Against this background, our principal aim is to enhance the way we measure the geographic dispersal of visitors. In doing so, we discuss the theoretical criteria for an ideal dispersal metric and use these criteria to highlight the advantages of the Gini index. Importantly, we harness the decomposition properties of the Gini index to build on equation (1). To achieve this, a Gini index equivalent of equation (1) is introduced using the Gini decomposition method of Lambert and Aronson (1993). We show, algebraically and graphically, that the ratio approach is embedded in the Gini index. As will be seen, using the Gini index decomposition methods, we propose not just one but a suite of dispersal metrics that can be added to the analysts' toolkit.

We compare the metric's ability to help us understand the underlying patterns in the dispersal of tourists through an application on inbound tourism data in Australia. We expect the outcomes to aid tourism researchers, practitioners and managers wanting to widen the range of spatial measurement methods, and assist with informed decision-making as to the choice of the appropriate method based on criteria firmly grounded in theory. As a result, analysts can have greater confidence that the tools introduced by our method has desirable properties based on robust and relevant principles.

The structure of the paper is as follows. Section two introduces the Gini index, discussing how it is used in tourism research. Included in the discussion are the checklist of theoretical properties of an "ideal" metric for measuring spatial distribution of tourism and the extent to which the ratio- and the Gini approaches fulfill these criteria and why. In the methodology section, we explain the decomposition method and analytically show that the ratio is embedded in the Gini. In the results section, the practical significance of this method is discussed by applying them to Australian tourism data to analyse the aggregated spatial pattern of inbound visitors. The analysis is then extended to cover cases where there are greater than two destination groups.

2. Theoretical framework

The section provides an overview of the theoretical properties of the Gini index from the spatial measurement perspective, explaining why it is useful for the spatialised understanding of tourism development. This is necessary in order to provide a theoretically robust evaluation of the ratio and the Gini indexes, identifying precisely how and why the ratio approach should be extended. Below, we briefly introduce the two approaches and how they are used in tourism research.

2.1. Dispersal ratio and the Gini index: applications to tourism

2.1.1. The ratio method

As previously mentioned, often the interest in applying the ratio method in tourism is to gauge whether or not an individual trip or group of trips (e.g., a market segment) is geographically concentrated or dispersed. Expressed in fractions, the method shows the proportion of tourism spent outside the main gateway. If geographic evenness in tourism development is the goal then, presumably, keeping the proportion from dropping over time, and if possible, increasing it, would be the key objective. If the desired level of dispersal is known, then the ratio can be benchmarked against a specific target proportion.

2.1.2. The Gini index

Another common approach is the Gini coefficient. The Gini coefficient or index is a statistic conventionally used in order to describe in summary form the degree of inequality in distributions (usually of income and wealth). It is calculated by determining the area between a graph of the cumulative income share against the cumulative share of recipients (the so called Lorenz curve) and the line of perfect equality. This area is then expressed as a percentage of the whole triangular area under the diagonal. The resulting statistic reduces the position of the curve to a single figure. The Gini coefficient ranges from a minimum value of zero, when all individuals are equal, to a theoretical maximum of 1-1/N with N representing the population, when a single individual holds all the income and the others have none. In many applications on distributions with large N, the maximum value approaches one (Glasser, 1962).

One way to express the formula for the Gini coefficient is:

$$G = 1 - \frac{1}{N}\sum_{n=1}^{N}(\lambda_{n-1} + \lambda_n) \quad (2)$$

In equation (2), N could represent the number of regions in the sample. λ_n is the cumulative fraction of, for example, visitor numbers or visitor nights distributed in the smallest region to n-th smallest region. Interpreted this way, the Gini coefficient measures the inequality in the distribution of visitors/visitor nights across the regions. If the DR is based on rank-based grouping (e.g., top 4 destinations vs. rest), it is obvious that it is embedded in the Gini because it is λ_n (e.g., n = 4). It will be useful to know the exact