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Gravitational force exerted by Brazilian tourist destinations on foreign air travelers

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ABSTRACT

This article analyses the context of international tourist flows by air and tourism in Brazil, by applying the principles of the gravity model. The study includes 13 Brazilian international airports that served 108 origin-destination pairs, which accounted for 80.14% of the total tourist flows by air in 2012. In the statistical analysis applied, the dependent variable *Ft* is the tourist flow between the country of origin and the Brazilian state of destination. To approximate an explanatory equation, we formulated a linear function that was able to support, in 31.7% of the cases, the dependence of the international tourist flows with the variables considered in the linear regression performed. The conclusion is that the assumptions considered in this study only partially explain the gravitational force exerted by Brazilian tourist destinations, so there is a need to refine the model by including other variables that can influence the flows by air of international tourists.

1. Introduction

Availability of transports is a key element for the development of tourist destinations (Heraty, 1989; Prideaux, 2000; Bieger and Wittmer, 2006; Dieken and Button, 2011; Lohmann et al., 2013), and is included in the broad universe of tourist mobilities (Allis, 2013), helping to determine the geographic flow of tourists (Page, 2008). Interdisciplinary and multidisciplinary studies that bring together transport engineering and other disciplines like economics and geography, among others, are important to advance knowledge about tourism.

Brazil is the largest country by area and population in South America and is politically divided at the local level into 5570 municipalities[1] (IBGE, 2014), located in 27 "federative units" (26 states plus the Distrito Federal, containing the capital, Brasília, treated as a state here). These are arranged in five geographic regions (South, Southeast, Midwest, Northeast and North). Of these municipalities, 3345 are part of the process of regionalisation of tourism (Brasil, 2013a). While a process of municipalisation of tourism occurred in the 1990s under the National Program for Municipalisation of Tourism (PNMT), the regionalisation process began in 2003 with the Program for Regionalisation of Tourism (PRT), tied to the National Tourism Plan 2003–2007 (Brasil, 2003). This plan has been successively updated for the period 2007–2010 (Brasil, 2007) and the current one, 2013–2016 (Brasil, 2013a). Brazil has long been a major tourist destination in the global context, and this position has increased in recent years, both due to the holding of mega-events (2014 World Cup and the upcoming 2016 Olympic Games) and efforts under these plans to enhance the attractiveness of tourist destinations. According to the official statistics of the Ministry of Tourism, in 2012 the country received 5,676,843 foreign tourists, of whom 77.23%, arrived by air (Brasil, 2013b). Therefore, air transport plays a crucial role for the competitiveness of this activity in the context of the strategy to regionalise tourism in the country. According to the *Anuário Estatístico de Turismo* ("Tourism Statistical Yearbook") for 2013 (Brasil, 2013b), in 2012 there were 13 airports that received international traffic flows, located in 12 states (Amazonas, Bahia, Ceará, Minas Gerais, Pará, Paraná, Pernambuco, Rio Grande do Norte, Rio Grande do Sul, Rio de Janeiro, Santa Catarina and São Paulo) and the Distrito Federal.

The process of regionalisation marked its tenth anniversary in

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[1] The municipality is the local administrative unit in Brazil. It is akin to a county, except with a single mayor and municipal council. Municipalities range from lightly populated rural ones with one or two small towns to heavily populated urban ones that are part of greater metropolitan regions. There are no unincorporated areas in Brazil.

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2013, so with more than a decade now concluded, it is worthwhile analysing the results. Therefore, the general objective of this study is to identify, based on the principles of the gravity model, the attractive force of Brazilian states that have international airports. The study is exploratory and quantitative in nature, through statistical analysis.

2. Literature review

The relationship between transport and tourism distribution has been analysed in several empirical ways, a portion of which focused on the regional dispersal of tourists. For instance, Koo et al. (2012), undertaking a dispersion analysis of international tourists in Australia, stressed the need to provide an interpretation of the different distribution of tourism on a given territory and pointed out the importance of measuring the tourists' dispersion. This paper, instead, enquiries the pertinence of the gravity model in explaining the international tourist flows in Brazil.

The gravity model applied to tourism is empirical and is derived from the Law of Gravity developed by Newton in the seventeenth century. This law states that the force of attraction between two bodies is positively related to their masses and negatively related to the square of the distance between them. In the nineteenth century this law began to be applied to social phenomena (Saray and Karagöz, 2010) and is here considered relevant to study the relation between air transport and tourism in Brazil.

Archer (1976, cited in Lorde et al., 2015) was among the first authors to assume a critical position regarding the analysis of tourist demand through the traditional focus on economic theory, remarking that the influence of social, political and technological variables, which interact with strictly economic considerations, must be considered. This need for a broader perspective is confirmed in a recent study applying gravity models to investigate international flows of agritourists in Italy (Santeramo and Morelli, 2015). According to Morley et al. (2014), although the terminology "gravity models" have been largely overlooked by the international trade literature on tourist demand in recent decades, it has reappeared "within the literature fuelled by the good empirical results of such models".

After consulting the main international periodicals, we found 52 articles involving use of gravity models related to tourism. However, a careful reading of these works revealed that only some of them were focused on application of a gravity model. We also noted that the purposes for using gravity models to study tourism are varied. Table 1 summarizes these empirical works analysed, indicating the geographic-territorial focus, the correlation between the dependent variable of tourist flows/arrivals and the independent variable distance, and some remarks about transport and tourism.

Based on the review of the literature, it was evident that: (1) in examining the geographic distribution of tourist flows using gravity models, questions related to transport are typically tangential, even if not declaredly so; and (2) specifically regarding use of gravity models to analyse the interface of transport and tourism, some articles date from almost two decades ago (such as Taplin and Qiu in 1997 about car trips in Australia). Overall, studies focused on this relationship are scarce.

The article by Khadaroo and Seetanah (2008) served as an important source of inspiration for this study. The authors applied a gravity model to assess the relevance of transport infrastructure on the ability to attract tourist flows to destinations. The results indicated that along with tourist infrastructure, transport availability plays a significant role in generation of tourist flows. Therefore, here we address the following question: What is the influence of international tourist flows by air on the regionalisation of tourism in Brazil? On this matter, we also considered the article of Santos (2004), who after a theoretical analysis applied a gravity model of tourism to analyse the empirical relationship between transports and tourist flows in Brazil. That work was very useful as theoretical-methodological support for this study.

3. Data and method

Starting from notions of economic theories involving gravity models, in our basic model the flows (of products) between two points are directly proportional to the population of each centre and inversely proportional to the distance between them, as expressed in Equation (1):

$$Tij = \frac{k\, P_i P_j}{d_{ij}^{a}} \tag{1}$$

Where: k is a parametric constant; a denotes the transaction elasticity (varies according to the good or services considered); P indicates the population of each centre (i,j), which can be replaced by economic variables like GDP, per capita GDP, average income, employment or cost measures, among others; and d is the distance between the two points (ij). As defined in the first section, our overall objective is to investigate the applicability of the principles of gravity models to the context of international tourist flows by air to Brazilian states.

Therefore, the specific reference equation considered here is:

$$Ft_{(o,d)} = \frac{k\, C_o S_d}{D_{od}^{a}}. \tag{2}$$

Where: Ft represents the tourist flow from origin o to destination d; k is the parametric constant to be defined; C_o represents the socioeconomic variable(s) of the country of origin, S_d represents the socioeconomic variable(s) of the state of destination; D_{od} is the distance between the country of origin and the Brazilian destination state, and a is the transaction elasticity (parametric).

The methodological procedures involved building a database containing 108 origin country-destination state pairs. These pairs account for 80.14% of the total flow of tourists arriving by air. We collected the data from the Internet and successively tabulated them in a spreadsheet, considering the following variables and the respective sources:

- Tourist flow[2] (dependent variable) according to country of origin and state of destination, obtained from the *Anuário Estatístico de Turismo* from the Ministry of Tourism (Brasil, 2013b)
- Gross domestic product (GDP) per capita of countries of origin (World Bank, 2013a)
- Gross domestic product (GDP) per capita of Brazilian destination states (IBGE, 2012a)
- Population of countries of origin (World Bank, 2013b)
- Population of destination states (IBGE, 2012b)
- Distance between country of origin and state of destination (ANAC – SINTAC SACI, 2012; Airport Distance, 2014)

The population data of the country of origin were based on the

[2] According to the Statistical Yearbook of Tourism the "Tourist arrivals to Brazil-2011-2012" report gathers "data on the Flow of arrivals of Tourists to Brazil disaggregate by country of residence, months and access routes (air, sea, land or fluvial)." With respect to the different tourism segments, the purposes for considered travels are "leisure" and "business, events and conventions"(Brasil, 2013b).