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Spatial diffusions of the tourism system in the Great Bay Area

# Abstract

With the increasing trend of globalization, and the competitive environment in tourist destinations, collaborative strategies have been promoted under the regional destination marketing framework either at country level or city level. Destinations are longer being considered as isolated, but instead have complex interactions with neighbouring destinations from different aspects. Within each tourist destination system, tourism is an intersecting industry connecting many related industries such as accommodation, transportation, and tourist attractions, involving different sectors including tourists, destinations and communities. Thus, to evaluate the tourism system comprehensively requires a systematic approach from both macro level (i.e., destination-level) and micro level (i.e., individual-level), especially for regions with complex administrative relationships across cities such as the GBA area. This project aims to develop a systematic framework to examine the spatial diffusions of tourists in the GBA area from both macro spatial agglomeration perspective and individual tourist decision-making perspective.

# Background of Research

Tourism development in the GBA area

Spatial spillovers in tourism

## Tourist destination choice

As tourism destinations are complicated with different components, one of the most important component is the tourists. Although efforts has been made to model tourism demand by using a wide range of econometric methods or artificial intelligence methods using aggregated normally at the destination level, as Song et al. (2019) has suggested, the use of disaggregated data is one of the major research directions to avoid misspecification of individual decision making (Masiero et al., 2019). The focus on the decision-making process to select destination provides a platform to model tourism demand from individual tourist level instead of an aggregated level (Baltas, 2007).

Research on tourist destination choice relies on the random utility theory (Huybers, 2003), which states that when tourists select destinations, they tend to compare the overall utility of each possible destination choice set and choose the one with the highest utility based on the rank-order utility maximization rationale (Yang et al., 2013). Although utility of each choice set is unobservable, the final choices can be observed and used to deduct the rank order of each choice set. Many tourist studies have analyzed the attributes that affect utility of each destination and further affect destination choice, such as regular attributes of a destination including travel resources, service quality, and accessibility, travel costs and quality of service and overall satisfaction (Masiero & Qiu, 2018). Apart from those widely analysed attributes, Masiero and Qiu (2018) has considered individual tourists’ typical destination by integrating a focal function into destination attribute based on the prospect theory (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992) stating that individuals evaluate outcome based on a reference point. In tourist destination choice model, past experience of destination choice (i.e., typical destination) is considered as a reference point when making choice decisions.

Another important direction of destination choice decision research is the interrelationship of destination choices in a single trip. This corresponds to the spatial agglomeration theory that mentioned above, stating that destinations are not isolated given the existence of spatial spillovers being proven in many empirical studies (Yang & Wong, 2012). Wu et al. (2012) developed a new destination choice model based on the concept of future dependence (i.e., destination that will be visited in the later) using a mother logit model and results reviewed that travel time, diversity of destination and variety seeking significantly affect multi-destination choice behaviour. Yang et al. (2013) analysed multi-destination travel patterns from a subsequent decision-making perspective by partitioning the decision process into multiple stages with determinants identified by nested logit model at each stage. Results show that apart from destination and individual factors, spatial structures of the destinations also significant influence sequential choices.

Following the above direction, this project will take into account the interrelationship of destination choices in the GBA area, by considering geographic factors and social interaction factors given the complex relationship in the GBA cities when simulating the individual tourist decision making utility function. This interrelationship corresponds to the spatial spillovers caused by world-of-mouth (social interactions) and multi-destination travel patterns (accessibility and geographic factors). However, the two factors are not empirically tested in the macro spatiotemporal econometric model. Thus one major contribution of this study is to explain this spatial spillovers of tourism demand from individual destination selection procedure from the demand perspective of spillover.

## ABM in tourism

Modelling individual choice selection behaviour reflects individual decision making procedure and individual heterogeneity, whereas understanding the whole complex tourism system requires to account for interactions of different components in the system. To model complex phenomena of social relationship and behaviours, agent-based modelling has been frequently used in social science research and in tourism research due to the complex nature of the tourism system (Boavida-Portugal et al., 2015). ABM modelling framework has been employed to analyse different aspects in tourism, such as tourist decision making, tourist flow management and cultural tourism management. In tourist decision making analysis, studies model at the individual level first, to incorporate individual heterogeneity and diversity in attributes and behaviors interacting in the system by adopting a bottom-up approach (Macal & North, 2010).

Boavida-Portugal et al. (2015) developed an ABM modelling framework to understand where and why tourist decide to vacation based on a theoretical proof-of-concept perspective with tourists and destinations being the two types of agents identified in the study. Within the ABM system, tourists are affected with social influence and individual level influence when making decisions to travel to one of the five destinations with attraction list provided and motivations assumed beforehand which are matched with destination attractiveness. The relationships between factors that determines the decision procedures are parameterized in the ABM system firstly based on theoretical foundation, and the parameters are then calibrated and validated using real data. Two experimental scenarios has been conducted and results show that destination awareness and individual preferences shapes destination choices. Li et al. (2021) develops a simulated framework of visitor flows that incorporates the interactions between visitor agents (i.e., attributes and decision making rules) and environment (i.e., destination and attraction). In the study, the agents were classified into three categories based on decision patterns, namely global optimizers, sequential optimizers and radial optimizers, and the utility maximization decision-making rules has been identified for each agent type for simulation. To account for the magnitude of spillover, the frequency of cross-boundary travel has been measured to represent spillover effects generate in the simulated system. The results is further validated with exploratory spatial data analysis and results show that western cities have lower level of spillover effects than the eastern cities. Qiu et al. (2016) has also investigated the spatial tourist diffusions process of tourism system in Sichuan by integrating micro-level tourist behaviors with a macro-level tourist flow structure in a regional tourist spot system. Both tourist agents and tourist spot’s manager agent and the environment are incorporated within the ABM system in which tourist spot-selection and route scheduling behaviors and tourist-spot management behaviors are investigated simultaneously. Tourist flows (i.e., spatial diffusions) of tourist spots have been simulated in the Sichuan area.

# Aims and objectives

The aim of this project is to unravel the complexity of spatial diffusions of tourism system in the GBA area from multiple perspectives. The detailed objectives are as follows:

* To model the spatial interactions and transmission mechanism of tourism development in the cities in the GBA area by using a series of cutting-edge spatiotemporal econometric models with the use of aggregated macro-level data from official statistics.
* To model the tourist destination choice decision-making procedure to verify the demand-side factors causing spatial spillovers across destinations (i.e., multi-destination travel patterns and world-of-mouth effect) from experimental design using different destination sets in the GBA area.
* To simulate tourists’ visiting patterns in the GBA area by using agent-based modelling and conduct scenario testing to aggregate individual tourist behaviors into macro-level influence on the whole GBA tourism system.
* To compare the findings from official statistics and aggregated finds derived from individual tourist decision making process to verify the spatial diffusion mechanism of the GBA tourism system

# Research plan and Methodology

As mentioned above, this project will develop an integrative and comprehensive framework in muti-stages of measuring spatial diffusions of tourism demand and tourist flows across the cities in the GBA area from both macro perspective (destination-level), micro perspective (individual-level) and the combined perspective. At the first stage, this project will examine the spatial diffusion mechanism of tourist flows in the GBA area using aggregated tourism and economic statistics data, by taking into account spatial interactions, hierarchical and multilevel relationship across cities and regional tourism development differences. At the second stage, the demand side factors of spatial spillovers including multi-desitnation travel patterns and the world-of-mouth effect will be empirically tested at the tourist level by using an experimental design including multiple destination set in the GBA area. Finally the findings from the macro study and the micro study will be cross validated in the ABM framework to simulate spatial diffusions of tourist flows in the GBA area.

# Methodology

## Hierarchical spatial model

## Spatial two-regime model

## Experimental design

To test the individual decision making process in the GBA destination specifically, this project will employ an experimental design method to analyse the interrelationship of destination choice. Basically destinations will be included in multiple sets to reflect how individual-level destination choices are influencing each other. The experiment scenarios and destination choice set will be developed carefully to design a series of GBA-applicable scenarios and attribute dimensions instead of including only generic attributes. A thorough desk research of the GBA area and GBA-related tourism literature will be conducted first , followed by using the Delphi method to conduct in-depth interviews with academic professionals to evaluate the scenario settings. Currently the destination attribute dimensions will follow Maseiro and Qiu (2018) to include cultural attractions, natural attractions, outdoor recreational attractions, entertainment attractions, hospitality services, food and dining services, transportation services, and price. Other attributes related to destination image will be incorporated as well following Kirillova et al. (2020), including affective image, cognitive image and destination quality in the 11 cities in the GBA area.

The experimental design will be conducted through distributing survey to tourists in China. The tourists will be divided into two groups, including GBA tourists and Non-GBA tourists. To model the destination selection rationale, a mixed multinomial logit (MMNL) will be employed for estimation. Different from previous literature, the utility function in this study will incorporate both social interactions and spillovers from other GBA destinations. The utility of selecting destination for individual with the consideration of social spillover and destination spilllover can be specified as follows:

Here is the standard value function of destination ’s attributes. Social interactions is reflected in , where represents the social relationship between individual and individual . is the estimated level of effects from social interaction in shaping destination choices. Destination-level spillovers reflecting multi-destination travel patterns is denoted by , where several specifications of will be empirically tested, capturing administrative relations, geographical distance and transportation time between each pair of cities in the GBA area. is the estimated level of effects from multi-destination travel patterns.

## Agent-based modelling (ABM)

Similar to the simulated framework proposed by Li et al. (2021), the basic ABM framework in this study will also include three agents, namely visitor agents (proxy of individual tourists), environment (proxy of destination) and their interactions (proxy of destination choice decision-making process). Visitor agents are interrelated as well, by capturing the social interaction effects in pre-categorised social groups (i.e., latent class identified in the previous stage of this project). Environment (i.e., cities in the GBA area) are interrelated as well in the simulated system, which is captured by the administrative relationship, geographical distance and transportation convenience across cities in the GBA area. The procedures of ABM simulation is as follows in Figure 1:

Diagram

Description automatically generated

The parameterization will be based on tourist decision making rules derived from theoretical framework, previous literature and the findings from the previous experimental design research. The theoretical model will be further calibrated using real world data for validation and if the individual level tourist flows can reflect aggregated level real word situation, then the system will be further employed for scenario testing. Another important setup of the ABM system is the categorization of tourist types. Different types of tourist will have different decision making rules. The classifications will be determined based on the findings in the previous stages and in-depth interviews with practical professionals in tourism bureaus.

## Data

Secondary data collection will be conducted in the first stage for the macro study on destination spatial diffusions. Data on city-level tourism statistics, economic and social statistics will be collected in official statistics such as China Statistic Yearbook at city level in mainland China, Hong Kong Tourism Board (HKTB) and the Statistics and Census office (DSEC) in Macau.

Primary data collection will be conducted in the second and third stage of the project. Surveys including the experimental design will be distributed to GBA and Non-GBA tourists and qualitative in-depth interviews will also be conducted in multiple stages to ensure the quality of the experiments and the scenario settings.

# Project Outcomes and Deliverables

The major outcome of this project is the development of a comprehensive and integrative macro-micro framework to examine the spatial diffusions of the tourism system in the GBA area. This multi-stage project includes several studies, which will be translated into two submissions in top-tier journals such as Annals of Tourism Research and Journal of Travel Research. Preliminary findings of this research will at the International Association of Tourism Economics (IATE) conference held in 2023.

Beyond academia, practically this project will generate some implications for destinations in the GBA area. The final findings of this project will be written into a white report to distribute to the tourism industry through social media of the investigators, School channels and the annual IMPACT conference held in SHTM polyU to generate more practical contributions to the tourism industry.

# Budget and Budget Justification

Conference attendance: HK$15,000 2 = HK30,000

Proofreading: HK$10,000

PhD 3+1 Scheme: HK$18,100 12 = HK$217,200

Data collection: HK$50,000

Fieldtrip in the GBA area: HK$30,000

Inviting Co-I’s visit

Flight: HK$10,000

Accommodation: HK$1,600 10 Nights = HK$16,000

Subsistence: HK$500 10 = HK$5,000

Visiting the UK

Flight: HK$10,000

Accommodation: HK$1,600 10 Nights = HK$16,000

Subsistence: HK$500 10 = HK$5,000

Total budget = HK$399,200

# Contributions of the Project to Teaching and Learning

This project will generate several contributions to Teaching and Learning beyond academia. To begin with, this project will use a wide range of different methods. Those systematic approaches can be taught to post-graduate level students with examples of data sample used in this project for hands-on practice. The methods and findings can be introduced in Research Methods, Tourism Economics and PhD statistics modules at different levels. Methodological workshops can be held as well to introduce the use of the family of spatiotemporal econometric methods and the ABM methods to explore the applicability of those methods in different disciplines and promote more collaborations. Practical implications related to destination image, destination management and marketing can also be taught to students to have an understanding of tourism destination management and how real-life tourism industry can be affected and benefited by academic research.

# Significance and Value of the Project to SHTM

This project can also bring value to SHTM. Firstly, as mentioned above, the methodological framework of the widely applicable spatial econometric methods and ABM methods can broaden our post-graduate students’ horizon to explore more possibility in their own research and promote more collaborations with colleagues within SHTM. Secondly, this project will be internationally collaborated with University of Surrey. Academic visits between the two universities will be facilitated during the project periods to further promote more international collaborations in the two schools. Moreover, as the topic is closely related to the real tourism industry in the GBA area, practically the project findings will be distributed through media channels to the tourism and hospitality industry to generate greater practical impact. This project will also be used as a foundation of a series studies of related to ABM simulations with tourists, employees, destinations and hospitality organisations as agents across different levels and future external grant applications.

# References:

Baltas, G. (2007). Econometric models for discrete choice analysis of travel and tourism demand. *Journal of Travel & Tourism Marketing*, 21(4), 25–40.

Boavida-Portugal, I., Ferreira, C. C., & Rocha, J. (2017). Where to vacation? An agent-based approach to modelling tourist decision-making process. *Current Issues in Tourism*, *20*(15), 1557-1574.

Huybers, T. (2003a). Domestic tourism destination choices – A choice modelling analysis. *International Journal of Tourism Research*, 5(6), 445–459.

Song, H., Qiu, R. T., & Park, J. (2019). A review of research on tourism demand forecasting: Launching the Annals of Tourism Research Curated Collection on tourism demand forecasting. *Annals of Tourism Research*, *75*, 338-362.

Macal, C. M., & North, M. J. (2010). Tutorial on agent-based modelling and simulation. *Journal of Simulation*, 4(3), 151–162. doi:10.1057/jos.2010.3

Masiero, L., & Qiu, R. T. (2018). Modeling reference experience in destination choice. *Annals of Tourism Research*, *72*, 58-74.

Masiero, L., Yang, Y., & Qiu, R. T. (2019). Understanding hotel location preference of customers: Comparing random utility and random regret decision rules. *Tourism Management*, *73*, 83-93.

Wu, L., Zhang, J., & Fujiwara, A. (2012). A tourist's multi-destination choice model with future dependency. *Asia Pacific Journal of Tourism Research*, 17(2), 121-132.

Yang, Y., & Wong, K. K. (2012). A spatial econometric approach to model spillover effects in tourism flows. *Journal of Travel Research*, *51*(6), 768-778.

Yang, Y., Fik, T., & Zhang, J. (2013). Modeling sequential tourist flows: Where is the next destination?. *Annals of Tourism Research*, *43*, 297-320.