A Spatial Econometric Approach to Model the Growth of Tourism Flows to China Cities

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April 15, 2010 AAG 2010 Conference, Washington DC
Contents

1. Introduction
2. Literature Review
3. Methodology
4. Exploratory Spatial Data Analysis
5. Spatial Econometric Models
6. Conclusion
Introduction

- **Rationale and problem statement**
  - Few studies on tourism flows have focused on China.
  - Despite the rich literature on tourism demand analysis (Lim, 1997; Song & Li, 2008), few studies have concentrated on tourism development analysis.
  - More appropriate and accurate models are needed to examine spillover effects in tourism flows.
  - Due to great regional differences in terms of physical and economic aspects in China, distinctions may exist when modelling tourism flows to different regions.
Introduction

- **Scope of study**
  - The spatial distribution and determinants of *inbound* tourism flows to 341 China cities from 1999 to 2006 and those of *domestic* tourism flows from 2002 to 2006.

- **Research questions**
  - What are the main determinants of inbound and domestic tourism flows to the cities in China?
  - To what extent are the spillover effects significant in tourism flows to these (sample) cities?
  - Do cities in different locations necessarily share different models for the growth of tourism flows?
Contents

1. Introduction

2. Literature Review

3. Methodology

4. Exploratory Spatial Data Analysis

5. Spatial Econometric Models

6. Conclusion
Literature Review

- **Causal models of tourism flows – Economic perspective**

- **Tourism demand analysis**
  Determinants that influence demand include the own price of the good, the price of a substitute good and consumers' income (Song, Wong, & Chon, 2003).

- **Tourism development analysis**
  Factors that influence tourism flows on the supply side include
  - Tourist attractions (Gabe, Lynch, & McConnon, 2006)
  - Tourism infrastructure (Saayman, 2005),
  - Transport infrastructure (Louca, 2006),
  - Non-transport infrastructure (Eugenio-Martín, Martín, & Scarpa, 2004)
  - Economic expansion (Oh, 2005),
  - International trade (Khan, Toh, & Chua, 2005; Turner & Witt, 2001),
  - Negative events (Cohen, 2007).

Go Gators!
Literature Review

- **Causal models of tourism flows – Geographic perspective**
  - Spatial interaction model (SIM)

\[ T_{ij} = G \frac{P_i A_j}{D_{ij}^b} \]

- Tendency
  - More advanced methods for estimation
  - Fewer for forecasting
  - More economic and geographic variables included

- Limitations
  - poor forecasting ability (Calantone, 1987)
  - a lack of theoretical background
  - no explanation of interaction between destinations

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Literature Review

Supply Side

- Productivity Spillover
  - Labor Movement
  - Demonstration Effect
  - Competition Effect
- Market Access Spillover
- Joint Promotion
- Negative Events

Demand Side

- Multi-Destination Travel of Tourists

Spillover Effects in Tourism Flows

Go Gators!
Contents

1. Introduction
2. Literature Review
3. Methodology
   4. Exploratory Spatial Data Analysis
   5. Spatial Econometric Models
6. Conclusion
Methodology

- **Spatial Panel Model**
  - The traditional fixed effects model extended to include spatial error autocorrelation (SEM model) can be specified as:

  \[
  Y_{it} = X_{it}\beta + u_i + \phi_{it}, \phi_{it} = \delta \sum_{j=1}^{N} w_{ij} \phi_{jt} + \varepsilon_{it} , E(\varepsilon_{it}) = 0, E(\varepsilon_{it}\varepsilon_{it}') = \sigma^2 I_N
  \]

  - The traditional model extended with a spatially lagged dependent variable (SAR model) reads as (Anselin, 1988):

  \[
  Y_{it} = \delta \sum_{j=1}^{N} w_{ij} Y_{jt} + X_{it}\beta + u_i + \varepsilon_{it} , E(\varepsilon_{it}) = 0, E(\varepsilon_{it}\varepsilon_{it}') = \sigma^2 I_N
  \]

  - In the SEM model, \(\delta\) is usually named the spatial autocorrelation coefficient, while in the SAR model, \(\delta\) is referred to as the spillover coefficient.
Methodology

**Specification of the model**

\[
\ln T_{it} = \beta_0 + \delta \sum_{j=1}^{N} w_{ij} \ln T_{jt} + \beta_1 \ln hotel_{it} + \beta_2 \ln FDI_{it} + \beta_3 \ln road_{it} + \beta_4 \ln air_{it} + \beta_5 \ln GDP_{it} \\
+ \beta_6 \ln tele_{it} + \beta_7 NP_{it} + \beta_8 HERI_{it} + \beta_9 A4_{it} + \beta_{10} D03_{it} + \alpha_i + \lambda_t + \varepsilon_{it}
\]

- \( T_{it} \) is the number of inbound or domestic tourist arrivals
- \( hotel_{it} \) is the number of star rated hotels,
- \( FDI_{it} \) is the total Foreign Direct Investment (FDI) relative to GDP,
- \( road_{it} \) is the density of road, measured by the total length of road divided by the administrative area of the city.
- \( air_{it} \) is the total number of air passengers who depart from or arrival at airports of city
- \( GDP_{it} \) is the gross domestic product (GDP)
- \( tele_{it} \) is the number of registered telephone numbers.
- \( NP_{it} \) is the number of national parks,
- \( HERI_{it} \) is the number of world heritage sites,
- \( A4_{it} \) is the number of AAAA scenic spots,
- \( D03_{it} \) is the dummy variable of the SARS outbreak
Methodology

- $w_{ij}$ is the element of spatial weighting matrix $W$, which is an $n \times n$ matrix that formalizes the spatial structure (nodes and links) of each city.
  - Nearest neighbor weights
    - $w_{ij} = 1$, if city $j$ is one of the $K$ nearest neighbors of city $i$.
  - Contiguity-based spatial weights:
    - $w_{ij} = 1$, if city $i$ and city $j$ share the same border; $w_{ij} = 0$, otherwise
  - Distance-based spatial weights:
    $$w_{ij} = \begin{cases} 
    0 & \text{if } i = j \\
    1 & \text{if } d_{ij} \leq D \\
    0 & \text{if } d_{ij} > D 
    \end{cases}$$

  - where $d_{ij}$ is the geographical distance between the centres of two cities, and $D$ is the selected threshold distance above which the spatial interactions are assumed to be insignificant.
Contents

1. Introduction
2. Literature Review
3. Methodology
4. **Exploratory Spatial Data Analysis**
5. Spatial Econometric Models
6. Conclusion
ESDA

Moran Significance Map for Log Number of Inbound Tourist Arrivals in 1999

The Beijing-Tianjin cluster
The Yangtze River Delta cluster
The Fujian coast cluster
The Pearl River Delta cluster

Missing value
HH
LL
LH
HL
Not significant
Moran Significance Map for Log Number of Inbound Tourist Arrivals in 2006
The Moran Significance Map for Log Number of Domestic Tourist Arrivals in 2002

- Missing value
- HH
- LL
- LH
- HL
- Not significant

**Clusters:**
- The Beijing-Tianjin cluster
- The Shandong Peninsula cluster
- The Yangtze River Delta cluster
- The Pearl River Delta cluster
- LL cluster in the west
- LL cluster in the northeast
Moran Significance Map for Log Number of Domestic Tourist Arrivals in 2006

The Beijing-Tianjin cluster
The Shandong Peninsula cluster
The Yangtze River Delta cluster
The Chengdu cluster

LL cluster in the west
LL cluster in the northeast

Missing values
HH
LL
LH
HL
Not significant

Go Gators!
Five hot-spot areas for domestic tourism.
- High level of economic development in these areas and hence strong travel propensity of residents
- Residents’ free and recreational life-styles

Difference from inbound tourism hot-spot areas
- Shandong Peninsula cities and Chengdu area are not hot-spots for inbound tourism
- Fujian coast is not hot-spots for domestic tourism
Contents

1. Introduction
2. Literature Review
3. Methodology
4. Exploratory Spatial Data Analysis
5. **Spatial Econometric Models**
6. Conclusion
Spatial Econometric Model

- Spatial panel model
  - Make full use of information contained in the data (both cross-section and time-series dimensions).
    - Most coefficients are significant with expected signs. This suggests that tourism development is not only dependent on infrastructure of tourism sectors.
    - World heritage sites are most important tourist attractions. AAAA scenic spots are not significant for domestic tourists.
    - The spillover effects are larger in inbound tourism flows
    - Inbound tourists are more demanding than domestic tourists with higher infrastructure elasticities.
    - SARS outbreak is more detrimental to inbound tourism.
Spatial Panel Model Results for Inbound Tourism Flows

<table>
<thead>
<tr>
<th>Variable</th>
<th>All cities</th>
<th>Eastern</th>
<th>Central</th>
<th>Western</th>
</tr>
</thead>
<tbody>
<tr>
<td>δ</td>
<td>0.355***</td>
<td>0.387***</td>
<td>0.327***</td>
<td>0.227***</td>
</tr>
<tr>
<td>lnhotel</td>
<td>0.175***</td>
<td>0.419***</td>
<td>0.213***</td>
<td>0.065</td>
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<tr>
<td>lnFDI</td>
<td>0.029***</td>
<td>-0.018</td>
<td>0.013</td>
<td>0.021</td>
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<tr>
<td>lnroad</td>
<td>0.174***</td>
<td>0.284***</td>
<td>0.131</td>
<td>0.052</td>
</tr>
<tr>
<td>lnair</td>
<td>0.058***</td>
<td>0.026***</td>
<td>0.084***</td>
<td>0.048***</td>
</tr>
<tr>
<td>lntele</td>
<td>0.189***</td>
<td>0.366***</td>
<td>0.207***</td>
<td>0.029</td>
</tr>
<tr>
<td>NP</td>
<td>0.140**</td>
<td>0.086</td>
<td>0.215*</td>
<td>0.159</td>
</tr>
<tr>
<td>HERI</td>
<td>0.365***</td>
<td>0.094</td>
<td>0.611**</td>
<td>0.875***</td>
</tr>
<tr>
<td>A4</td>
<td>0.046***</td>
<td>-0.006</td>
<td>0.093***</td>
<td>0.060*</td>
</tr>
<tr>
<td>D03</td>
<td>-0.269***</td>
<td>-0.110***</td>
<td>-0.359***</td>
<td>-0.388***</td>
</tr>
<tr>
<td>constant</td>
<td>-0.281</td>
<td>0.032</td>
<td>-0.682**</td>
<td>-0.979***</td>
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<tr>
<td>R-squared</td>
<td>0.917</td>
<td>0.970</td>
<td>0.863</td>
<td>0.894</td>
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<td>corr-squared</td>
<td>0.547</td>
<td>0.714</td>
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<td>0.448</td>
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<tr>
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<td>-3091.509</td>
<td>-523.544</td>
<td>-1278.391</td>
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<td>LR test</td>
<td>2504.945***</td>
<td>1021.657***</td>
<td>860.206***</td>
<td>809.909***</td>
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</tbody>
</table>

Note: *** indicates significant at the 0.01 level, ** indicates significant at the 0.05 level, * indicates significant at the 0.1 level.
### Spatial Panel Model Results for Domestic Tourism Flows

<table>
<thead>
<tr>
<th>Variable</th>
<th>All cities I</th>
<th>All cities II</th>
<th>Eastern</th>
<th>Central</th>
<th>Western</th>
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</thead>
<tbody>
<tr>
<td>δ</td>
<td>0.305***</td>
<td>0.296***</td>
<td>0.265***</td>
<td>0.152***</td>
<td>0.451***</td>
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<tr>
<td>lnhotel</td>
<td>0.166***</td>
<td>0.158***</td>
<td>0.181***</td>
<td>0.235***</td>
<td>0.139***</td>
</tr>
<tr>
<td>lnroad</td>
<td>0.099***</td>
<td>0.103***</td>
<td>0.117***</td>
<td>0.115***</td>
<td>0.072*</td>
</tr>
<tr>
<td>lnair</td>
<td>0.020***</td>
<td>0.019***</td>
<td>0.013***</td>
<td>0.019***</td>
<td>0.020***</td>
</tr>
<tr>
<td>lnGDP</td>
<td>0.484***</td>
<td>0.461***</td>
<td>0.328***</td>
<td>0.549***</td>
<td>0.496***</td>
</tr>
<tr>
<td>lntele</td>
<td>-0.060*</td>
<td></td>
<td>0.111*</td>
<td>-0.049</td>
<td>-0.113**</td>
</tr>
<tr>
<td>NP</td>
<td>0.102***</td>
<td>0.102***</td>
<td>0.145***</td>
<td>0.073</td>
<td>0.082*</td>
</tr>
<tr>
<td>HERI</td>
<td>0.176***</td>
<td>0.175***</td>
<td>0.145***</td>
<td>0.162</td>
<td><strong>0.201</strong></td>
</tr>
<tr>
<td>A4</td>
<td>0.006</td>
<td>0.005</td>
<td>0.009</td>
<td>0.013</td>
<td>0.004</td>
</tr>
<tr>
<td>D03</td>
<td>-0.089***</td>
<td>-0.090***</td>
<td>-0.114***</td>
<td>-0.114***</td>
<td>-0.047</td>
</tr>
<tr>
<td>constant</td>
<td>0.498**</td>
<td>0.805***</td>
<td>1.839***</td>
<td>0.866**</td>
<td>-0.327</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.969</td>
<td>0.969</td>
<td>0.973</td>
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<td>0.973</td>
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<tr>
<td>corr-squared</td>
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<td>0.838</td>
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<td>LL</td>
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<td>4.126</td>
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<td>1730.137***</td>
<td>1836.630***</td>
<td>614.175***</td>
<td>486.419***</td>
<td>489.231***</td>
</tr>
</tbody>
</table>

**Note:** *** indicates significant at the 0.01 level, ** indicates significant at the 0.05 level, * indicates significant at the 0.1 level |
Regional differences

• The magnitude of spillover effects on inbound tourism flows is largest for Eastern cities whilst being smallest for Western cities. However, spillover effects in domestic tourism flows are largest for Western cities.
• The infrastructure elasticities for Eastern cities are always the highest, while those for Western cities are the lowest.
• World heritage sites play a dominant role in attracting tourists to the west.
• The income elasticity for domestic tourism is smallest in the east.
• SARS outbreak is most harmful to the west for inbound tourism while to the east for domestic tourism.
Spatial Econometric Model

- **Determining the Scope of Spillover Effects**
  - The spillover effect curve shows how the magnitude of spillover effects evolves as the distance from city O increases.
<table>
<thead>
<tr>
<th>Distance (km)</th>
<th>Eastern cities</th>
<th>Central cities</th>
<th>Western I cities</th>
<th>Western II cities</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Inbound flows</td>
<td>Domestic flows</td>
<td>Inbound flows</td>
<td>Domestic flows</td>
</tr>
<tr>
<td></td>
<td>FE-SAR</td>
<td>RE-SAR</td>
<td>FE-SAR</td>
<td>RE-SAR</td>
</tr>
<tr>
<td>200 km</td>
<td>-229.922</td>
<td>-522.198</td>
<td>-554.309</td>
<td>-198.499</td>
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<tr>
<td>250 km</td>
<td>-239.909</td>
<td>-531.416</td>
<td>-557.090</td>
<td>-201.250</td>
</tr>
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<td>300 km</td>
<td>-238.149</td>
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<td>-557.604</td>
<td>-203.624</td>
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<tr>
<td>350 km</td>
<td>-239.030</td>
<td>-535.747</td>
<td>-558.649</td>
<td>-203.615</td>
</tr>
<tr>
<td>400 km</td>
<td>-237.904</td>
<td>-536.083</td>
<td>-557.878</td>
<td>-204.525</td>
</tr>
<tr>
<td>450 km</td>
<td>-234.177</td>
<td>-535.546</td>
<td>-555.741</td>
<td>-204.459</td>
</tr>
<tr>
<td>500 km</td>
<td>-236.411</td>
<td>-537.391</td>
<td>-557.410</td>
<td>-203.673</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Distance (km)</th>
<th>Inbound flows</th>
<th>Domestic flows</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>FE-SAR</td>
<td>RE-SAR</td>
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<tr>
<td>250 km</td>
<td>272.040</td>
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<td>275.027</td>
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<td>278.314</td>
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<td>283.349</td>
<td>5.917</td>
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<th>Domestic flows</th>
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</thead>
<tbody>
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<td>RE-SAR</td>
</tr>
<tr>
<td>200 km</td>
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<th>Distance (km)</th>
<th>Inbound flows</th>
<th>Domestic flows</th>
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<tr>
<td>550 km</td>
<td>87.349</td>
<td>-203.673</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Distance (km)</th>
<th>Inbound flows</th>
<th>Domestic flows</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>FE-SAR</td>
<td>RE-SAR</td>
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<tr>
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<td>-554.309</td>
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<tr>
<td>550 km</td>
<td>-57.410</td>
<td>-58.649</td>
</tr>
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</table>
Contents

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2. Literature Review
3. Methodology
4. Exploratory Spatial Data Analysis
5. Spatial Econometric Models

6. Conclusion
Conclusion

- **Summary of findings**
  - Moran significance maps indicated four significant *inbound tourism* hot-spot areas, and five *domestic tourism* hot-spot areas.
  - The results of spatial econometric models confirmed the existence of spillover effects in tourism flows, and suggested that infrastructure factors, tourist attractions, the SARS outbreak, the degree of openness and the potential of the local market were significant determinants of tourism flows.
  - The spillover effects in inbound tourism flows were larger, and infrastructure elasticities were higher for inbound tourism flows compared to domestic flows.
  - Various infrastructure elasticities were higher for Eastern and Central cities in comparison to those for Western cities.
Conclusion

**Implications**

- **Theoretical implications**
  - The tourism spillover framework provides the foundation for further research.
  - The work provides new approaches in tourism demand modeling and spatial analysis.

- **Practical implications**
  - Cities should make full use of the cross-city spillover effects in tourism flows from neighboring cities to support local tourism development.
  - More resources should be allocated to hot-spot areas.
  - The construction and improvement of infrastructure should be emphasized.
  - Different tourism policies should be proposed for cities in different geographical regions
Conclusion

- **Limitations**
  - Data availability
  - Data quality
  - Estimation methods

- **Suggestions for future research**
  - Further qualitative and quantitative studies to investigate potential factors contributing to spillover effects
  - Seasonal variation of hot-spot areas
  - Models of disaggregated tourism flows for different purposes

Go Gators!
Thank you!

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www.tourismstudy.net

China Regional Tourism Development Database (CRTD)