REGIONAL TOURISM COMPETITION IN THE BALTIC STATES: A SPATIAL STOCHASTIC FRONTIER APPROACH

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This paper is aimed at a statistical analysis of competition for tourists between regions within the Baltic states (Estonia, Latvia, Lithuania) and an estimation of the relative efficiency levels of these regions. We apply a modern approach called Spatial Stochastic Frontier which corresponds to a spatial modification of a stochastic frontier model. We specify two alternative spatial stochastic frontier models: distance-based, and travel-time based. It is intended to identify the influence of existing transport networks on research results.

Using the model we analyse region-specific factors (tourism infrastructure, employment, geographical position and natural attractions) which affect the numbers of visitors and estimate regions’ efficiency values.

We discover a significant level of inefficiency in these Baltic states regions and propose some ways to improve the situation.

Keywords: spatial stochastic frontier, efficiency, competition, regional tourism, transport network

1. Introduction

The growing importance of the tourist industry and its influence on the overall development of destination countries and regions mean that tourism policy is now strategically very important. Consequently it is the subject of research all around the world.

Over the last decade tourism has increasingly become an area of competition [1, 2] between countries or regions for visitors. Competition forces regions to be more attractive for tourists and to use their resources more efficiently. Now regions can be examined not as a geographical areas with natural or heritage attractions, but as businesses which should use all possible resources to beat their competitors and attract more tourists.

When we consider regions within a country (or several adjacent countries) as competitors, indicators of efficiency should be brought to the forefront. As economic units in a competitive environment, regions should be examined in terms of the efficiency of their use of resources and how this can be improved. Unfortunately, there is very little analysis of region efficiency in the tourist literature. The majority of research in this area is at the microeconomic level, and contains efficiency analyses of hotels, restaurants, and other business units. There is little research designed to analyse efficiency at a regional level. One of the few studies in this area that can be referred to is the analysis of Italian tourist destinations [3], conducted using DEA and the Malmquist Index.

This research is intended to analyse the competitiveness and efficiency of regions within the Baltic states (Estonia, Latvia, and Lithuania). Tourism is one of the most important industries for these countries, but there is no research known to us which analyses the competition between regions in this area.

Regional spatial structure and existing transport networks play a very important role in modelling of these regions’ competition and efficiency. Spatial modifications of the standard stochastic frontier model for efficiency estimation are presented.

In this research we specify a spatial stochastic frontier model for the analysis of these regions’ competition for tourists, and their efficiency. We extend the analysis to include Baltic state regional data. In addition we analyse the estimated results obtained from the model and provide some recommendations.
2. Spatial stochastic frontier model

2.1. Short review of a standard stochastic frontier model

The well-known stochastic frontier model is usually presented as [4]:

\[
y = f(x, \beta) + \varepsilon,
\]

\[
\varepsilon = v - u, v \sim N(0, \sigma_v^2), u \geq 0,
\]

where 
- \( y \) – an output;
- \( x \) – a vector of resources;
- \( f \) – a production function;
- \( \beta \) – a vector of unknown coefficients;
- \( \varepsilon \) – a composite error term.

The first component of a composite error term, \( v \), shows the random variation of the efficiency frontier. The second one, \( u \), shows the technical inefficiency of regions (as a distance from the efficiency frontier). An efficiency level of a given region \( i \) can be estimated as [5]:

\[
TE_i = e^{-E(u_i|\varepsilon_i)},
\]

where \( E(u_i|\varepsilon_i) \) – conditional expectation of \( u_i \) given estimated \( \varepsilon_i \).

In this research we used the truncated normal distribution for the second error term component \( u \) with a conditional mean (the first distribution parameter depends on the set of factors \( z \)):

\[
u \sim N^+(\tilde{\varepsilon}, \sigma_v^2)
\]

The Cobb-Douglas functional form of the efficiency frontier was used:

\[
\ln(y) = \beta \ln(X) + v - u
\]

We have used a standard \( \gamma \) value to test the stochastic frontier specification versus a simple OLS regression:

\[
\gamma = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_v^2}.
\]

If a value of \( \gamma \) statistics is close to 1, we accept the hypothesis about the presence of inefficiency in the data and the preference for the stochastic frontier model.

2.2. Spatial modification of the stochastic frontier model

Spatial econometrics considers the possibility of geographic interaction between the economies of neighbouring regions. The general spatial autoregressive model is specified [6, 7] as:

\[
y = \rho W y + \beta X + \varepsilon,
\]

\[
\varepsilon = \lambda W \varepsilon + \upsilon, \upsilon \sim N(0, \sigma^2)
\]

where 
- \( y \) – a vector of dependent variable values;
- \( x \) – a matrix of explanatory variables' values;
- \( \varepsilon \) – a vector of residuals;
- \( \upsilon \) – a matrix of contiguity.

The feature of the model is designed in the components with the contiguity matrix \( W \). This square matrix contains the information about inverse distances between data points, so a higher value means
closer points, and zero values on the main diagonal (to exclude $y$ values self-dependence). The authors assume that a value of the dependent variable $y$ at a given data point depends on its own neighbour values, and closer neighbours have stronger influence. The same assumption is specified for the residuals $\varepsilon$.

One possible spatial modification of the stochastic frontier model [8] with the Cobb-Douglass form of the efficiency frontier and the truncated normal inefficiency component is:

$$\ln(y) = \rho \ln(W y) + \beta \ln(X) + v - u,$$

$$u \sim N^* (\lambda W y + \varepsilon, \sigma_u^2),$$

$$v \sim N(0, \sigma_v^2).$$

The definition of the $W$ contiguity matrix can be different and vary between research studies. Usually distances are specified as geometrical Euclidean distances, or as great-circle distances (in the case of significant geographical remoteness of data points). This specification is the most popular, but not the only one. In some research (including this paper) it is necessary to include real journeys within the model, so the matrix with inverse travel time or cost values better matches the real situation. In our research we used and compared both approaches. Detailed analysis is presented in the Model Specification section.

One of the main points of the research is the values of $\rho$ and $\lambda$ parameters. Parameter $\rho$ shows the influence of model output values (the number of tourists) in neighbouring regions on the output in a given region. Our reasoning states that this influence can be regarded as positive (cooperation of regions), or as negative (competition between regions) [9]. The analysis of the $\rho$ value will answer this major research question.

Parameter $\lambda$ shows the influence of output values in neighbouring regions on efficiency in a given region. We expect a positive influence here, because both cooperation and competition should improve an economic unit’s efficiency in a healthy economy.

3. Data

Panel data used in the research includes information about regions of Latvia, Estonia and Lithuania between 2005 and 2008 (data for 2009 is not yet completely available).

The division of these countries into regions is not well-defined and can cause some problems. We used the Nomenclature of Units for Territorial Statistics level 3 (NUTS 3) approach to define regions in Estonia and Lithuania (15 and 10 regions respectively), but not for Latvia. In NUTS3 Latvia comprised only 4 regions, which are significantly larger than the regions in Estonia and Lithuania, and appear very heterogeneous. For this reason we used the same approach as the National Statistical Office of Latvia to divide the regions. 26 regions of Latvia correspond in terms of size and population with NUTS3 regions of Estonia. The regions of Lithuania are significantly larger (approximately twice the size, see Table 1), but their separation was impossible due to a shortage of information. Statistical data about smaller Lithuanian regions (municipalities) was provided by the National Statistical Office, starting from 2009 only. We think that this discrepancy is a matter of scale only and not a matter of ‘production’ differences (which are critically important for a frontier model) and that the discrepancy does not affect the received results significantly. In any case dummy variables have been incorporated into the model, which captured as this difference in Lithuanian regions’ definition as all other “production” and efficiency differences.

The statistical information was collected from the following sources:

1. National statistical offices of the Baltic states provided information about the number of tourists visiting a given region, the number of hotel beds, the number of enterprises in tourism-related sectors (according to NACE rev.2 classification), and also information about the area of the region, its population and road coverage. These parameters are described in detail in the Model Specification section.
2. Schedules of railways and regional coach services are used for collecting data regarding travel times between regional centres.
3. TomTom (a digital mapping and routing company) is used for information about road distances and travel times by car between regional centres.
4. The Museums Associations of Latvian, Lithuanian, and Estonian supplied information about the number of museums in each region.
5. GIS system (Google Earth) is used for information about the geographical coordinates of regions and natural tourist attractors (sea-side, national parks).
Table 1. Descriptive statistics for used indicators

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total</th>
<th>Estonia</th>
<th>Latvia</th>
<th>Lithuania</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Mean</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>Tourists, people</td>
<td>73902</td>
<td>79276</td>
<td>8795</td>
<td>257930</td>
</tr>
<tr>
<td>Hotel beds</td>
<td>1609.8</td>
<td>1400.9</td>
<td>184</td>
<td>4752</td>
</tr>
<tr>
<td>Labour, enterprise</td>
<td>1976.4</td>
<td>974.6</td>
<td>183</td>
<td>3019</td>
</tr>
<tr>
<td>Museums, count</td>
<td>15.9</td>
<td>16.5</td>
<td>4</td>
<td>38</td>
</tr>
<tr>
<td>Area, sq. km</td>
<td>3390</td>
<td>2895</td>
<td>1023</td>
<td>4806</td>
</tr>
<tr>
<td>Population, people</td>
<td>113713</td>
<td>62887</td>
<td>10118</td>
<td>170719</td>
</tr>
<tr>
<td>Roads/area ratio, km/sq.km</td>
<td>0.706</td>
<td>0.397</td>
<td>0.273</td>
<td>0.546</td>
</tr>
</tbody>
</table>

4. Model Specification

The specification of the spatial stochastic frontier model includes output and resource parameter selection and a definition of the contiguity matrix.

In this research we consider a region as an economic unit which uses its own resources to attract and service tourists. The term 'tourists' can mean different things. It can refer to people who are accommodated in a region, but also to people who are just visiting the region; day-trip tourists or people in transit through the region. Tourists can be classified according to the purpose of their trip – business or private. We assume (and data collected by national statistical offices support this assumption) that the most important tourists for a region’s economy are those who are accommodated in the region. Usually a tourist who is accommodated in a given region spends a significant amount of time in that region and supports the region’s economy through spending money and using local services. For this reason, as a dependent variable, we chose the number of tourists (tourists) staying at least one night in a hotel, motel or any other kind of collective accommodation establishment. This definition of the dependent variable should add a value to the 'competition' scale pan of the 'competition-cooperation' scales.

The set of explanatory variables includes resources used in a given region to attract and service tourists. We include a region’s tourism infrastructure in the model in the form of a number of beds available in hotels and other types of accommodation (beds). This conforms to our definition of tourists. We also assume a strong relationship between the number of beds offered and other tourism facilities.

We included the number of enterprises in tourist-related sectors as a service quality and labour force parameter. Generally it is impossible to separate enterprises serving tourists and residents, therefore we used the total number of enterprises in chosen sectors of the economy. We used the NACE rev.2 classification and selected the following economic sectors as related to tourism: wholesale and retail trade; repair of motor vehicles and personal and household goods (class G); transportation and storage (H); accommodation and food services (I), information and communications (J). The final parameter used (named services) was calculated just as the total number of enterprises in the chosen sectors.

Transport infrastructure was included in the model in two different forms. The first one is related to the level of region accessibility for international tourists. We considered the distance to the nearest airport/sea port (nearestGate) as the accessibility metric. The distance was measured in kilometres, travel time by car, train and coach. Usually regions in the Baltic countries have good connections of all types with the nearest airport, so all 4 parameters were highly correlated. We chose only one region’s accessibility parameter (travel time by car) to avoid of the multicollineriarity problem. No distance decay functions were applied.

The second transport-related parameter was constructed to include local transport infrastructure in the model. We used a ratio of the total road lengths of a region and the region’s area as a metric (road_coverage), because usually all tourist movements within a region in the Baltic states are done by car or bus.
We considered museums, castles and palaces as man-made tourist attractions. After data collection we discovered a strong relationship between the numbers of this kind of attraction. Therefore we used only one of them (the number of museums) in the final model specification.

Natural attractions were included in the model in the form of a dummy variable for the sea-side (sea, yes/no) and the number of national nature parks (natparks) in a region.

An important parameter of the spatial stochastic frontier model is the contiguity matrix $W$. This matrix presents distances between regions in the model and can be defined in different ways [10].

The simplest method of defining the $W$ matrix is as an inverse Euclidean distance between regions. According to this approach we calculate the distances between regions in terms of kilometres between their main cities. The method can be modified by taking the spherical surface of the Earth into account (a great-circle distance). In this study we filled this matrix with simple Euclidian distances between regional centres and restricted the distance with 1 (about 110 km). The model with this continuity matrix is called Model DIST.

The main disadvantage of this approach is obvious – being geographically close generally does not mean being easy accessible. There may be no road two points or the road distance may be significantly longer than the direct distance. Matrix definition is a critical point for spatial models, so we used an alternative approach to compare the estimation results. We defined an alternative contiguity matrix on the basis of travel times between regional centres by car. This alternative model specification is noted as Model ROAD. Travel times reflect the real distance between regions more precisely and differ significantly from the geographical distance (see Figure 1). We calculate the coefficient of correlation between the models’ distance and travel time spatial components ($W_{tourists}$) and discovered an absence of a significant relationship (correlation = 0.06, p-value = 0.37).

Another possible approach is based on a binary contiguity matrix, which is constructed solely on the basis of direct borders between regions. We rejected this approach as providing too much unusable information.

An efficiency frontier form can vary during the observable time interval (2005-2008). This variation can be caused by changes in the economies of the Baltic states and other general factors. We included the time variable (years) in the specification of the efficiency frontier and as an explanatory variable for a regions’ inefficiency level. We received insignificant values of the considered parameters in both cases and decided to exclude the time variable from the model. Therefore we conclude that no significant changes in regional tourism efficiencies occurred during the period of the study.

Another model specification hypothesis was related the different countries' specifics. Estonia, Latvia, and Lithuania are significantly different in terms of economics and politics, and differences in regional tourism are also possible. We included dummy variables for Estonia (EE) and Lithuania (LT) into the models to check for permanent differences of regional tourism efficiency frontiers between countries.

In addition to country-specific differences in the efficiency frontier position we investigated possible differences in the main 'competition-cooperation' area. It is possible that the level of competition (or cooperation) between regions varies between countries. We have included cross dummy variables $EE\ln(W\_tourists)$ and $LT\ln(W\_tourists)$ to test this hypothesis.

The final model specification with the Cobb-Douglass form of the efficiency frontier and truncated normal distribution of the inefficiency component after removing insignificant explanatory variables is:
\[ \ln(\text{tourists}) = \rho \ln(W \cdot \text{tourists}) + \beta_1 \ln(\text{beds}) + \beta_2 \ln(\text{services}) + \beta_3 \ln(\text{museums}) + \\
+ \beta_4 \ln(\text{nearestGate}) + \beta_5 \text{sea} + \beta_6 \text{EE} + \beta_7 \text{LT} + \\
+ \beta_8 \text{EE} \cdot \ln(W \cdot \text{tourists}) + \beta_9 \text{LT} \cdot \ln(W \cdot \text{tourists}) + \nu - u, \]
\[ u \sim N^+(\lambda \ln(W \cdot \text{tourists}), \sigma_u^2), \nu \sim N(0, \sigma_\nu^2). \]

5. Empirical Results

Using the presented specification of a spatial stochastic frontier model we constructed three alternative models:

1. Model NOSPAT – stochastic frontier model without spatial components;
2. Model DIST - spatial stochastic frontier model with distance-based contiguity matrix;

The Model estimation results are presented in Table 2.

Table 2. Estimation results of three alternative models: Model NOSPAT (without spatial components), Model DIST (distance contiguity matrix), and Model ROAD (travel time contiguity matrix)

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Model NOSPAT</th>
<th>Model DIST</th>
<th>Model ROAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>\ln(\text{tourists})</td>
<td>Coefficient</td>
<td>p-value</td>
<td>Coefficient</td>
</tr>
<tr>
<td>\ln(\text{beds})</td>
<td>0.878</td>
<td>0.000</td>
<td>0.890</td>
</tr>
<tr>
<td>\ln(\text{nearestGate})</td>
<td>0.003</td>
<td>0.896</td>
<td>0.043</td>
</tr>
<tr>
<td>\ln(\text{services})</td>
<td>0.300</td>
<td>0.000</td>
<td>0.387</td>
</tr>
<tr>
<td>\ln(\text{museums})</td>
<td>-0.107</td>
<td>0.094</td>
<td>-0.264</td>
</tr>
<tr>
<td>\ln(W \cdot \text{tourists}), \rho</td>
<td>-0.091</td>
<td>0.002</td>
<td>-0.094</td>
</tr>
<tr>
<td>\text{Sea}</td>
<td>0.163</td>
<td>0.043</td>
<td>0.099</td>
</tr>
<tr>
<td>\text{EE}</td>
<td>0.502</td>
<td>0.000</td>
<td>3.706</td>
</tr>
<tr>
<td>\text{LT}</td>
<td>-0.271</td>
<td>0.087</td>
<td>2.213</td>
</tr>
<tr>
<td>\text{EE} \cdot \ln(W \cdot \text{tourists})</td>
<td>-0.227</td>
<td>0.002</td>
<td>-0.114</td>
</tr>
<tr>
<td>\text{LT} \cdot \ln(W \cdot \text{tourists})</td>
<td>-0.174</td>
<td>0.000</td>
<td>-0.066</td>
</tr>
<tr>
<td>Constant</td>
<td>2.841</td>
<td>0.000</td>
<td>3.682</td>
</tr>
<tr>
<td>\ln(W \cdot \text{tourists}), \lambda</td>
<td>-0.491</td>
<td>0.000</td>
<td>-0.152</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.179</td>
<td>0.745</td>
<td>6.603</td>
</tr>
</tbody>
</table>

Statistics

| Log likelihood | -78.393 | -50.518 | -59.226 |
| \gamma | 0.921 | 0.983 | 1.000 |

Firstly we need to test the validity of the usage of stochastic frontier and their dominance over the simple regression. The \( \gamma \)-statistic values for all three models are near to 1 (significantly higher than 0), so we state the presence of inefficiency in the data, and prefer stochastic frontier models.

We used the likelihood-ratio test to compare spatial and non-spatial model specifications:

\[
P\{ LR > \chi^2_{\nu} (4) \} = P\{ 2(\ln(H_1) - \ln(H_0)) > \chi^2_{\nu} (4) \} = \\
= P\{ 2(-59.226 - (-78.393)) > \chi^2_{\nu} (4) \} = P\{ 38.334 > \chi^2_{\nu} (4) \} = 0.000.
\]
Therefore we reject the model without spatial components and accept the spatial stochastic frontier models. A difference in efficiency estimates between spatial and non-spatial models will be discussed later in this section.

The comparison of two alternative spatial model specifications is not only a statistical task, but also a matter of interpretation. The essence of these two models is different, and a researcher can choose one or the other depending on the goals of his research. We chose the model based on travel times (Model ROAD) for analysis in this research.

The majority of Model ROAD coefficient estimates are significant and match our expectations. The number of beds in hotels and the number of enterprises in tourism-related sectors have a significant positive influence on the number of tourists, so predictably these can be considered as important resources for regional tourism. This relationship is bidirectional; businesses adapt to the real economic situation and develop in regions with higher numbers of tourists.

The number of beds in hotels and the number of enterprises in tourism-related sectors have a significant positive influence on the number of tourists, so predictably these can be considered as important resources for regional tourism. This relationship is bidirectional; businesses adapt to the real economic situation and develop in regions with higher numbers of tourists.

The locational characteristics of regions also significantly influence tourist numbers. The sea-side is one of the most powerful attractions in the Baltic states and has, as expected, a significant positive value. The influence of travel time from the nearest airport/port is significant in the Model DIST, but not significant in the Model ROAD. This can be easily explained using the fact that the travel time is already included in the Model ROAD for regions located near to main gates (in form of the contiguity matrix), and possibly there is no significant difference for other regions (due to the law of distance-decay).

The only unexpected parameter value is the negative influence of the number of museums in a region. The fact that having a large number of specialised museums may not act as a tourist attractor is predictable, but the negative sign is more difficult to explain. We do not make any assumptions or conclusions about this result in this study. It is a point that requires additional investigation.

The dummy variable EE (specifics of Estonia) has a significant positive sign, so we conclude that Estonian regions have a higher level of efficiency. This can be explained by the strong relationships between Estonia and Finland (including in the tourism sector). More than 35% of tourists visiting Estonia in 2008 arrived from Finland. In addition the lower crime rate and more stable political atmosphere can be considered as reasons for the positive distinction in favour of Estonia (for example, according to Transparency International’s Corruption Perception Index 2009, Estonia occupies 27th place while Lithuania and Latvia are 52nd and 56th respectively). The dummy variable for Lithuania also tends to be positive, but in the Model ROAD it is insignificant, so we do not distinguish between Latvia and Lithuania in terms of tourist attraction.

Analysis of competition and cooperation between regions in the Baltic States is one of the main points of this research. The spatial component ln \( W \cdot \text{tourists} \), included in the models, has a significant negative value (\( \rho \)) for both cases. This means that tourists accommodated in a neighbouring region cannot be considered as a resource for a given region, but quite the contrary. They have a negative influence on the region’s tourist numbers. So we state that competition between regions for tourists is present in all Baltic states.

This fact can be explained in different ways. Firstly, as we used the number of accommodated tourists as a dependent variable, this conclusion shows that tourists prefer to stay in one particular region and visit neighbouring regions (if at all) as one-day trips.

The second reason for competition between regions is shortage of organised tours in the Baltic states. Most of these tours are still country-oriented and usually have a base region where the tourists stay, several one-day trips to neighbouring regions. The development of tours offering several night’s stay in different regions would improve the level of regional cooperation.

In addition we analysed cross-dummy variables to discover differences in competition levels between countries, but in our final model these effects are insignificant (though with a tendency to higher competition levels in Estonia and Lithuania).

As we stated, for competition between regions for tourists we expect a relation between spatial component and regional efficiency levels. Economic theory postulates that a higher level of competition leads to a higher efficiency of economic units. In our case we observe this effect via the value of \( \lambda \) coefficient. According to stochastic frontier model specification, the negative sign of this coefficient decreases the value of a region’s inefficiency \( u \), and so has a positive influence on its efficiency. This can be stated as another very important conclusion of this research.

The stochastic frontier approach allows us to calculate efficiency level values for a given region for every time point. We presented average efficiency values (2005-2008 years) in Table 3 and their geographical distribution in Figure 2.
Table 3. Estimates of region efficiency levels

<table>
<thead>
<tr>
<th>Latvia</th>
<th>Estonia</th>
<th>Lithuania</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region</td>
<td>Efficiency</td>
<td>Diff.</td>
</tr>
<tr>
<td>Ventspils</td>
<td>93</td>
<td>0</td>
</tr>
<tr>
<td>Valmiera</td>
<td>89</td>
<td>0</td>
</tr>
<tr>
<td>Cesis</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>Ogre</td>
<td>75</td>
<td>-8</td>
</tr>
<tr>
<td>Jekabpils</td>
<td>70</td>
<td>-9</td>
</tr>
<tr>
<td>Preili</td>
<td>68</td>
<td>-6</td>
</tr>
<tr>
<td>Bauska</td>
<td>68</td>
<td>-11</td>
</tr>
<tr>
<td>Saldu</td>
<td>68</td>
<td>-12</td>
</tr>
<tr>
<td>Kulda</td>
<td>67</td>
<td>-14</td>
</tr>
<tr>
<td>Riga region</td>
<td>64</td>
<td>-3</td>
</tr>
<tr>
<td>Madona</td>
<td>58</td>
<td>-15</td>
</tr>
<tr>
<td>Jelgava</td>
<td>57</td>
<td>-17</td>
</tr>
<tr>
<td>Valga</td>
<td>56</td>
<td>-6</td>
</tr>
<tr>
<td>Liepaja</td>
<td>54</td>
<td>-29</td>
</tr>
<tr>
<td>Limbazi</td>
<td>48</td>
<td>-28</td>
</tr>
<tr>
<td>Aizkraukle</td>
<td>46</td>
<td>-16</td>
</tr>
<tr>
<td>Daugavpils</td>
<td>46</td>
<td>-17</td>
</tr>
<tr>
<td>Talsi</td>
<td>45</td>
<td>-20</td>
</tr>
<tr>
<td>Kraslava</td>
<td>41</td>
<td>-23</td>
</tr>
<tr>
<td>Tukums</td>
<td>39</td>
<td>-15</td>
</tr>
<tr>
<td>Aluksne</td>
<td>34</td>
<td>-16</td>
</tr>
<tr>
<td>Ludza</td>
<td>30</td>
<td>-19</td>
</tr>
<tr>
<td>Rezekne</td>
<td>20</td>
<td>-11</td>
</tr>
<tr>
<td>Average</td>
<td>59%</td>
<td>70%</td>
</tr>
</tbody>
</table>

* – average efficiency levels, estimated using Model ROAD
** – differences between average efficiency levels, estimated using Model ROAD and Model NOSPAT (Eff_{Model ROAD} – Eff_{Model NOSPAT})

Figure 2. Map of regions’ efficiency levels (Model ROAD)

The average value of region efficiency levels is 63%, so regions have a significant internal potential and could attract 58.7% more tourists (37/63 = 0.587) using available resources and increasing the efficiency of their utilization.
Estonian regions are relatively more efficient (70%) than regions in Latvia and Lithuania (59% and 60% respectively), and there is no significant difference between Latvian and Lithuanian regions. Also it can be noted that Latvian and Lithuanian regions are more heterogeneous than regions in Estonia. A complete analysis of regions is beyond the scope of this research.

One of the main goals of this research is the comparison of spatial and non-spatial stochastic frontier models. Estimates of parameters (Table 2) included in both models correlate to each other and the models look similar. Differences between the models’ efficiency estimates are presented in the Tables, but they should not be analysed directly, because generally efficiency estimates of different model specifications are non-comparable. Values presented in the tables allow conclusions about the patterns of efficiency estimates to be made, not the numbers themselves. We can conclude that the application of the spatial model does not significantly affect central regions (Riga, Vilnius, Harju) and regions without powerful neighbours (Saare). However, efficiency estimates for regions located near to popular centres for tourist accommodation are significantly changed under the influence of spatial structure inclusion (Liepaja, Rapla, Telsiai). This result is economically explainable and can be considered as evidence for the utility of spatial stochastic frontier models.

6. Conclusions

In this research we examine the efficiency of regions in the Baltic states as places for tourist accommodation. We use information about spatial structure to estimate the effects of agglomeration and competition for tourists between regions and their influence on the relative efficiency levels of regions.

We suggest a spatial stochastic frontier model and estimate its parameters for Estonian, Latvian, and Lithuanian regions between 2005 and 2008. This model allows us to distinguish the effects of different factors (inputs) on the regions’ attractiveness for tourists and efficiency levels. We estimate the suggested spatial model using two different approach to distances; geographical (Euclidean) and travel-time based. We also control unobservable country-specific effects. We compare spatial models and a model without spatial components and note the advantages (theoretical and empirical) of the spatial models.

We discover that the competition effects in the Baltic states are stronger than the effects of agglomeration. We note that tourism in the Baltic countries is still significantly separated, and the development of transport networks and international holiday tours is highly desirable.

We find a significant positive relationship between competition between adjacent regions and those regions’ efficiency levels. This matches our economic expectation.

We also calculate and review values of region efficiency and find a significant level of inefficiency (the average efficiency is only 63%) in all three Baltic states.

References