Tourism geography in Europe

Thomas Sick Nielsen, Berit C. Kaae

Danish Center for Forest, Landscape and Planning, University of Copenhagen, Denmark

Abstract

In the tourism component of SENSOR, attraction modelling is needed to predict the likely distribution of growth in tourism facilities at the sub-national level. Modelling of tourism flows between countries is obtained through a demand modelling linked to a bilateral flow matrix. This paper presents analysis of tourist beds at the NUTSX level in order to allow for a geographical disaggregation of tourism loads within the country. In summary, 79% of the variation in tourism bed densities and 39% of the variation in growth through the 1990s can be explained by physio-geographical predictors in combination with GDP/capita and population. Prominent predictors of tourist attraction are the relatively ‘fixed assets’ of alpine areas in the region and access to the coast, but several variables also link the attraction modelling to other model outcomes from the SENSOR project. Population density, GDP/capita, urban and nature land cover are generally positively related to tourism loads, while agriculture is negatively related to tourism. Thus, the regression models presented in the paper can be used to estimate the attractiveness of regions to tourists in a way that will be sensitive to the scenarios specified in the SENSOR project. Furthermore, the regression results suggest the magnitude of a saturation tendency, implying that crowding at some destinations will gradually redistribute tourist to other regions within the country.

Keywords

Europe, tourism, tourist beds, attractiveness, statistical analysis

1 Introduction

Tourism is a significant factor contributing to economic, social and environmental changes, positive and negative, in the regions visited. Around 60% of world-wide tourism takes place in Europe, and tourism to Europe is growing rapidly. From an estimated 443.9 million international tourist arrivals in Europe in 2005 (UNWTO 2006), the number of arrivals is predicted to reach 717 million in 2020 (WTO 2001). These figures do not include the high number of domestic tourists travelling within their own country. In 2002 – within the EU-15 alone - there were 1,507 million overnight stays by tourists, of which 939 million stays were by domestic tourists (62%) and 568 million by international tourists (38%) (Eurostat 2006). Tourism in the EU is primarily driven by intra-EU-25 tourist flows. Domestic tourists account for 59% of tourist overnight stays and 32% are other EU-25 tourists, while only 9% come from outside the EU-25 (CEC & Eurostat 2006a).

An immediate spatial impact of tourism is derived from the tourists' demands for facilities, including infrastructure and overnight accommodation. In 2004, the EU-25 had a capacity of approximately 24.4 million tourist bed places (Eurostat 2006a), and the number of beds is growing. In addition, well over 10 million second homes are located within EU-25. The second homes are generally not included in statistics on tourism, which focus solely on "collective establishments". The facilities for tourists are spatially encroaching on other land uses. Statistical sources do not include explicit data on the land appropriated for tourism facilities, and it must be assumed that tourists take up a proportion of urban land uses and therefore contribute to urban growth and sprawl (EEA 2006), depending upon the regional context.

The tourism modelling of the SENSOR project includes a number of steps and sub-models (see chapter 8 for an overview of the modeling framework). In the demand modeling, an economic model linked to a tourism demand model predicts the flows of tourists between the European countries in response to general price levels and transport prices in particular. However, the demand model predicts changes only at the national level, and a more detailed evaluation of the likely spatial impacts of tourism under different scenarios, requires a tool for geographical allocation of inbound tourists at the sub-national level. The goal of this chapter is to develop such a tool based on the tourism attraction factors.

Objectives

The objective of the modeling exercise is to identify key tourism attraction factors – based on available European and global data sets - which can explain the geographical distribution of tourists in European regions. The regions used for the analysis are the so-called NUTSX regions, constructed for use in the SENSOR project. The NUTSX regions combine existing NUTS2 and NUTS3 regions to arrive at a more comparable size for the regions across Europe, and thus overcome some of the analytical problems related to the diversity in size between underlying geo-statistical units.

Key questions

The main questions which the model addresses are the following:

> *What are the determinants of the geographical distribution of tourism loads in Europe? How far can we determine these factors by using available European statistics on physio-geographical aspects, such as land-use, climate, location and accessibility?*
> *Are there significant saturation effects for tourism growth at the level of NUTSX regions?*

Limitations

The limited availability of data below country level forms an important part of the premise for the analysis. In the cross-sectional analysis, an extensive range of available data at the NUTSX-level will be assembled in an attempt to explain the geography of European tourism. The lack of suitable variables especially affects the analysis of the development in tourism over time. Very few data for the development over time is available at the level of the NUTSX zones – used in the SENSOR project – and in the present analysis.

2 Background

The current distribution of tourists is highly uneven, as some regions of the EU are more especially attractive to tourists. A diversity of motives and attractors influence the selection of tourist destinations. This is the result of highly complex psychological motives and social and economic factors forming the demand for tourism, as well as the supply of a variety of tourism opportunities meeting these demands. Despite tourists' highly individual motives and preferences, the tourism patterns across Europe remain oriented towards certain regions – attributes of these regions appear to be more attractive to tourists than those of other regions – but what are the attractors?

2.1 Travel motives

The motives for travelling are very complex and differ from person to person in response to their underlying psychological needs and constraints. In general, we distinguish between push factors – the factors (e.g. employment, community, and personal life) motivating people to travel away from their home, and pull-factors – the factors in the receiving regions attracting people to choose certain destinations they find attractive in meeting their underlying needs (WTO 1997).

The motives for travelling vary with many factors, such as age, sex, stage in the family life-cycle stage, personality, interests, etc. Previous travel experience also plays a role, as people tend to have different motives as they get more experienced according to the Travel Career Ladder (Pearce 1988, 1991).

According to the theory of ritual inversion (Graburn 1983), tourists going on holiday often seek some level of contrasts to their everyday life and home environment. The theory suggests in their choices and activities, tourists may select places and activities which are opposites of those experienced in their home environment. However, each type of tourism only involves a few key reversals. The amount and type of contrasts vary by several factors, including the tourist's tendency toward more adventurous or safety-oriented experiences, which reflect their different personality types (Plog 1974). Examples of contrast-seeking related to the natural environment may include Northern Europeans seeking the warm and sunny Southern European climate or land-locked Central Europeans seeking the wide-open coastal areas and beaches, or the Dutch seeking the hilly or mountainous areas for vacation as a contrast to their own lowlands. Some landscape features (e.g. sandy coastal beaches) are attractive to most people as they represent the classical images of a holiday. All in all, the choice of tourist destination relies on a wide range of factors of which only some are related to the actual landscape features.

2.2 Studies of travel motives

A large number of studies address tourist demand models (e.g. Crouch 1995, Hu & Ritchie 1993, Klenosky 2002, Lim 1995, Lohmann & Kaim 1999, Papatheodorou 2001, Pike 2002, Seddighi & Theocharous 2002, Witt and Witt 1995). But almost all studies focus on economic and demographic factors of the countries of origin of tourists and provide little input to identify relevant destination attributes to include in the study.

Almost all models attempting to explain tourism flows focus on the demand side – the background factors in the tourists' country of origin stimulating or limiting their propensity to travel. But while this is part of the equation, the pull factors of the destination attracting tourists to visit – the supply side - seems to be largely ignored.

A study by Zhang & Jensen (2007) analyses tourism flows from a supply-side perspective based on new theories of international trade. The attraction factors they include to explain tourist arrivals are: receipts, population, GDP per capita, hotel capacity, FDIHR (foreign direct investment in hotel and restaurant sector), the stock of foreign direct investment, openness (of export and import), PPP (relative price level of the destination), and a time trend. Furthermore, a country-specific variable is used to cover the cultural and natural attractions, including climate and scenic advantages.

Results show that the fixed country-specific effects that capture natural endowments are highly significant. Countries compete for tourist arrivals on the basis of natural endowment. In a world-wide context, however, this competition is more between countries from different world regions than between countries from the same region. Advantageous natural endowments between countries of the same region matter only among the OECD and the Middle East countries. This means that some OECD countries rely extensively on the country-specific factors, such as scenic attraction and cultural heritage, as a basis of comparative advantage to distinguish their tourism product, whereas other countries do not. The higher relevance of country-specific factors within the OECD may be explained by the majority of tourists emanating from the OECD countries and having a better appreciation of the underlying cultural and heritage endowments of their own countries as compared to countries in more distant regions.

The results render strong support for the relevance of certain supply-side factors in explaining international tourism flows, such as natural endowments, as well as created assets associated with technology, infrastructure and international knowledge spill-over. Interestingly, price competitiveness is not found to be a robust variable. Within the OECD area, prices play the reverse role – higher prices attract more tourists. This is explained by these countries having been able to differentiate and augment the tourism product that they offer.

Unfortunately, the highly important country-specific effects identified in their study are not further explored by Zhang & Jensen (2007). The supply-side factors discussed in their study are largely economic. More detailed identification of key destination attributes is the focus of the present study, but only within the EU-region.

2.3 Destination attributes

A few empirical studies touch on the issue of destinations and their attributes. A 1997-98 Eurobarometer survey (CEC, 1998) included data on which type of destinations tourists from the EU-15 countries choose. Sixty-three percent of European holiday makers choose the sea, 25% the mountains, 25% the cities and 23% the countryside. National differences were found for most factors as well as socio-demographic differences.

A study of travel motives and vacation activities of 55,.000 tourists in 15 European countries (Danmarks Turistråd 1999) included a few pull motives. The natural features of the destination were valued highly by all nationalities: Experiencing nature was highly important or important to between 65-80% of the tourists – particularly Danes, Poles and Italians, while Swedes and Norwegians were the least interested (having vast expanses of wilderness at home). Visiting undisturbed areas was either important or highly important for between 25-57%, with the French, Italian, and British tourists being most interested, while the Swedes and Norwegians were the least interested. The quality of the environment was also included in the survey. Here 45-78% found it important or highly important to visit places with clean air and water – especially the Poles, Italians, French, and British tourists. Furthermore, 11-57% found it important or highly important to visit places caring for the environment – the Germans viewed this factor as especially important.

A few pull-motives related to climate were also included: Enjoying the sun/getting a suntan were important or highly important to between 47-68% of the respondents – though not particularly those from Northern Europe. Experiencing a different climate was important or highly important to between 40-65%. Here the tourists from Southern Europe tended to be a bit more interested than tourists from other European countries with more shifting weather conditions. This may reflect the desire oft many Southern Europeans for cooler climates during the hot summer season.

The cultural and historic attractions were also included: Visiting historic places was important or highly important to between 39-58% with smaller national differences. Cultural experiences were important or highly important to 25-50%, and particularly the Germans an Italians were interested in these attractions. However, although some national differences are found for most factors, no clearly consistent pattern emerges from this data.

3 Data and methodology

This section presents the data used for the analysis of tourism loads in European regions as well as the methodology employed in the analysis and specification of tourism predictors. The section describes dependent variables, independent variables, and the overall methodology.

3.1 Dependent variables

The dependent variables consist of the only tourism indicator available at NUTS3 level from EUROSTAT with a reasonable coverage of European space, namely the number of tourist beds.

Data at the NUTS3 level allows for a dataset to be aggregated to the NUTSX regions used in the SENSOR project and the present analysis. The number of tourist beds by region is available from EUROSTAT from the mid-1990s onwards. This allows for two dependent variables to be analysed: (1) density of tourist bed spaces in NUTSX regions; and (2) growth in number of tourist bed spaces in NUTSX regions.

The number of bed spaces in NUTSX regions, as used in the analysis for 2000/2001/2002 was dependent upon the variations in data-availability between the European countries. The growth-variables will represent average yearly change based on data from the period 1995/1996/1997/1998 until 2000/2001/2002, depending on the specific data that is available from the different countries.

3.2 Independent variables

The independent variables included in the analysis are presented in Tables 1 and 2. These are primarily selected from data sets with tourism relevance that have European coverage and can be aggregated to the NUTSX level. Thus, climate, landscape, land cover, nature and access to the coast are important elements, together with statistics from the EUROSTAT databases: population and GDP. Although most of the factors identified in the literature as central to tourism are represented, additional variables with information on the cultural environment and similar amenities would be desired. However, more refined analysis may be possible in the future as more data becomes available.

Table 1. Description of independent variables for use in cross-sectoral analysis

Key factor	Operational independent variable
Coast	Length of coastline
	Coast dummies (Mediterranean, Atlantic/English canal, other coast)
Landscape	Bio-geographical region dummies (including alpine areas/mountains)
Nature	Forest and natural land cover (%)
	Corine biotopes (sites and % of land cover)
	Sites with national designation status (sites and % of land cover)
Culture	Urban Morphological zone (%)
	MEGA-city (ESPON definition)
	Historical city (more that 1 mill. inhab. before World War II)
	World heritage sites (UNEP)
Climate	Temperature (summer and winter)
	Precipitation
Accessibility	Distance to nearest international airport
	Daily accessibility
	Potential accessibility
Population	Population density
Price levels	GDP in EURO/capita

Table 2. Description of additional independent variables for the analysis of changes in tourism loads in NUTSX regions.

Key factor	Operational independent variable
Tourism	Tourist density per land area, urban area or coast length
Population	Change in population density
Price levels	Change in GDP in EURO/capita

The list of explanatory variables is clearly shorter than what would have been preferred from a theoretical point of view and from the perspective of policy implications. The inclusion of strategic variables in the data set would be desirable as a link to regional policy. Such variables may be public investment in culture (presently available only at the country level) or accounts of cultural or tourism-oriented attractions such as museums, entertainment, etc. It is possible that the analysis presented in the present paper may be improved when data becomes available, e.g. as an output from the ESPON project on cultural heritage (ESPON 1.3.3, 2006). Furthermore, additional variables to represent change over time are desirable. In the present analysis, only change in population and GPD at the NUTSX level can be included. The most important 'omitted' change variable in the analysis of growth in tourist bed densities is likely to be the change in accessibility. However, lack of access to historical transportation networks makes this variable very difficult to include. The analysis presented therefore rely on measures of accessibility in the present situation (2000/2001) based on variables from the ESPON project on transport infrastructures (ESPON 1.2.1, 2004).

Within ESPON 1.2.1, analysis of accessibility was done at the NUTS 3 level with respect to daily accessibility and potential accessibility; by surface modes, air-mode and multimodal (fastest combination of modes). In this context, 'daily accessibility' refers to an assessment of the maximum travel times that would be allowed in a daily (everyday) travel budget and the number of customers or purchasing power within this (time) range. 'Potential accessibility' measures accessibility based on the number of customers or purchasing power within Europe by assuming that the travel distance has a negative impact on the likeliness of interaction taking place (distance decay). Both types of measures, together with the more simple 'distance to airport', are included in the analysis.

3.3 Methodology for analysis

The methodology for analysis can be presented as two subsequent steps that will apply to the cross-sectional analysis of tourist beds and to the analysis of change over time. These two steps are data reduction and multivariate analysis.

Step 1: Data reduction

Factor analysis is employed to reduce the number of variables and describe the main variations across European space within three sub-groups of variables. The first sub-group consists of the variables that indicate temperature and precipitation. These variables are likely to be closely correlated, and data reduction into factors is necessary before analysis proceeds. The second sub-group of variables is those that describe land use, including nature and the degree of urbanisation, in the area. As with the first two sub-groups, the values on these variables are likely to be closely correlated and partly mutually exclusive. The third sub-group of variables is those that describe accessibility. The ESPON 1.2.1 project has made a range of measures available, and these will be used to extract the dimensions that vary across European space.

Especially in the context of the present study, which recognises its limitations due to the limited availability of explanatory variables besides physical and geographical data, it seems reasonable to reduce these sets of variables into the main differences across European space. In this way, we avoid the rather arbitrary results that may result from an inclusion of the variables without reduction.

Step 2: Multivariate analysis

The sets of factors derived in Step 1 are included as explanatory/independent variables in multivariate analysis of the variation in tourist densities across Europe. The remaining variables -- access to the coast, accessibility, population density, price-level proxy and possibly regional dummies (new member states, accession countries) -- will be included in parallel with factors derived in Step 1.

The multivariate analysis is carried out cross-sectional, with the tourist densities in 2001 as dependent variables, and with the change in tourist densities per year as the dependent variable. The analysis of changes in bed densities will include changes in drivers and explanatory factors over time, when available, but will otherwise rely on the more 'fixed' description of the physio-geographical properties of the regions used in the cross-sectional analysis.

4 Data reduction: factor analysis

To reduce the number of variables but also retain the relevant variations within Europe in the dataset, factor analysis in the form of Principal Component Analysis (PCA) was applied to the following subsets of variables: land cover, climate, and accessibility variables. The aim was to reduce the large number of variables within each subset to a smaller number of factors/components capturing the major differences within Europe, such that these components/factors could be subsequently incorporated into the explanatory analysis of the number of tourist beds in European NUTSX regions.

The reduction of variables into components/factors was guided by the eigenvalue criterion (a principal component should have an eigenvalue above 1), with some adjustments in the case of land use based on the interpretation of the components suggested by the analysis.

Table 3. Summary of factors (components) derived from Principal component analysis of land cover, climate and accessibility variables respectively.

LAND COVER/USE	
82% of variation in 7 variables:	Artificial surfaces; surfaces for transport infrastructure; surfaces used for agriculture; forest and nature land cover; wetlands; surface covered by Corine biotopes; and surface within the urban morphological zone (all measured in pct. of land cover within NUTSX regions)
Explained by 3 factors:	
Urban (F1)	Urban land uses vs. agriculture or nature.
Agriculture (F2)	Agriculture vs. urban or nature land cover (some blend in of wetlands in agricultural areas).
Nature (F3)	Nature areas and/or wetlands vs. urban, agriculture or forest land cover.
CLIMATE	
80% of variation in 7 variables:	Temperature at the warmest location in the region in the warmest quarter of the year; average temperature across all locations in the region in the warmest quarter of the year; temperature at the coldest location in the region in the coldest quarter of the year; average temperature across all locations in the region in the coldest quarter of the year; precipitation at the driest location in the region in the driest quarter of the year; average precipitation across all locations in the region in the driest quarter of the year; average yearly precipitation
Explained by 2 factors:	
Precipitation (F4)	Wet and temperate climate
Temperature (F5)	Warm and dry climate
ACCESSIBILITY	
73% of variation in 10 variables:	Number of commercial airports; traffic in commercial airports; driving time by car to commercial airports; driving time by car to motorway access; daily population accessible by car; daily market/GDP accessible by car; potential accessibility by air; potential accessibility by rail; potential accessibility by road; and potential multimodal accessibility.
Explained by 2 factors:	
Potential accessibility (F6)	The potential and daily accessibility, largely governed by surface modes, but with some contribution from the air-mode as well.
Access by air (F7)	Access to international airport and the level of service offered at this airport (passenger volumes).

As the main result of the principal component analysis, seven land-use variables, seven climate variables, and 10 accessibility variables are reduced into three land-use factors, two climate factors and two accessibility factors for further analysis. These factors will be used in the multivariate regression models in the next section together with the remaining 'non-reduced' variables (Table 3).

5 Analysis of tourist bed densities in 2001

To enhance knowledge of the correlations between the explanatory variables under control for other relevant factors, we have carried out a multivariate analysis of tourist bed densities as well as the yearly growth in bed densities (next section). This paper presents analysis based on the 'optimal model' approach. The optimal regression model is the model that explains the highest proportion of variation in the dependent variable with statistically significant effects and without inexplicable signs and effects (contra-intuitive effects) on the explanatory variables.

The optimal regression models, based on the data at hand, were identified based on a sequence of model searches in the SPSS statistical software. Particular attention was given to the effects of multi-colinearity between the variables and the differences in the number of missing cases, that may change the results as variables are gradually taken out of the equation (list-wise exclusion of cases was used). Gradual alterations to the subset of variables that formed the basis for model searches were applied to test the 'robustness' of the end result. The regression models resulting from the search can be seen in Table 4. Independent model searches were carried out for EU-25, EU-15 and the new-member countries in the eastern part of Europe (N-10 in ESPON terminology).

A cross correlation matrix for the explanatory variables included in the analysis can be seen in Table 5. Many of the variables are correlated to some degree, especially the new member state dummy and GDP/capita that display a Pearson correlation of -0.884. In the model for EU-25, these two variables were also those that were predicted to the highest degree by the other explanatory variables (Tolerance levels 0.133 and 0.152 respectively). The results for EU-15 and N-10 do, however, indicate that GDP/capita should be present in the EU-25 model. At the same time, the new member state dummy seems to be significantly partially correlated with the tourist bed density and thus allows some control within the model for the large east-west differences.

Table 4. Regression models explaining the density of tourist beds in NUTSX regions in 2001. Variables derived from factor analysis is indicated with 'F'; natural log transformations with 'LN'.

	EU25			EU15			N10		
	B	**Beta**	**Sig.**	**B**	**Beta**	**Sig.**	**B**	**Beta**	**Sig.**
(Constant)	-11,849	-	0,000	-9,232		0,000	-12,164	-	0,000
Potential accessibility (F6)	0,230	0,153	0,000	0,224	0,188	0,000	-	-	-
Urban (F1)	0,095	0,060	0,090	0,106	0,090	0,073	-	-	-
Agriculture (F2)	-0,249	-0,167	0,000	-0,191	-0,165	0,000	-0,332	-0,187	0,000
Nature (F3)	0,165	0,114	0,000	0,198	0,184	0,000	-	-	-
Alpine, pct. of land cover	0,678	0,091	0,000	1,209	0,170	0,000	-	-	-
Mediterranean coast	1,152	0,245	0,000	1,057	0,297	0,000	1,640	0,232	0,000
Atlantic coast	0,852	0,162	0,000	0,790	0,210	0,000	-	-	-
Other coast	0,460	0,099	0,000	0,345	0,100	0,011	0,970	0,137	0,001
Pop. /sq.km, 2001 (LN)	0,411	0,307	0,000	0,443	0,441	0,000	0,538	0,333	0,000
GDP/capita, 2001 (LN)	1,137	0,758	0,000	0,859	0,221	0,000	1,233	0,584	0,000
New member states (0, 1)	1,131	0,348	0,000	-	-	-	-	-	-
N=		454			312			142	
Adj. R-square		0,793			0,735			0,742	

The regression models explaining the variation in tourist bed densities in 2001 in EU-25 and EU-15 (Table 4) contain a large share of the variables that formed the basis for model searches. Tourist beds are positively related to potential accessibility, indicating that the more accessible regions have higher tourist densities.

The three land cover factors indicate that the degree of 'urban-ness' and the presence of nature areas attract tourists, while agricultural land uses are negatively correlated with tourist bed densities.

Furthermore, the percentage of land cover in the Alpine biogeographical region and the three variables indicating access to the coast are all positively related to tourist bed densities. The effect of Alpine land cover is likely to receive a large part of its influence from ski tourism, with some added value from the characteristics of the landscape and the contrast to the rest of Europe.

Access to the coast is clearly a very important feature of attractiveness in the regression models. The Mediterranean coast appears as the most attractive coast (the most important variables among the coast-variables) followed by the Atlantic coast and the English canal, and the other coasts of Europe.

Table 5. Bivariate correlations (Pearsons r) between the explanatory variables included in the regression model explaining tourist bed densities in 2001 (Table 4). Correlations significant at the 5% level (two tailed test) are marked with ‘*’.

	Potential accessibility (F6)	Urban (F1)	Agriculture (F2)	Nature (F3)	Alpine pct. of land cover	Mediterranean coast	Atlantic coast	Other coast	Pop./km^2. 2001 (LN)	GDP/capita 2001 (LN)	New member states
Potential accessib. (F6)		0,428*	0,149*	-0,133*	-0,161*	-0,160*	-0,023	-0,096*	0,637*	0,483*	-0,346*
Urban (F1)	0,428*		0,000	0,000	-0,141*	-0,093*	-0,062	0,090*	0,728*	0,263*	-0,090*
Agriculture (F2)	0,149*	0,000	1,000	0,000	-0,384*	-0,252*	0,065	0,269*	0,012	0,031	0,018
Nature (F3)	-0,133*	0,000	0,000		-0,105*	0,108*	0,022	0,297*	0,093*	0,081	-0,085
Alpine pct. of land cover	-0,161*	-0,141*	-0,384*	-0,105*		0,066	-0,115*	-0,192*	-0,092*	-0,307*	0,252*
Mediterranean coast	-0,160*	-0,093*	-0,252*	0,108*	0,066		-0,070	-0,158*	0,028	0,027	-0,148*
Atlantic coast	-0,023	-0,062	0,065	0,022	-0,115	-0,070		-0,132	0,050	0,117	-0,187
Other coast	-0,096*	0,090*	0,269*	0,297*	-0,192*	-0,158*	-0,132*		-0,068	0,294*	-0,183*
Pop./ km^2 2001 (LN)	0,637*	0,728*	0,012	0,093*	-0,092*	0,028	0,050	-0,068		0,211*	-0,045
GDP/capita 2001 (LN)	0,483*	0,263*	0,031	0,081	-0,307*	0,027	0,117*	0,294*	0,211*		-0,884*
New member states	-0,346*	-0,090*	0,018	-0,085	0,252*	-0,148*	-0,187*	-0,183*	-0,045	-0,884*	

On the basis of the model searches, the effect of the Mediterranean coast cannot be reduced to a matter of coast and warm climate. Other aspects that could lend themselves to the effect of the variable are the character of the sea, other aspects of climate such as wind, vegetation and landscape, and most likely the (historical) position of the Mediterranean on the mental map of northern European tourists.

Population density and wealth measured as GDP/capita are both positively related to tourist bed densities. Both variables can be explained as a general relationship between the level of activity in the region and how this affects the development of the tourism sector, as well as the overall attractiveness and visibility of the region.

GDP/capita is the most important variable (based on beta coefficients) in the model for EU-25, but GDP/capita only ranks third within the EU-15 group. The use of the variable GDP/capita in the models is likely to introduce some endogenity to the regression model, as GDP may be higher because there are tourists. However, it is the perception of the authors that given the rough scale of analysis and the cross-sectional approach, the GDP per capita variable is more likely to reflect a local economy that facilitates the development and expansion of tourist services among other things; and maintains relations with the outside world, and through this, improves its position as a potential destination for tourists and business travellers alike (see also Zhang and Jensen, 2007).

The prominent effect of the GDP variable in the EU-25 model, which also includes a dummy variable for new member states, can be interpreted as being in favour of seeing the GDP pr. capita as a signifier of the state of the economy; the development of competitive tourist services/facilities; and the integration into a wider European market (yielding more comparable economic results).

Among the new member states of the European region: GDP/capita is the most important explanatory variable; followed by population density and the Mediterranean coast.

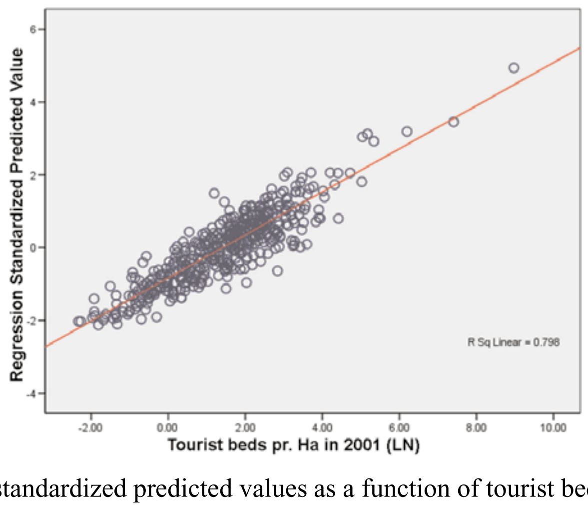

Fig. 1. Plot of standardized predicted values as a function of tourist beds pr. ha.

This probably also reflects a pattern where the development of tourism is focused mainly on the largest cities, or on a limited number of nodes on the coast.

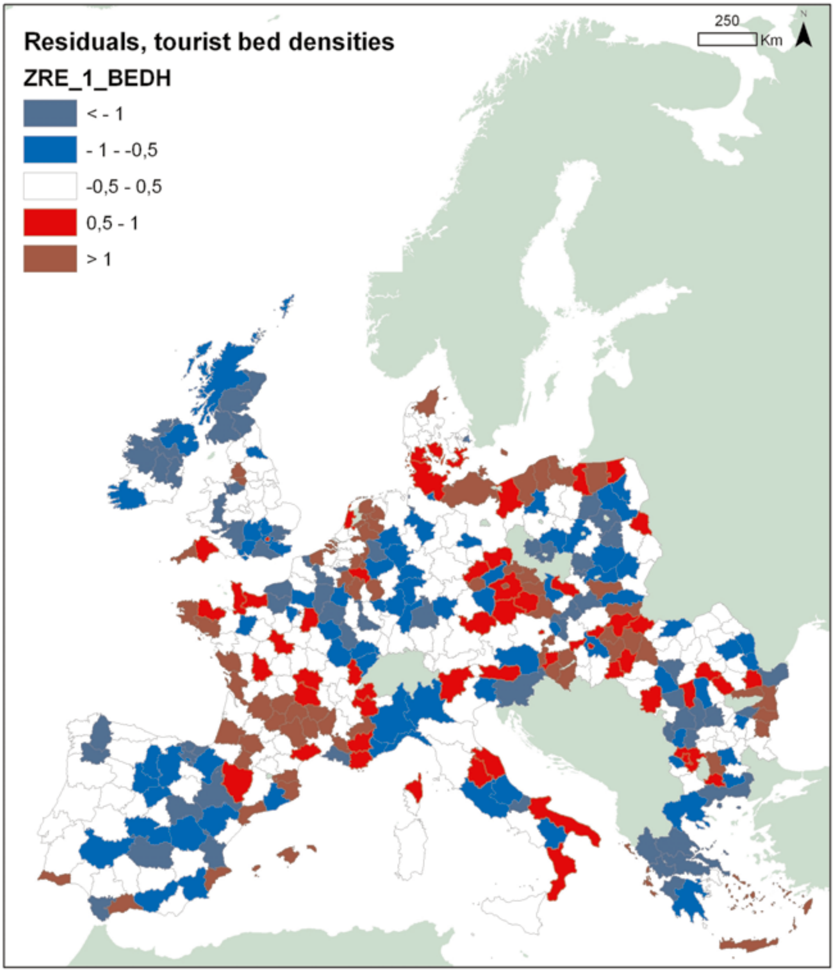

Fig.2. Standardised residuals by NUTSX region.

The overall fit between the predicted tourist bed densities and observed, empirical bed densities for EU-25 is indicated in Figures 1 and 2. The plot of predicted densities against observed bed densities displays a generally linear form, with a regular dispersal on both sides of the regression line (error-term). Thus, the linear regression model seems to be a most appropriate representation of the variation in the data. The map of residuals (difference between observed and predicted bed densities) in Figure 2 indicates that there are no severe spatial biases, country biases or the like in the result. There are some regional clusters of biases that indicate that the analysis could be improved through the inclusion of more variables and if nothing else through the inclusion of dummy variables. These are: NUTSX regions on the southern shore of the Baltic Sea, and the French 'Massif Central'; both have positive residuals and Greece has negative residuals.

6 Analysis of growth in tourist bed densities, 1994-2001

Growth within the relatively short time period covered by the EUROSTAT data on tourist beds is considerably harder to explain statistically than the distribution of bed densities in the status quo condition. Different specifications of the dependent variables were tested: growth in absolute numbers, relative growth, growth in beds pr. inhabitant; growth in beds pr. capita, etc. However, no substantial differences were found with respect to the level of explanation that could be achieved or the theoretical preconditions for linear regression analysis. This section presents the results for relative growth in tourist bed density (Table 5).

There are differences in comparison with the regression models explaining tourist bed densities in 2001. Where no significant correlation with climate is found in the 'status quo' models, there is a strong positive correlation between growth in tourist beds and warm climate, and a corresponding negative correlation between precipitation and tourist beds. Furthermore, there is no significant correlation between growth in tourist densities and access to the Mediterranean coast. Thus, the results indicate that the European tourism geography is changing: there is a shift from wet and temperate regions towards warm and dry regions; at the same time, there is a reduced importance of the Mediterranean coast. As a broader interpretation, the travel range of the tourists is becoming wider due to tourists' increased wealth and mobility. This allows tourists to favour warm and dry locations in the south of Europe. At the same time, the increasing 'footlooseness' of tourists is allowing tourist services to be developed in areas that have not previously received large volumes of tourists. The increasing diversification of the tourism demand indicated by the 'travel career ladder' (Pearce 1988, 1991) may also form part of the explanation, as the population of Europe becomes more and more accustomed to travelling abroad.

Adding to this difference, between the model describing status quo and the model describing growth, is the negative sign on the variable tourist beds pr. square km in 1994 (the beginning of the period covered by the data). This indicates that a saturation effect may be at work. Crowding at the destination could be a disincentive; at the destination, crowding may discourage further development of tourist facilities; for the potentially inbound tourists, the crowding may cause them to choose to go somewhere else.

Potential accessibility, urban, agriculture, nature, alpine areas and growth in population density also add to the explanation and prediction of growth in tourist bed densities. For these variables, the signs (+/-) were the same as what was found in the model of tourist beds densities in 2001. A dominance of agricultural land uses was negatively correlated with tourism growth, while the other variables were positively correlated. It is remarkable that the agricultural land uses appeared to be the second most important variable within the regression model explaining tourism growth (Beta= - 0,270).

Table 6. Optimal multivariate regression models explaining relative growth p.a. in tourist bed densities, between 1994 and 2001. Version 1 include the variable "Coast – but not Mediterranean" while version 2 omits this variable. Variables derived from factor analysis is indicated with 'F'; natural log transformations with 'LN'.

	Beds/Ha pct. growth p.a. 1994-2001					
		Version 1			**Version 2**	
	B	**Beta**	**Sig.**	**B**	**Beta**	**Sig.**
(Constant)	-2,324		0,021	-2,739		0,006
Potential accessibility (F6)	0,016	0,169	0,019	-	-	-
Precipitation (F4)	-0,023	-0,212	0,000	-0,015	-0,143	0,007
Temperature (F5)	0,033	0,245	0,000	0,016	0,122	0,018
Urban (F1)	0,025	0,243	0,000	0,024	0,247	0,000
Agriculture (F2)	-0,025	-0,270	0,000	-0,023	-0,251	0,000
Nature (F3)	0,009	0,107	0,039	0,007	0,087	0,078
Alpine, pct. of land cover	0,121	0,214	0,001	0,017	0,142	0,004
Coast – but not Mediterranean	0,043	0,189	0,002	-	-	-
Pct. growth p.a. in pop/Ha (LN)	2,109	0,123	0,016	2,483	0,145	0,005
Beds/sq.km, 1994 (LN)	-0,058	-0,734	0,000	-0,050	-0,649	0,000
N=		306			308	
Adj. R-square=		0,390			0,361	

Any type of coast contributed positively to tourist bed densities in 2001, but only non-Mediterranean coasts seem to be significantly related to the growth in tourist bed densities. This effect has been assembled into one dummy variable in Table 6. As the significance of all other coasts than the Mediterranean suggests a rigid precision of the result, including the spatial allocation of tourism growth not supported by the limitations to the methodology, an attempt was made to remove this variable from the model (Table 6, version 2). This exercise also removed accessibility from the model, as it became insignificant. The level of explanation measured by R-square declined slightly, from 39% to 36%. Thus, the difference between Mediterranean coasts and other coasts adds slightly to the explanation of trends in the late 1990s.

As the availability of historical data on tourist beds from the new member states in Eastern Europe was very limited, only few cases from Eastern Europe were included in the analysis. However, no significant difference between EU-15 and N-10 countries, with respect to growth in tourist bed densities was found within the data at hand.

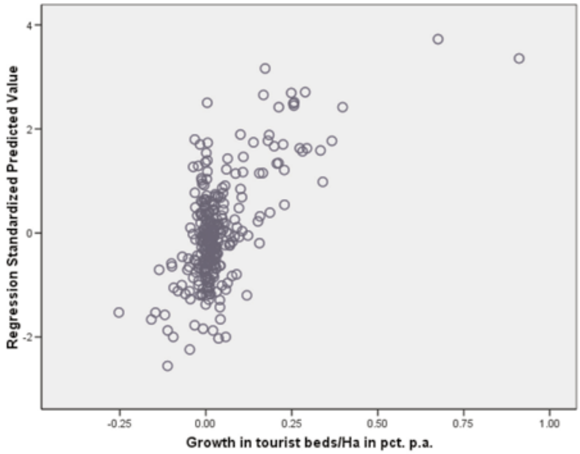

Fig. 3. Plot of standardized predicted values as a function of growth in bed densities (model: Table 6, version 1).

The plot of predicted growth against observed growth (Figure 3) reflects the differences in the ability of the regression model to predict growth in tourist bed densities. With an adjusted R-square of 0.390 for growth – compared to an adjusted R-square of 0.793 for the present status – the pattern of growth is clearly more difficult to describe and analyse statistically.

The R-square of 0.390, however, is still substantial and indicates that the results add to our knowledge of the correlates of tourism growth across Europe. With respect to the spatial distribution of the residuals, Figure 4 indicates that the negative residuals in the Mediterranean region (Portugal, Greece, Corsica, Sicily) may warrant a search for additional driver variables or alternatively, regional dummy variables. There are also generally negative residuals on the British North Sea coast and an identification of the 'British Isles' in a dummy variable could also be attempted.

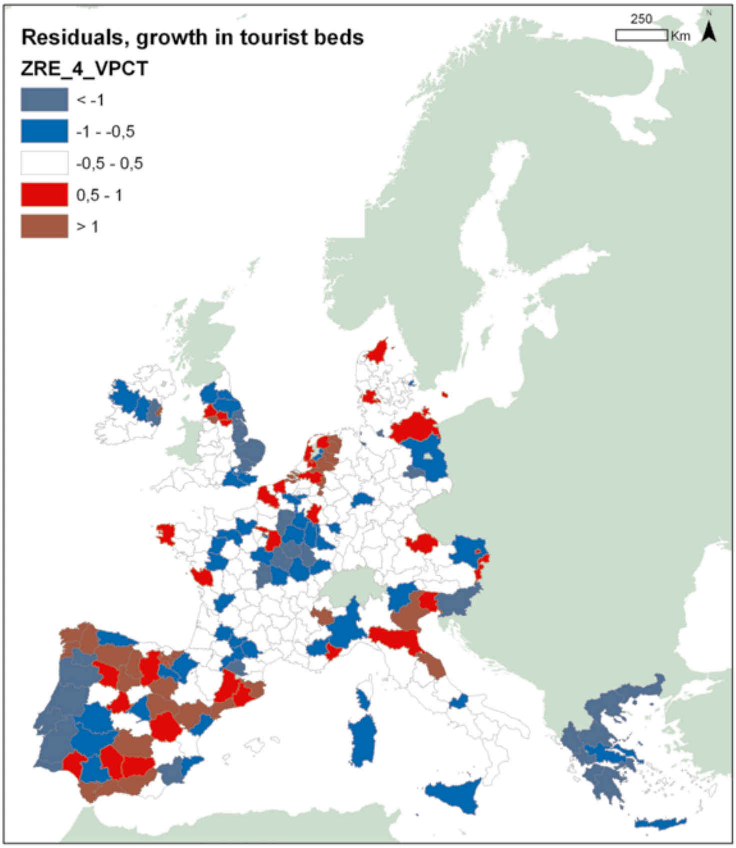

Fig. 4. : Standardized residuals by NUTSX region.

6.1 Sensitivity towards baseline and policy scenarios

The model results presented in this paper allow for the prediction of tourists by NUTSX regions in response to population, economic development and aspects of the landscape/land cover. The predicted number of tourists can also be interpreted as an index of tourist attractiveness by region that can serve the purpose of geographical distribution of nationally inbound tourists.

The map in Figure 5 shows the current tourist attractiveness predicted on the basis of the empirical data for 2001. The map in Figure 6 shows the growth in tourist bed densities through the 1990s, predicted on the basis of population growth, tourist bed density at the offset combined with land cover and other variables reflecting status quo in 2001.

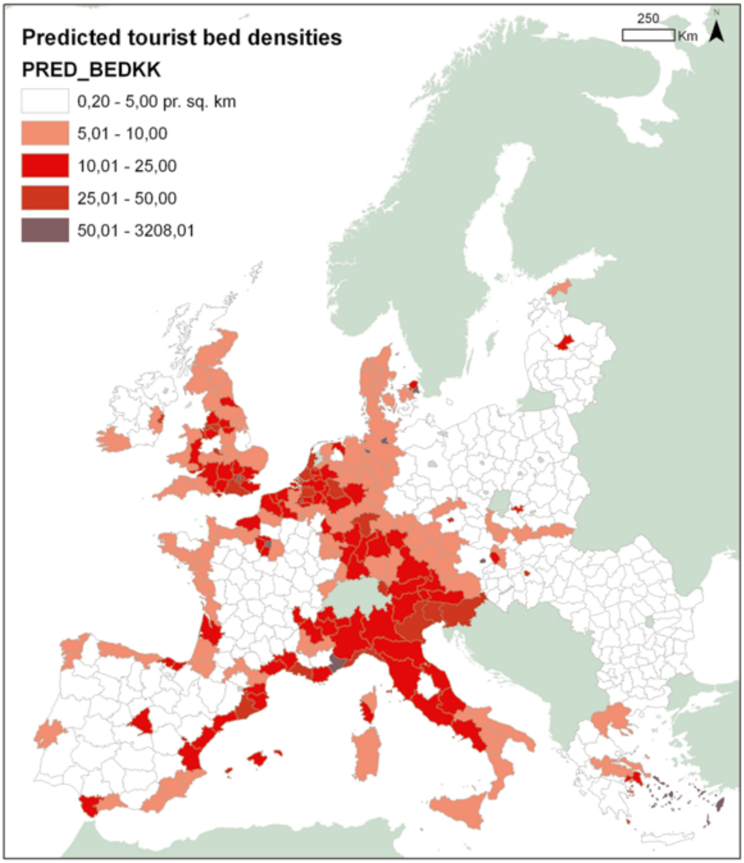

Fig. 5. predicted tourist bed densities in NUTSX region, 2001

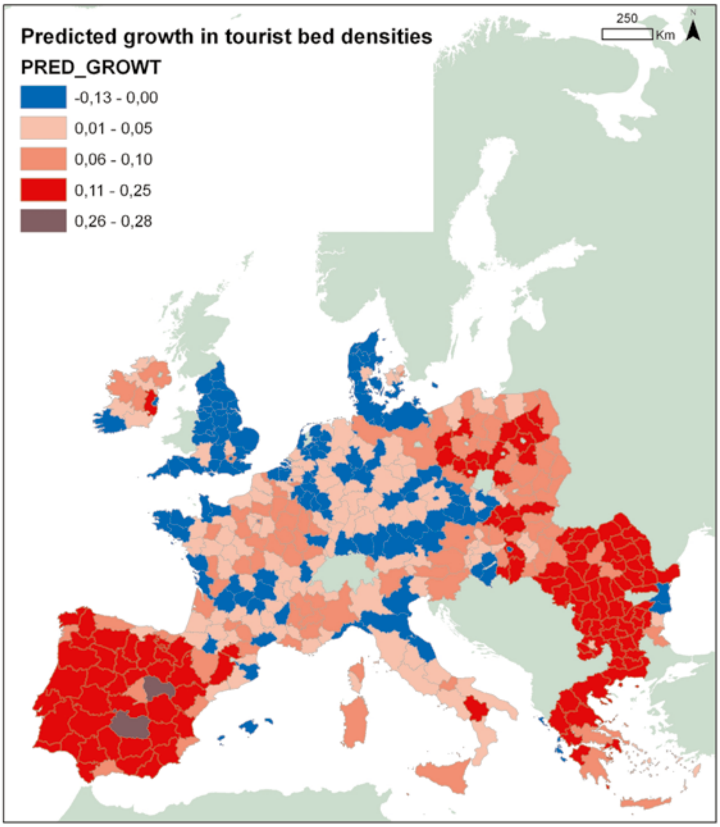

Fig. 6. predicted relative growth in tourist bed densities by NUTSX region, 1994-2001

Some of the predictors of tourist attractiveness -- such as climate and access to coast and mountains -- are likely to remain the same in the SENSOR scenarios for 2015 and 2025. Accessibility is likely to change in some parts of Europe, but this is not modelled within the SENSOR project, and the allocation of tourists in 2015 and 2025 must rely on the overall differences in accessibility within Europe in 2001. However, the remaining variables included in the regression models -- land use, population, GDP/capita -- will change the attractiveness of the single NUTSX region in response to outputs from the various models employed in the SENSOR project: CAPRI, EFISCEN, NEMESIS, the demographic model, and policy scenarios for nature protection. Furthermore, the 'saturation' tendency included in the analysis of tourism growth suggests a gradual redistribution of attractiveness for tourism in response to crowding at the destinations.

6.2 Land use/land cover effects

The analysis of tourist bed densities in 2001 as well as the analysis of growth has revealed significant effects made by the three land use factors: urban, nature and agriculture (see Table 3). The three factors have been derived from the Corine land cover data sets in combination with Corine biotope data and the European Environmental Agency map of urban morphological zones. Factor loadings by land use/land cover variable are shown in Table 7.

Table 7. Factor loadings of land use variables (measured in percent of land within region), by component/factor, resulting from principal component analysis and varimax rotation. Highest factor loadings are printed in bold.

Land use variable:	F1 Urban	F2 Agriculture	F3 Nature
Artificial surfaces	**0,981**	0,030	-0,023
Transport infrastructure	**0,880**	0,001	0,001
Agriculture	-0,403	**0,867**	-0,061
Forest and nature areas	-0,362	**-0,907**	-0,022
Wetlands	0,000	0,379	**0,660**
Corine biotope area	-0,026	-0,308	**0,741**
Urban Morphological Zone	**0,959**	-0,028	-0,016

The regression analysis has indicated that factor/component 1 (Urban) and 3 (Nature) are positively related to tourist attractiveness, while factor 2 (Agriculture) is negatively related to tourist attractiveness. To some extent, this may be the result of proxy effects, indicating an average level of associations between types of regions and tourist densities across Europe. Thus, employing the regression results to predict future geographical distributions of tourists implicitly involves assuming that these general associations between type of region and tourism will continue in the future. Given the geographical level, at which the modelling within SENSOR is undertaken, this is a reasonable assumption.

6.3 GDP and population

The analysis of tourist bed densities in 2001 indicates a positive effect of population density as well as GDP per. capita. The analysis of growth in tourist bed densities indicates a positive effect of growth in population density. These are likely to stem from a range of causal effects and mechanisms that is generally associated with wealth and population density.

Again using the regression result to allocate future tourism loads will imply the reasonable (best guess) assumption that these relations will carry on into the future. While most of the bio-physical attraction factors are relatively stable (climatic changes are not likely to take serious effect within the 2025 time horizon of the SENSOR project), some of the attraction factors are sensitive to the outcome of other SENSOR models such as the GDP and the population, as predicted through the SENSOR's demographic model and the NEMESIS model. Thus, the disaggregation of population and GDP forecasts to the NUTSX level can be incorporated in the evaluation of tourist attractiveness of NUTSX regions in 2015 and 2025 and will affect the distribution of tourists within the country.

7 Summary and conclusions

The multivariate regression models explained 79% of the variation in tourist bed densities by NUTSX regions in 2001 (Table 4), and 39% of the variation in relative growth rates between the regions (Table 6). The statistical explanation of the status-quo distribution of tourist densities clearly provides a better fit to the log-linear regression model than to the corresponding model explaining growth in tourist densities. The main explanation for the poorer result for the model explaining growth is probably the short time period covered and the many random movements on the tourist market that cannot be captured in rough and general models.

The modelling exercise presented in this chapter, however, produces consistently explicable results with respect to what factors and variables that are related to tourist loads in European regions. The predictors are summarised in Table 8, where they are also sorted according to their contribution to the statistical explanation (standardized regression coefficients, Beta).

Table 8. predictors of tourist bed densities in NUTSX regions in EU25+2, and growth in tourist bed densities in the late nineties. The variables are ordered by their contribution to the statistical explanation of tourist bed densities, with the most important variable in the top.

Tourist bed densities in 2001	**Growth in tourist bed densities in pct. p.a.**
GDP/capita (+)	Tourist bed density at the offset (-)
New member states (+)	Agricultural land cover (-)
Population density (+)	Temperature (warm and dry climate) (+)
Mediterranean coast (+)	Urban land cover / "Urbanness" (+)
Agricultural land cover (-)	Alpine areas (+)
Atlantic coast or English canal (+)	Precipitation (wet and temperate climate) (-)
Potential accessibility (multimodal, surface modes most important) (+)	Other coast than Mediterranean (+)
Nature land cover (Corine biotopes and wetlands) (+)	Potential accessibility (+)
Other coast than Atlantic/Mediterranean (+)	Growth in population density (+)
Alpine areas (+)	Nature land cover (+)
Urban land cover / "Urbanness" (+)	

At a more general level, the important variables are land cover and the mix of land uses in the region; climate; alpine areas; access to the coast; accessibility; population density; and the level of wealth.

The main differences between the statistical explanation of status quo and growth, respectively, are differences between 'old' and 'new' members of the European Union. The new member countries seem to have higher bed densities under 'ceteris paribus' conditions; and the importance of a saturation effect in explaining the growth in tourist bed densities (see section 8). Because of the lack of suitable time series on tourist beds from the new member countries, the data does not support conclusions on the importance of old vs. new member countries when it comes to tourism growth. Other sources, however, suggest that tourism growth is higher in the new member states (CEC & Eurostat 2006b).

Other differences between predictors of tourist densities and tourism growth, respectively, are the role of the climate. Climate factors have been omitted from the final model explaining bed densities in 2001. The insignificance of the climate within Europe is probably caused by the existing (historical) tourist industries in Northern Europe, which is counterbalanced by Mediterranean tourism. The growth trend is different, as relative growth significantly favours warm and dry climates at the expense of wet and temperate climates (northwestern Europe). This can be interpreted as a spatial redistribution of tourism within Europe that is probably driven by increasing levels of mobility and increased wealth. More complex climatic preferences by tourists were also found in a study across 15 European countries (Danmarks Turistråd 1999). Rather than a simple pattern of Northern Europeans seeking southern climate, sun-seeking and interest in different climates was found to be prevalent across most countries of both Northern and Southern Europe.

The high interest in coastal regions confirms the results of the Eurobarometer survey (European Commission 1998) where most European holiday makers choose the sea (63%) as their preferred type of holiday destination. Also, the interest in Alpine regions is supported, as 25% preferred the mountains as holiday destination. In contrast, the negative relation to agricultural areas is somewhat contrasted by the 23% of the respondents in the Eurobarometer survey who state their preference for the countryside as a holiday destination. However, this may be because the term 'countryside' encompasses much broader areas and experiences than do 'agricultural areas'. The attraction of 'urbanness' is also supported by the 25% of the tourists in the Eurobarometer survey who prefer cities as holiday destination, but many of the tourist accommodation facilities also cater to business tourists, who tend to hold meetings in populated and easily accessible places such as cities.

Quite interestingly, the GDP is positively related to the number of tourist facilities. This is similar to results by Zhang & Jensen (2007), who find that within the OECD area, prices play a reverse role – higher prices attract more tourists. Zhang & Jensen explain this by these countries having been able to differentiate and augment the tourism product that they offer. The perception of the authors of this modelling chapter is also that the GDP per capita variable more likely reflects a thriving local economy that facilitates the development and expansion of tourist services as part of a diverse economy and hereby becomes a hot-spot for travellers, rather than the higher GDP being a result of many tourists.

Overall, the attraction modelling has identified a number of key attraction factors in the destinations which to a large extent explain the great variations in the location of tourist overnight facilities. This direct modelling of the supply-side attraction factors has not been identified – as far as we have been able to find – in any other studies at this scale and level of detail (NUTSX level). Focus in tourism modelling is clearly on the demand side and on understanding what stimulates or limit peoples travels rather than what they seek to find in the destinations. While Zhang & Jensen (2006, in print) attempt a supply-side modelling approach, this is still based mostly on economic and development factors, while natural, cultural and, climatic factors are included only as a country-specific dummy. This study finds this country-specific dummy to be highly important but does not include any specification or data about it. In contrast, our modelling produces results with direct identification of key attraction factors, using these to establish an attraction index to be used in allocating tourist flows at the sub-national level.

8 Future refinement of the modelling

The results of the models in this chapter can be interpreted only by reference to the list of variables available for analysis in the first place (see appendix in Kaae et al. (2007). Due to limited data, potentially important attractors of tourists have been omitted, e.g. cultural facilities, expenditure on culture, 'events', and environmental quality. Some of these variables are not available at the NUTSX level, and it is necessary to satisfy with proxy variables such as wealth and population density (as included in the models). Aspects of environmental quality can probably be described based on available environmental data; however, changes over time will be more difficult to represent. The analysis of growth in tourist bed densities could be improved, and the report is reinforced in its conclusions through the inclusion of additional changes in explanatory variables over time, e.g. land use patterns and accessibility. Completion of the analysis with this type of data will be attempted in future revisions within the SENSOR project.

References

Commission of the European Communities (1998) Facts and Figures on the Europeans on Holidays 1997-1998 - Executive Summary, March 1998. A Euro barometer survey carried out for the EC DG XXIII, Enterprise policy, Distributive trades, Tourism and Co-operatives

Commission of the European Communities & Eurostat (2006a) EU integration seen through statistics, Key facts of 18 key policy areas. Office for official publications of the European Communities, Luxembourg

Commission of the European Communities & Eurostat (2006b) Panorama on tourism. Office for official publications of the European Communities, Luxembourg

Crouch GI (1995) A meta-analysis of tourism demand. Annals of Tourism Research 22: 103-118

Danmarks Turistråd (1999) Sammenfattende Screening-Analyse 1999 og hovedresultater af de enkelte Screening-Analyser 1995-1998. Danmarks Turistråd, Copenhagen

ESPON 1.2.1 (2004) Transport services and networks: territorial trends and basic supply of infrastructure for territorial cohesion. European Spatial Observatory Network, Luxembourg

ESPON 1.3.3 (2006) The role and spatial effects of cultural heritage and identity (2004-2006). European Spatial Observatory Network, Luxembourg

Eurostat (2006) Data extracted from the Eurostat datasets on Economy and finance, and Population and housing (including tourism), available online: http://epp.eurostat.ec.europa.eu

European Environment Agency (2006) Urban sprawl in Europe, The ignored challenge. EEA report no 10/2006, European Environment Agency, Copenhagen.

Graburn NHH (1983) The anthropology of tourism. Annals of Tourism Research 10: 9-33

Hu Y, Ritchie JRB (1993) Measuring destination attractiveness: a contextual approach. Journal of Travel Research 32: 25-34

Kaae BC, Nielsen TS, Hasler B, Neye S (2007 draft) Deliverable 2.2.1 Sectoral analysis of tourism. Part of EU SENSOR project 'Sustainability Impact Assessment: Tools for Environmental, Social and Economic Effects of Multifunctional Land Use in European Regions' Module 2: European land-use scenario assessment and forecasting. Draft November 2006

Klenosky DB (2002) The'pull' of tourism destination: A means-end investigation. Journal of Travel Research 40: 385-395

Lim C (1995) Review of international tourism demand models. Annals of Tourism Research 24: 835-849

Lohmann M, Kaim E (1999) Weather and holiday destination preferences, image attitude and experience. The Tourist Review 2: 54-64

Papatheodorou A (2001) Why people travel to different places. Annals of Tourism Research 28: 164-179

Pearce PL (1988) The Ulysses Factor: Evaluating Visitors in Tourist Settings. Springer, New York

Pearce PL (1991) Fundamentals in tourist motivation. In: Pearce DG and RW Sutter (eds) Tourism Research: Critiques and Challenges, pp 113-124. Routledge, London

Pike S (2002) Destination image analysis – a review of 142 papers from 1973 to 2000. Tourism Management 23: 541-549

Plog SR (1974) Why destinations rise and fall in popularity. Cornell HRA Quarterly, 14: 55-58

Seddighi HR, Theocharous AL (2002) A model of tourism destination choices: a theoretical and empirical analysis. Tourism Management 23: 475-487

UNWTO (2006) UNWTO World Tourism Barometer. vol. 4, no. 1, January 2006. http://www.world-tourism.org/facts/eng/pdf/barometer/barom0601_ex_e.pdf Access date 28.03.06

Witt SF, Witt CA (1995) Forecasting tourism demand: a review of empirical research, International Journal of Forecasting 11: 447-475.

World Tourism Organization (WTO) (1997) International Tourism: A Global Perspective. WTO, Madrid

World Tourism Organisation (WTO) (1997) Tourism 2020 vision, Volume 7 Global Forecasts and Profiles of Market Segments, Madrid

Zhang J, Jensen C (2007) Comparative Advantage, Explaining Tourism Flows. Annals of Tourism Research 34: 223-243