AT2 (Mittleres Ennstal, Austria): Measuring the influence of landscape on competitiveness of rural areas in Austria

Objective

The results of literature and data analysis illustrate that the CSA "Mittleres Ennstal", which is located in a remote rural area in Austria, falls behind other regions in Austria as regards regional competitiveness. The results of the local stakeholder workshops and expert surveys however indicate that the cultural landscape in the region is highly appreciated and in stakeholders eyes would hold great potential of generating value, e.g. for tourism and the marketing of regional products. However, the actual influence of the landscape on regional competitiveness remains unclear and is assumed to be low – at least in terms of direct "monetary" effects. Against these backgrounds, first, we aim at measuring the competitiveness of rural regions both in its economic and social sense in terms of "efficiency" on municipality level. Second, we target to assess the influence of landscape on the competeveness of a municipality.

Methodology

With Data Envelopment Analysis (DEA) we assess technical efficiency scores for municipalities by benchmarking an output-to-input ratio of each municipality against the output-to-input ratio of those municipalities with the best performance. We use population as input factor, as we assume that the 'population' of a specific community is the main 'input' for economic and social outcome. As factors of economic and social outcome, we use education level, economic performance, employment rate and population development. For interpretation of results we carry out a GIS analysis. In a second stage we conduct a multiple linear regression analysis to measure the potential influence of landscape and non-landscape related factors on the competitiveness of a municipality.

Table 1. Factors for DEA and second stage regression

Factors for DEA	**Explanation**
Population (I)*	Number of population
Education level (O) *	Highest educational attainment
Economic performance (O)*	Municipal tax (€)
Employment rate (O) *	Number of persons employed
Population development (O) *	Population Change, 2002-10
Factors for regression analysis	**Explanation**
Landscape related contextual Variables	
Openness of landscape (OL)	Proportion of non-forestry to forestry area (%)
Mountainous landscape (ML)	Altitude diff. btw. highest a. lowest agricultural field (m)
Characteristic Landscape (CL)	Landscape showing diverse and complex structure (ha)
Mountain pastures (MP)	(ha)
Non-landscape related contextual Variables	
Tourism (T)*	Overnight Stays
Location (ND)	Distance to next urban area (m)
Value of Land (VL)	Land tax (€)

*I = Input, O = Output

We apply our model in three model regions: model region 1 consists of rural municipalities concerning Statistics Austria (2014), model region 2 consists of rural and mountainous municipalities and model region 3 comprises rural, mountainous municipalities with tourism.

Results – The competitiveness of rural municipalities

Overall, our DEA results show that the efficiency scores range between 0.7 to 1.0, indicating a generally high efficiency level. The GIS-analysis shows that the most competitive rural municipalities with high efficiency scores turn out to be located either in close proximity to cities (e.g. around Vienna, Graz, Linz or Innsbruck) or along major infra-structural routes, such as the important west-east connection between Salzburg and Vienna, or along the northwest – south connection throughout the Alps. In contrast, the municipalities with the lowest efficiencies are located in very remote areas, such as the high Alps. The model also depicts single municipalities within very remote areas, which show exceptional high efficiencies. These outstanding municipalities surrounded by low efficient, remote municipalities represent touristic strongholds, such as e.g. “Sölden”, “Lech” or “Untertauern”, characterised by high-level skiing tourism.

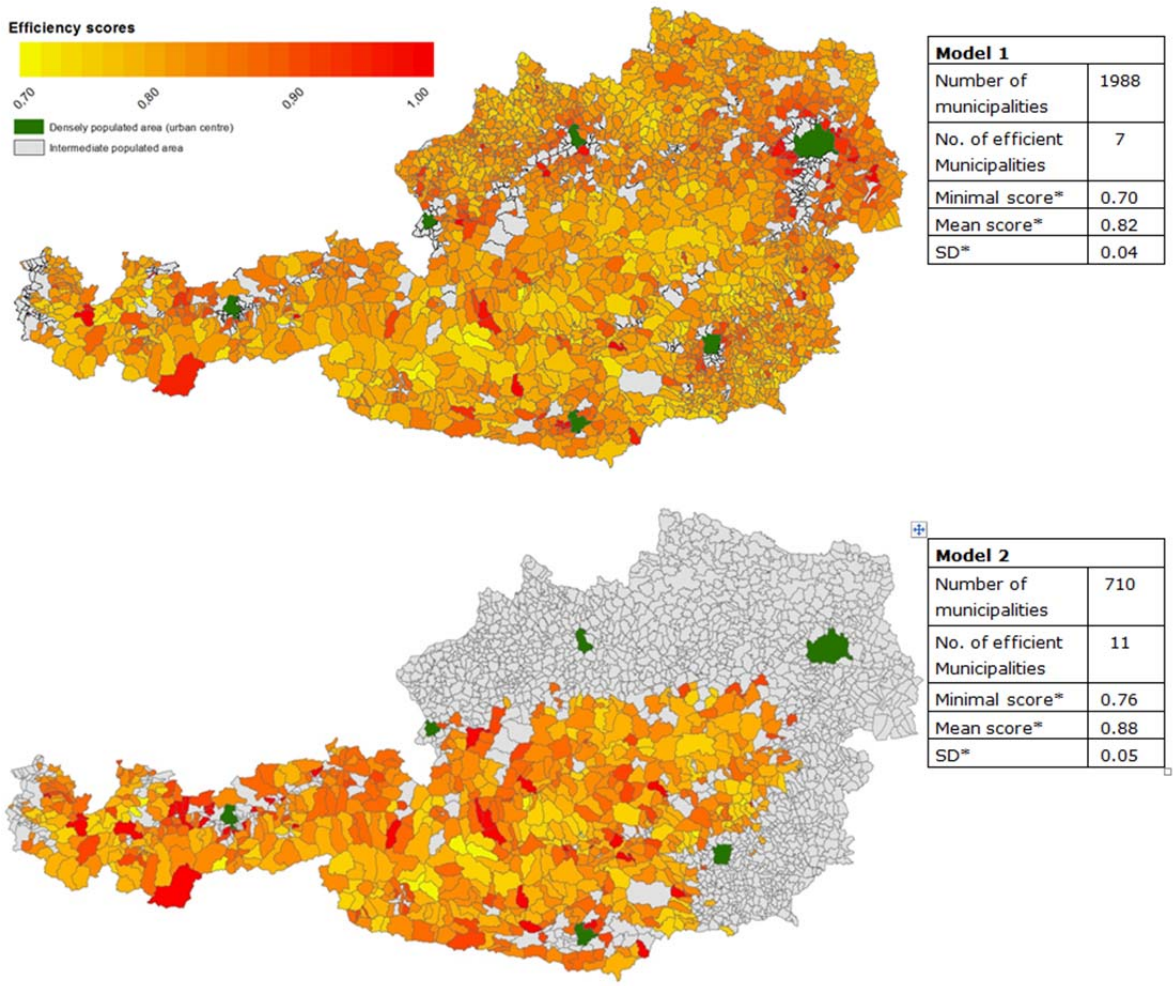

Figure 1: Spatial distribution of efficiency scores; example model region 1 & 2.

Results – Which landscape and non-landscape related factors can potentially affect rural economies and societies (regional competitiveness)

From the results of the regression analysis it becomes rather clear, that first and foremost the "non-landscape" factors, namely "closeness to semi-urban and urban regions" and "tourism" show significant influence on the efficiency of rural regions – whereas it has to be noted that the overall correlations are low. However, the most decisive "non-landscape" related factor turns out to be the closeness to semi-urban and urban regions.

Table 2. Results second stage, OLS regression.

	Model 1	**Model 2**	**Model 3**
R^2	0.1898	0.0981	0.1592
Adj. R^2	0.1878	0.0905	0.1513
p-value	<2e-16	1.076e-13	6.371e-08
(log) Tourism	0.0015***	0.0025***	0.0094***
(log) Distance next urban area	-0.0215***	-0.0131***	-0.0121***
(log) Openness of landscape	0.0083**	-0.0133.	-0.0211**
(log) Mountainous landscape	-0.0098***	-0.0159***	-0.0168***
(log) Characteristic landscape	0.0002	-0.0003	-0.0009
(log) Mountain pastures	-	0.0021	-0.0006

significance levels: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

As regards "landscape" related factors our results reveal that their influence on regional competitiveness is far lower and less significant than the influence of non-landscape related factors. The influence of the landscape factor "openness of landscape" varies throughout our three model regions as regards algebraic sign. While in Model region 1 the influence of openness of landscape is positive, in the "mountainous" model regions 2 and 3, the influence is negative. This result is not surprising, as model 1 includes areas high percentages of productive, flat and open landscapes with good agricultural pre-conditions, where also for historical reasons most Austrian cities and infrastructural strongly developed regions are located. In contrast, in the mountainous regions the percentage of "useable" open land is significantly lower: open land in mountainous regions to a high share consists of bare rocks, areas with sparse vegetation, glaciers of agricultural area of bad quality and managed with low intensity.

Another result of our analysis to be discussed is the influence of the factors "characteristic landscape" and "mountain pastures", which both considers very specific landscape elements within the Austrian mountainous landscape and, consequently, match very clearly the aesthetic and intrinsic value of landscapes. Our results reveal that such factors have no significant influence on competitiveness – if any non-significant correlation can be detected, the influence appears to be rather negative. Especially when referring to our up-stream research, this result is sobering enough, as exactly such factors, being crucial for the "beauty" of alpine rural landscapes and the related cultural services provided in a landscape, are to a high degree appreciated and valued by the local society while up to now this valorisation is obviously not reflected in terms of competitiveness.

Basically, our analysis shows that the more "mountainous" a municipality is located, the less efficient it is. It is to note that the correlation describing this impact is low, however it is significant. In general, the factor "mountainous landscape" can be taken as a structural parameter, as the more a region is

located in the mountains, the more remote it is as regards access to infrastructure, education and labour markets.

Lesson learned & Policy Recommendations

When looking at our DEA results, we observe that they are consistent to a high degree. This becomes clear particularly when putting the results into a spatial context, as municipalities near big cities show higher efficiency scores. The consistency of the DEA results is also confirmed by our case study municipalities: Here, it becomes obvious, that those two municipalities located in the main valley show a higher efficiency than the ones located in the more remote side valleys. The highest efficiencies we detect for the main-valley municipality Stainach. Referring to our up-stream qualitative research results, this is not surprising. In Stainach, the urban centre is located and a major local food industry company is offering broad employment possibilities. Also as regards agriculture, in the main valley production conditions are significantly better than in the side valleys, where agricultural production is shaped by low-intensive grassland use. The least efficient municipality within our case study area is "Oppenberg". Also this result is confirming our expectations: Oppenberg is the highest located of the 4 surveyed municipalities and characterized only by agricultural activities. At the moment the municipality is faced with severe migration. The low technical efficiency of this municipality is therefore clearly reliable.

Another demonstration that our model is reliable is given by the correlation between the DEA efficiencies and the value of land. This correlation is rather convincing, since the value of land (representing on the one hand the quality of agricultural area and on the other hand the real-estate and building values) to a high extent mirrors the competitiveness of a region.

As regards landscape related factors our results reveal that their influence on regional competitiveness is far lower than the influence of non-landscape related factors. Also it becomes obvious that factors representing very typical elements for Austrian mountainous landscape and, consequently, match very clearly the aesthetic and intrinsic value of landscapes have no significant influence on the competitiveness of a municipality.

Basically, the selection of input and output factors in our study followed two main criteria, namely 'relevance' and 'data-availability'. At this point it has to be noted, that first we tried to establish an ideal model of measuring competitiveness, considering social and economic factors orientated at existing indices for measuring regional competitiveness. However, it became obvious, that the main problem for using this "ideal" model was data availability. So, for example, data on average income per head or household, regional GDPs or data on the characteristics or even number of companies is not available on LAU2 level. An "ideal" DEA model of measuring regional competitiveness would also consider the approach of dynamic benchmarking, to analyse the performance of the municipalities over a period of time. Again, only few periodically recorded data is available on municipal level so also this idea had to be discarded due to data-shortages. Consequently, it is clear that the input and output-factors finally considered in our model, and also the static approach, are most likely not the be-all and end-all of measuring competitiveness on municipal level; in contrast, our model is rather strongly driven by "data-availability".

Reference

A.Reindl, L. Schaller, M. Kapfer and J. Kantelhardt (2014). Measuring the influence of landscape on competitiveness of rural areas in Austria. *Proceedings of 24th Annual Conference of the Austrian Society of Agricultural Economic (ÖGA)*. September 25-26, 2014. Vienna, Austria.

Responsible partner/person

Andreas Reindl, Lena Schaller, Martin Kapfer, Jochen Kantelhardt
University of Natural Resources and Life Sciences, Vienna (BOKU)
Institute of Agricultural and Forestry Economics
Feistmantelstr. 4, 1070 Vienna, Austria