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QUANTITATIVE ANALYSIS OF MARGINALIZATION INDICATORS – EXAMPLE OF THE PELJEŠAC PENINSULA, CROATIA

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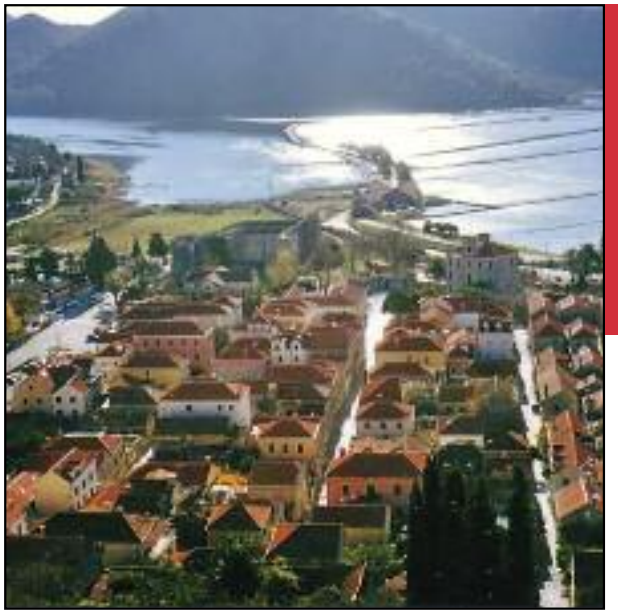

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Town of Ston and Salt pans in the background.

Quantitative analysis of marginalization indicators – example of the Pelješac peninsula, Croatia

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ABSTRACT: Besides marginalization on the international, national and regional levels, it is possible to speak about marginalization on the local level. It is especially important since its consequences and various aspects are felt in everyday life. This paper presents the results of quantitative analysis of the process of marginalization on the local level on the example of the peninsula of Pelješac in Croatian Littoral. The main aim of the research is to contribute to propose a quantitative approach in the research of marginalization. The authors have defined four indicators which form the basis of the GIS analysis: demographic, socio-economic, educational and an indicator of physical marginalization. In order to see relationship between the indicators, the peninsula has been divided into zones which differ according to the marginalization process. Such differences are expressed quantitatively in form of an index of marginalization.

KEY WORDS: geography, marginalization, Pelješac, Croatia, indicators, GIS

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1 Introduction

The issues of marginality and marginalization first appeared in scientific research in the first half of the 20th century (Park 1928; Stonequist 1937). Geographers did not significantly get involved in investigating the issue until the end of the century (De Koninck 1980; Vant 1986). Marginality and marginalization are closely related to economic development of regions. This is why the majority of geographical studies are primarily focused on economic marginality, observed from temporal and spatial points of view. More recently, other dimensions of marginalization, such as social, cultural, political and environmental, have been analyzed by geographers (Jussila, Leimgruber and Majoral 1998; Jussila, Majoral and Cullen 2002; Jussila, Majoral and Delgado Cravidão 2001). The processes of globalization and deregulation at the turn of the century have increased the rift between prosperous »central« regions and less prosperous »peripheral« regions. Although marginality is not the result of globalization and deregulation, it has been significantly reinforced by these two processes. Usually, the terms *peripherality* and *marginality* are considered synonyms. However, a geographical understanding of these two notions makes a clear distinction between them since marginality is a broader term which does not exist only in a spatial (geographical) context (Cullen and Pretes 2000; Leimgruber 2004).

The peninsula of Pelješac, in the southern Croatian region of Dalmatia, represents a typical peripheral area. It measures 348 km^2 and has 7789 inhabitants. The population is concentrated in 40 settlements, of which only Orebić can be considered urban. The peninsula is thinly populated (the average population density is 23.7 inhabitants per square kilometer) and it has no significantly developed economic activities except tourism and Mediterranean agriculture (Glamuzina 2009, 148).

The main purpose of the research is the quantitative and spatial analysis of the process of geographic marginalization.

1.1 Survey of previous research

In recent years marginalization has been thoroughly presented in geographical research (Déry, Leimgruber and Zsilincsar 2012; Leimgruber 2004). Part of the credit belongs to the International Geography Union (IGU) Commission on »Globalization, marginalization and regional and local response», which has popularized such research (Jones, Leimgruber and Nel 2007; Leimgruber 2010; Leimgruber, Majoral and Lee 2003; Majoral, Jussilaand Delgado Cravidão 2000; Valença, Nel and Leimgruber 2008).

Effects of marginalization in peripheral areas during the contemporary process of globalization have recently been studied in small towns in New Zealand. When the national government focuses on international macroeconomics and on larger population hubs inside the country, the only response is in local initiatives and entrepreneurship. The development problems were studied in Canada (Nel and Stevenson 2009; Conradson and Pawson 2009; Huskey and Morehouse 1992) where agrarian abandonment as a widespread problem of marginalized regions is an easily recognizable landscape feature (Sancho-Reinoso 2011).

Marginalization can be measured by qualitative or quantitative analyses. Qualitative analysis has been widely applied since such an approach emphasizes the individuality and specificity of a research area. Quantitative analysis reliy on statistical data and are still debatable (Déry, Leimgruber and Zsilincsar 2012).

This research starts from the need of operationalizing the theoretical approaches concerning spatial problems on a local level and translating them to implementable models. In general, aggregate spatial data are characterized by two spatial effects: dependence and heterogeneity which require development of specific methodological approaches. Since such issues are overlooked by traditional econometrics they are covered by a special field of spatial econometrics (Anselin 1988). The introduction of geographic information system in data analysis has created a need for new techniques which focus on spatial aspects of statistic data. In this sense, local indicators of spatial association, such as Moran's I, have been applied (Anselin 1995) and compared with other methodological approaches (Getis and Ord 1992). The relevance of the application of the same method, often called the Moran Coefficient (MC) in geographic research, just in other research which deals with spatial analysis, has been confirmed and even recommended (Griffith 2009). At the same time, spatial autocorrelation is becoming more widely used in economic geography (Getis 2010; Haining 2004, 89). Therefore, improvement of analytical techniques is necessary for better understanding of spatial processes. On the other hand, the application of GIS to spatial analysis is well documented in the scientific research (Worboys and Duckham 2004).

2 Methodology

The methodological approach of this research is based on an analysis of the official data published by the Croatian Statistical Bureau. Some data (distance to roads, the relation between air and surface distance, travelling time between a settlement and a regional centre) were derived from a digital elevation model and by the Via Michelin and Routes websites (Internet 1). The digital elevation model 25 × 25 m was made by vectorization of contour lines from topographic maps at a scale of 1 : 25,000. 16 relevant statistical data were grouped into four indicators. The analysis of the problem (Figure 1) starts with defining the major socio-geographic processes and issues in the marginalized area: long-term population loss, low population density, population ageing, emigration, underdeveloped labour contingent, stagnant economic structure (with high proportion of the agricultural population), significant geographic distance from the principal regional urban centres and poor educational population structure (low share of educated population, especially university-educated).

For the purpose of systematic analysis 16 relevant statistical data have been classified into four indicators:

- demographic,
- socio-economic,
- educational and
- physical marginalization indicator.

The demographic indicator (DI) contains four statistical data: number of inhabitants, population density, index of ageing and percentage of the young population age group (up to 18 years).

The socio-economic indicator (SEI) consists of: labour contingent, percentage of agricultural population, absent population (local residents which temporarily live outside of the their settlements) and transport cost to the regional centres.

The physical marginalization indicator (PMI) comprises of: elevation, distance to the principal regional centre, relation between air and surface distances, and travelling time between a settlement and the regional centre.

The educational indicator (EI) includes: illiteracy rate, percentage of the population which is highly educated, share of the population with the lowest level of education (with only an elementary school degree or without it) and percentage of the population currently enrolled in higher education.

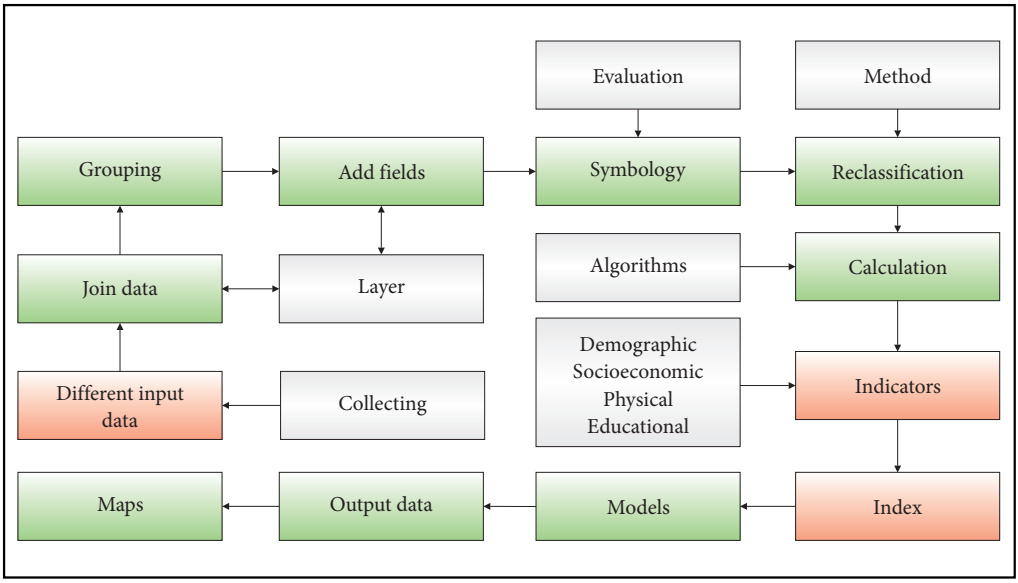

Figure 1: Scheme of the analysis of geographic marginalization applied in the paper.

For each of the 16 statistical data the range of values has been defined and analyzed. Applying the Jenks' optimization method which identifies natural breaks in the data set (Jenks 1967) the values have been grouped in five classes. Each class was given a prudential value from 1 (insufficient) to 5 (excellent).

Since the principal goal of this research is to contribute to methodology the authors have devised four models for calculating the index.

- In the first model all four indicators have been given equal importance: $M_I = (0.25 \times PMI) + (0.25 \times EI) + (0.25 \times DI) + (0.25 \times SEI)$.
- The second model emphasizes the importance of the indicator of physical marginalization (PMI) and the demographic indicator (DI): $M_I = (0.40 \times PMI) + (0.15 \times EI) + (0.30 \times DI) + (0.15 \times SEI)$.
- In the third model the PMI and the DI have switched places with the other two indicators: $M_I = (0.30 \times PMI) + (0.15 \times EI) + (0.40 \times DI) + (0.15 \times SEI)$.
- In the fourth model the PMI and the DI have been given larger but still equal importance: $M_I = (0.40 \times PMI) + (0.10 \times EI) + (0.40 \times DI) + (0.10 \times SEI)$.

The further procedure can be explained by the example of calculating the demographic indicator (DI). It comprises four statistic data: population number (P_n), population density (P_d), index of population ageing (I_{pa}) and share of the young (0–19 year olds) population (P_{0-19}). The demographic indicator was calculated using the following formula:

$$DI = \left[\frac{(P_n \times 0.25) + (P_d \times 0.25) + (I_{pa} \times 0.25) + (P_{0-19} \times 0.25)}{4} \right] - 0.25)$$

In the worst case model the prudential value for a certain settlement is 1 and in the best case model 5. The range is 0.25 to 1.25. For the purposes of easier manipulation, but also to enable an easier and clearer understanding of the output data, the sum was subtracted by 0.25, correcting the range of values from 0 (instead of 0.25) to 1 (instead of 1.25). Therefore, the value of 0 means total marginalization while 1 indicates that there is no marginalization at all. These values have been furthermore analyzed by applying Moran's I – a measure of spatial autocorrelation for examining the correlation among nearby locations or geographic units in space (Barković 2009). Negative values show no spatial autocorrelation, a zero value shows a random spatial pattern, while positive values confirm spatial autocorrelation. The values range from –1 (no spatial correlation or perfect dispersion) to + 1 (complete or perfect correlation).

3 Results

Applying the described methodology the values for all the 40 settlements of the peninsula were calculated just as the index of marginalization (Table 1).

In the case of demographic indicator there are no clear differences regarding the areas of the peninsula (Figure 2). The settlements with the highest values are isolated from each other and the distances between them are pronounced. The settlements with the highest values are mutually divided by extended areas with

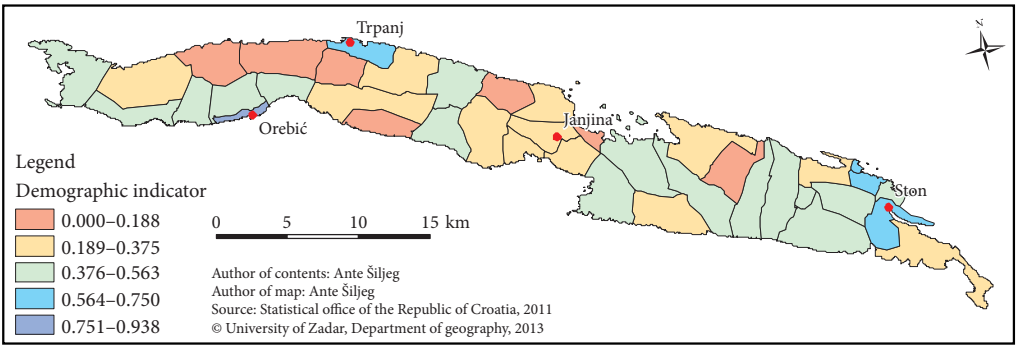

Figure 2: Demographic indicator on Pelješac.

Table 1: Values of the four indicators and the index of marginalization for each of the 40 settlements on Pelješac in 2001.

SETTLEMENT	Indicators				Index of marginalization			
	Demo-graphic	Socio-economic	Physical margin-alization	Educational	Model 1	Model 2	Model 3	Model 4
Boljenovići	0.500	0.438	0.375	0.438	0.438	0.431	0.444	0.438
Brijesta	0.313	0.500	0.563	0.563	0.484	0.478	0.453	0.456
Broce	0.313	0.250	0.438	0.313	0.328	0.353	0.341	0.356
Česvinica	0.500	0.250	0.250	0.375	0.344	0.344	0.369	0.363
Dančanje	0.063	0.563	0.313	0.500	0.359	0.303	0.278	0.256
Donja Banda	0.375	0.563	0.563	0.438	0.484	0.488	0.469	0.475
Donja Vrućica	0.000	0.500	0.438	0.375	0.328	0.306	0.263	0.263
Drače	0.188	0.500	0.688	0.688	0.516	0.509	0.459	0.469
Duba Pelješka	0.000	0.375	0.438	0.750	0.391	0.344	0.300	0.288
Duba Stonska	0.250	0.250	0.375	0.375	0.313	0.319	0.306	0.313
Dubrava	0.563	0.563	0.438	0.625	0.547	0.522	0.534	0.519
Gornja Vrućica	0.188	0.438	0.563	0.250	0.359	0.384	0.347	0.369
Hodilje	0.625	0.313	0.375	0.500	0.453	0.459	0.484	0.481
Janjina	0.375	0.625	0.563	0.563	0.531	0.516	0.497	0.494
Kučište	0.500	0.563	0.813	0.625	0.625	0.653	0.622	0.644
Kuna Pelješka	0.563	0.500	0.563	0.625	0.563	0.563	0.563	0.563
Lovište	0.563	0.563	0.750	0.500	0.594	0.628	0.609	0.631
Luka	0.625	0.438	0.375	0.313	0.438	0.450	0.475	0.475
Mali Ston	0.563	0.313	0.438	0.563	0.469	0.475	0.488	0.488
Metohija	0.563	0.500	0.375	0.500	0.484	0.469	0.488	0.475
Nakovanj	0.250	0.563	0.438	0.750	0.500	0.447	0.428	0.406
Orebić	0.938	0.500	1.000	0.500	0.734	0.831	0.825	0.875
Oskorušno	0.375	0.625	0.563	0.500	0.516	0.506	0.488	0.488
Osobjava	0.125	0.500	0.438	0.250	0.328	0.325	0.294	0.300
Pijavičino	0.313	0.500	0.563	0.500	0.469	0.469	0.444	0.450
Podgorje	0.438	0.500	0.625	0.438	0.500	0.522	0.503	0.519
Podobuče	0.188	0.563	0.813	0.563	0.531	0.550	0.488	0.513
Popova Luka	0.250	0.500	0.563	0.438	0.438	0.441	0.409	0.419
Potomje	0.563	0.625	0.563	0.625	0.594	0.581	0.581	0.575
Putniković	0.438	0.438	0.375	0.625	0.469	0.441	0.447	0.431
Sparagovići	0.438	0.500	0.375	0.313	0.406	0.403	0.409	0.406
Sreser	0.313	0.375	0.625	0.500	0.453	0.475	0.444	0.463
Stanković	0.563	0.563	0.875	0.500	0.625	0.678	0.647	0.681
Ston	0.750	0.313	0.438	0.500	0.500	0.522	0.553	0.556
Tomislavovac	0.313	0.438	0.375	0.500	0.406	0.384	0.378	0.369
Trpanj	0.625	0.438	0.688	0.500	0.563	0.603	0.597	0.619
Trstenik	0.250	0.500	0.625	0.438	0.453	0.466	0.428	0.444
Viganj	0.500	0.500	0.938	0.438	0.594	0.666	0.622	0.669
Zabrđe	0.500	0.500	0.375	0.500	0.469	0.450	0.463	0.450
Žuljana	0.500	0.438	0.688	0.500	0.531	0.566	0.547	0.569

Source: Statistical Office of the Republic of Croatia, 2001a; 2001b; 2001c; 2001d; 2001e; Internet 1

moderate and low values. Such distribution suggests population concentration in Orebić. In the northwestern part of the peninsula the settlement of Trpanj, a traffic junction (a ferry port connecting to the mainland), may be singled out. In the eastern part of the peninsula three settlements stand out.

Regarding the socio-economic indicator Pelješac shows more regular geographic distribution (Figure 3). An almost completely continuous zone of settlements with the highest and high values of the indicator stretches from the northwestern to the southeastern part. However, the southeastern part still differs significantly since it comprises of two zones with lower values especially in the area of Ston.

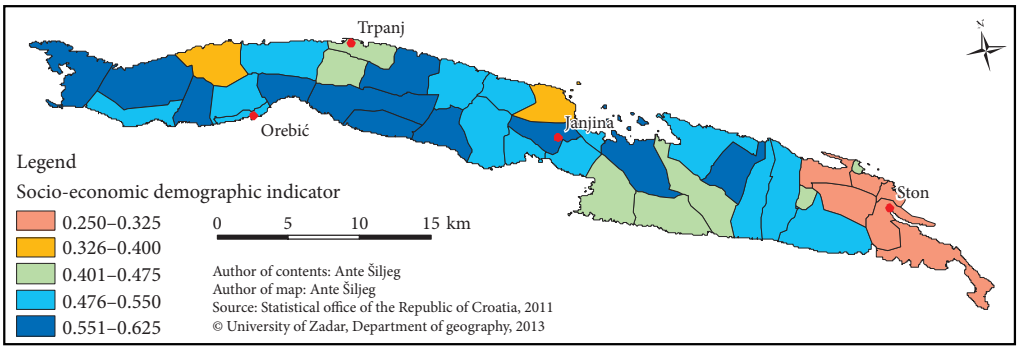

Figure 3: Socio-economic demographic indicator on Pelješac.

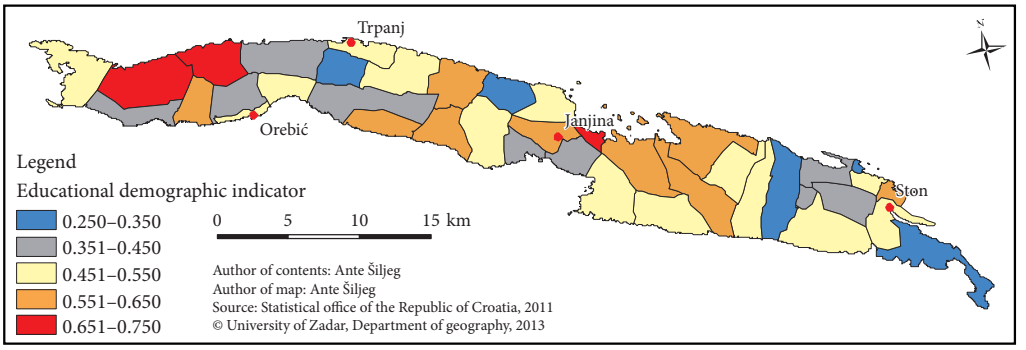

Figure 4: Educational demographic indicator on Pelješac.

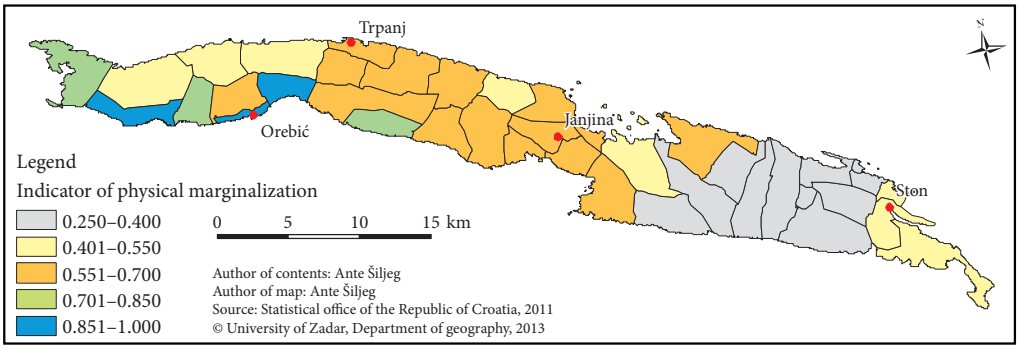

Figure 5: Physical marginalization indicator on Pelješac.

The educational indicator shows random geographic distribution (Figure 4) and does not provide information for drawing any conclusions regarding its spatial characteristics.

Although it seemed that in the case of the indicator of physical marginalization the distribution of values should be geographically equal while moving away from the northwestern part of the peninsula, where the principal settlement of Orebić is situated, this is only partly true (Figure 5). The reason for such situation is distance that influence the cost of daily commuting. Furthermore, reducing of jobs in Dubrovnik and Ploče during the last 25 years and developement of Orebić have also contributed to such a process. The spatial distribution of the indicator is not even due to steep mountainous terrain.

The values of the Moran coefficient range from 0.0711 (Model 3) to 0.1777 (Model 2). All four values (0.1106 Model 4; 0.1677 Model 1) are positive and are slightly beyond zero (Figure 6). The very fact that the four values are not grouped or dispersed shows that the chosen four indicators (demographic, socio-economic, educational and the indicator of physical marginalization) are relevant just as are the statistical data from which they were calculated. On the other hand, the same values show that there is no spatial autocorrelation among the 40 settlements of the peninsula.

4 Discussion

Marginalization is related to peripherality on national or international levels. Peripheral areas (just as the core areas) are not homogeneous. Although the sense of marginalization can be very subjective certain processes can be measured using statistical data.

The indicator of physical marginalization is important since physical limitations in everyday life are strongly felt by the local population (Glamuzina 2009). Therefore, various physical obstacles and mere geographic distances represent an issue in daily human interactions. Due to dispersed population of the Pelješac peninsula and rudimentary developed traffic system the sense of marginality in some settlements

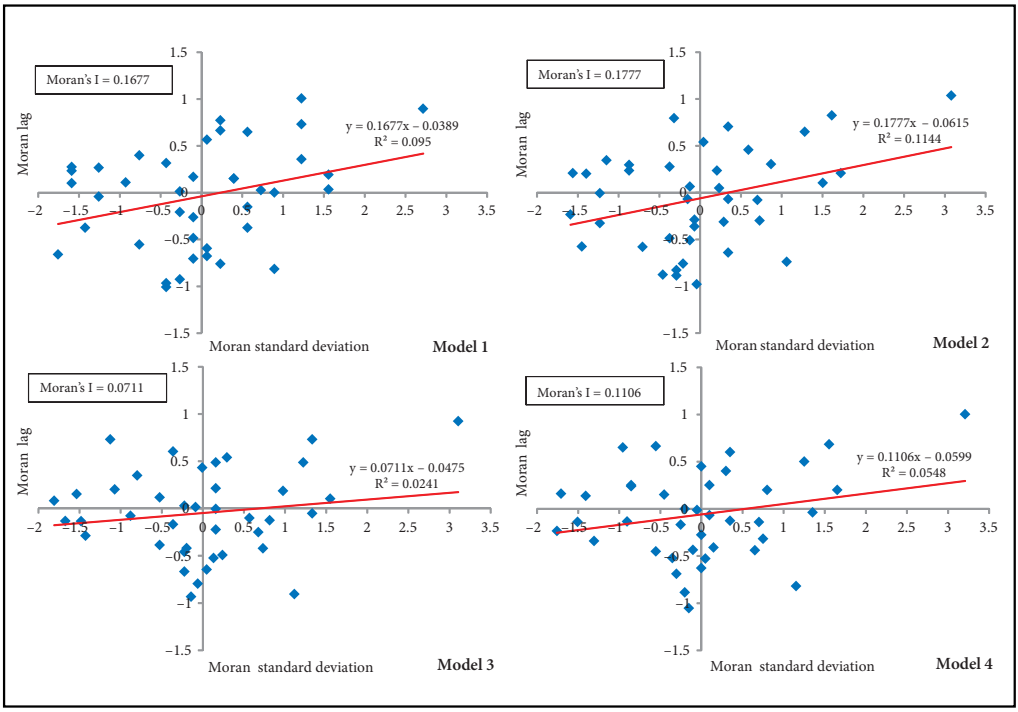

Figure 6: The Moran Coefficient in four scenarios on Pelješac.

is very present. Local population often highlights the problem of their physical limitations in everyday life (Glamuzina 2009).

Education and schooling are often referred as prerequisites for economic, social and overall development. But the role of education is different in the peripheral and underdeveloped areas with impoverished job opportunities. With only 7789 inhabitants dispersed throughout 40 settlements over a relatively small area, the peninsula itself represents a tiny segmented market. Such a situation does not stimulate further development. Pelješac depends on traditional Mediterranean agriculture, primarily the cultivation of grapes and olives. Littoral settlements have developed tourism which is of a seasonal character. Because of this the opportunity for jobs for a highly educated population is small and employment opportunities are much better in urban areas outside of the peninsula. However, a considerable distance from large urban centres of regional or subregional hubs disables daily migrations. That is why the share of highly educated population is very low in the majority of local settlements. The share of the population of the peninsula which is currently enrolled in higher education (22.65%) is twice that of the share of the highly educated population (11.48%). These data cast a light on the problem of the emigration of the highly educated population. In addition, 24 settlements have one-half or more inhabitants with or without an elementary education. Because of this a higher share of educated population does not represent an advantage for any settlement because highly educated population must fit into the existing socio-economic structure. Therefore, socio-economic indicator has been given the same (low) significance as the educational indicator. The pronounced population ageing of some settlements, together with the low proportion of young population, are signs of the process of gentrification. It puts certain settlements in an even more marginal position in comparison with others (Figure 7).

The index of marginalization shows the more subtle differences among the peninsula's settlements. The very range of values – from 0.263 (minimal) to 0.875 (maximal) – shows pronounced differences among the settlements confirming marginalization. Certain settlements constantly show low index values (meaning the extreme marginalization). Such settlements are much easier to find in the central and southeastern areas of Pelješac far from Orebić.

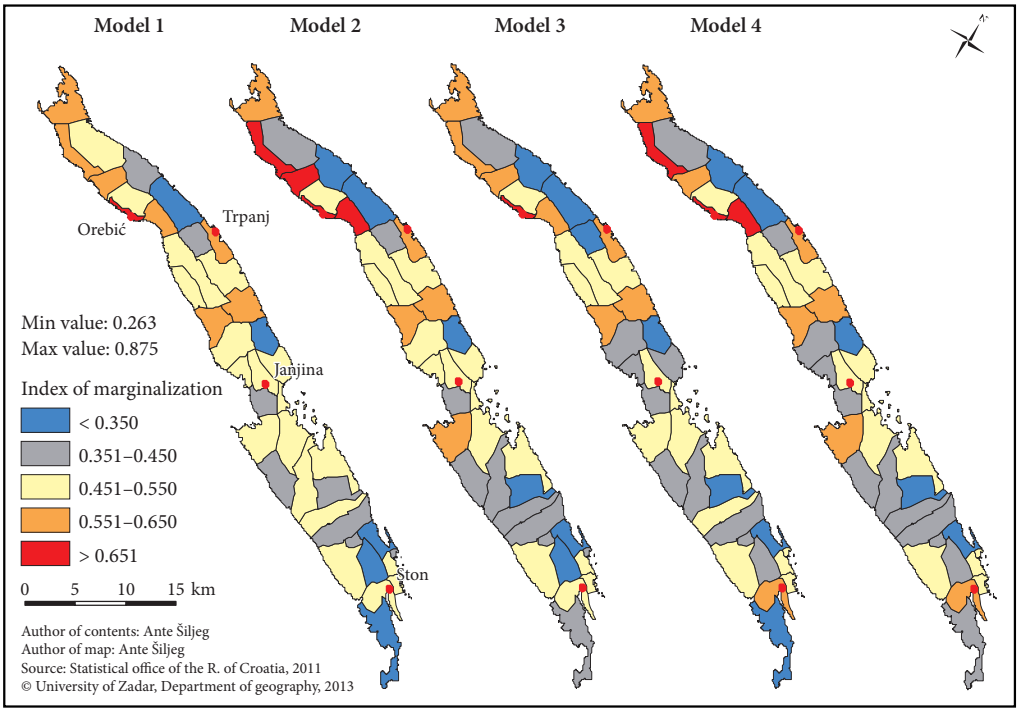

Figure 7: Index of marginalization in the four scenarios on Pelješac.

How to diminish marginalization in case of Pelješac? Can local initiative and entrepreneurship be the solution or a part of the solution? Is economic development the answer to the issues which burden the peninsula? Although the present economic base of Pelješac is narrow (vineyards, olives, tourism, catering, mariculture, a wind farm, a few small construction companies and one salt works) there are possibilities for their expansion. The development of new activities is possible in the case of cattle breeding, beekeeping and mining (construction stone) and investments in certain small industrial enterprises. However, there is a question of positive effects in sense of diminishing or even a reversal of problems of marginalization and peripherality. Distance from the population and economic core of Croatia, situated in the Zagreb region, at the same time represents a distance from the majority of the national market puts Pelješac in an unfavourable position regarding the placement of local products. Tourism can only be a partial solution since it exists during the summer. Therefore, the expansion of the local (and regional) market is temporary with very limited positive effects.

5 Conclusion

A quantitative approach was applied to analyze marginalization and geographic peripherality. This research shows the possibility to obtain relevant conclusions concerning marginalization using relevant statistic data and indicators of the quantitative approach. Quantification of the process of marginalization helps in the comparison of the processes and it offers more objective analysis.

The index of marginalization method as applied in this research shows a high degree of relevancy. Quantitative analysis offers geographers wide possibilities for spatial analysis, especially combined with qualitative approach.

Marginalization is primarily influenced by the position of the settlements in relation to the regional centre, while the position of settlements in relation to the coast is of secondary importance. That is why the models which emphasize the importance of the indicator of physical marginalization may be considered the most relevant for the purpose of this research.

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