FUNCTIONAL REGIONS OF THE CZECH REPUBLIC: COMPARISON OF SIMPLER AND MORE ADVANCED METHODS OF REGIONAL TAXONOMY

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Abstract

The article compares the results of three simpler methods of functional regional taxonomy to the results of the more advanced methods. All methods use daily travel-to-work flows provided by the 2001 census as a regionalisation criterion. Simpler methods rest in the application of primary-flow linkage in order to assign a basic spatial zone to a potential regional core, while more advanced method applies a relativised linkage measure that also takes into account a reverse flow between a pair of basic spatial zones. For comparisons the more advanced method approximates the size parameter used in simpler methods, which is however put into relation to a self-containment of a regional class. The article provides three comparisons of results and identifies main advantages and disadvantages of the two methodological approaches, concluding that the more advanced method provides geographically more relevant results.

Key words: regional taxonomy, regionalization algorithm, functional regions, travel-to-work flows, Czech Republic.

INTRODUCTION

Functional regional taxonomy attempts to delineate functional regions in a defined area. A functional region is usually understood as a region organised by functional relations, i.e. horizontal spatial flows or interactions. The chief objective of the article is to compare the results of three existing simpler methods of delineation of functional regions to the results of a more advanced method newly applied on the territory of the Czech Republic. As such the article provides three different comparisons of spatial patterns of functional regions of different types and documents the advantages and disadvantages of all four methods applied, particularly between simpler and more advanced procedures. The article also introduces to the Czech geographical research a new approach to delineation of functional regions (it has to be noted, however, that in the world the approach has been used since the beginning of the 1980s and that it is not quite new in general). All methods are based on the same spatial interaction used for the delineation of the regions, daily travel-to-work flows (though in some cases it is not explicitly stated) generally regarded as the most effective basis for the delineation of the functional regions (e.g. Ball 1980), the source of the data being the 2001 census of population.

The article discusses some definitions of functional regions, their particular types that are used for the comparisons and differences between them at first, then it proceeds with a discussion of simpler and particularly more advanced methods of the functional regions delineation, with a description and setting of the parameters of all four methodological procedures compared in the article, and finally the article comments on the findings of the comparisons. In order to achieve the objectives of the article the functional regions defined by Czech Statistical Office (ČSÚ 2004), Hampl (2005), and Sýkora and Mulíček (2009) have been included into the analyses (the fourth processed regional taxonomy based on the 2001 census data – Halás et al. 2010 – cannot be included since its methodological procedure completely lacks a basis for comparison).

THEORETICAL AND METHODOLOGICAL FOUNDATIONS

The term functional region has a general character and its meaning can easily be misconstrued or misinterpreted (Klapka et al. 2013). The functional region is based on the spatial flows or interactions that are maximised within the region and minimised across its borders so that the principles of internal cohesiveness and external separation regarding the spatial interactions are met. Generally, any kind of spatial flow or interaction can organise the functional region and its inner structure can be rather random and varied.

The term nodal region, introduced to geography by Nystuen and Dacey (1961), Haggett (1965) or Brown and Holmes (1971), is a special instance of the functional region. It features the orientation of spatial flows or interactions that are centred to or radiate from the so called node (i.e. focus, centre or core). As such the nodal region is organised around its core and its inner structure is developed better than in the case of the functional region (Klapka et al. 2013).

The term local labour market area (LLMA) or travel-to-work area (TTWA) is discussed for instance by Smart (1974), Coombes et al. (1979), Ball (1980) or Coombes and Openshaw (1982). Again LLMAs are special instances of function regions based on labour commuting, i.e. mostly on daily travel-to-work flows. In this case the interactions organising region are restricted to a daily cycle and need not necessarily be oriented at any core, though in practice they mostly are (Klapka et al. 2013).

Simpler methods of regional taxonomy

Simpler methods of delineation of functional regions, in this case we should rather speak of nodal regions, are inspired by the graph theory and they analyse the structure of oriented graph (Nystuen nd Dacey 1961; Slater 1976; Holmes and Haggett 1977). These methods are in the Czech human geographical research used from the beginning of attempts to delineate nodal regions (e.g. Macka 1967; Maryáš and Řehák 1987a, b; Baštová et al. 2005; Halás et al. 2010; Kraft and Vančura 2010) and they are somewhat unluckily referred to as a "first flow" method (cf. for instance Holmes and Haggett 1977 for more correct terminology and who also put forth some disadvantages of the primary-flow linkage method and propose more advantageous methods based on the graph theory).

Simpler methods of regional taxonomy based on the primary flow usually rest in two steps (see e.g. methods used for comparison in this article – ČSÚ 2004, Hampl 2005, Sýkora and Mulíček 2009). Firstly the potential cores of regions are identified, then remaining basic spatial zones are assigned to these cores according to the primary flow, i.e. in case of daily travel-to-work flows according to the highest number of out-commuters from each basic spatial zone. Other flows are usually disregarded. Of course, resulting regions have a strongly nodal character.

More advanced method of regional taxonomy

More advanced methods attempt to aggregate basic spatial zones into regional classes using more complex linkage measures (Smart 1974; Masser and Scheurwater 1978; Coombes et al. 1982). The article applies the maximisation of the measure proposed by Smart (1974) as a linkage criterion:

$$\left[\frac{T_{ij}^2}{\sum_k T_{ik} \cdot \sum_k T_{kj}} + \frac{T_{ji}^2}{\sum_k T_{jk} \cdot \sum_k T_{ki}} \right] \qquad [1]$$

where T_{ij} denotes a daily travel-to-work flow from i to j and i is a subset of j and j is a subset of k. This measure has two substantial advantages in comparison to primary flow: it takes into account reverse flows between basic spatial zones (or between a basic spatial zone and regional class), and it relativizes flows between a pair of basic spatial zones by the total inflow and outflow for a basic spatial unit eliminating thus the influence of different size of the zones.

The regional taxonomical procedure has to meet predefined criteria concerning the identification of regional cores and minimum size and self-containment of resulting regional classes. Thence these methods are referred to as rule-based methods of functional regional taxonomy (e.g. Coombes et al. 1982, Casado-Díaz 2000, or Casado-Díaz and Coombes 2011) and, when based on daily travel-to-work flows, they can be used to delineate local labour market areas.

The first effort to do so has been made by Smart (1974), however, his proposal was criticised by Ball (1980) and Coombes and Openshaw (1982) as purely heuristic. Another rule-based method has been developed at the Centre for Urban and Regional Development Studies (CURDS) in Newcastle (Coombes et al. 1979). In this article we apply the second variant of the CURDS algorithm, designed for delineation of LLMAs (Coombes et al. 1986). The algorithm is divided into several steps, each comprising a number of steps and rules (see more in Coombes et al. 1986 for more detail): identification of regional cores, creation of multiple cores, creation of proto-regions, creation of final regional classes (i.e. LLMAs) that satisfy the objective function controlling the minimal size and self-containment of regional classes and the trade-off between the two indicators.

METHODS AND PARAMETERS: LOOKING FOR COMPARABILITY

In order to compare the results of each simpler method of the delineation of functional regions to the results of the more advanced method some common denominator has to be found in the parameters of all the methods discussed. It is only logical that the parameters of the algorithm of the latter method should be adjusted to some of the parameters of the former group of methods. It is not easy since the three simpler methods do not take into account the basic and for the delineation of the regional classes crucial characteristic of functional regions of any type, that is the self-containment of the region (regional class).

Let us shortly remind quantitative characteristics and demands of the three simpler methods of regional taxonomy and look for possible common denominators. ČSÚ (2004) uses total travel-to-work flows as a region-organising spatial interaction. Daily travel-to-work flows are used as a secondary criterion. Resulting regions are called labour micro-regions and they consist of a centre and at least three municipalities in a hinterland (ČSÚ 2004:41). They exhibit a high level of self-containment, particularly for the daily travel-to-work flows (ČSÚ 2004:41). The method sets the minimum population size criterion to 10,000, out of which the population size of a hinterland should exceed 4,000. However, ČSÚ (2004:42) admit that some micro-regions might appear problematic as for their self-containment, since the size criterion is too loose. ČSÚ (2004:41) delineate 184 labour micro-regions (Figure 1).

Hampl (2005) uses two spatial interactions: labour commuting (travel-to-work flows) and school commuting stressing the importance of the former. Elementary functional regions (micro-regions of a first level) are delineated on the basis of labour commuting and considered as basic building units of a regional system (Hampl 2005:79). These will enter the following comparisons. A parameter of their size is known. Hampl (2005:81) requires that the elementary functional regions should have at least 15,000 inhabitants, out of which at least 5,000 inhabitants should be in the hinterland of a regional core. Both values are considered critical (see further). Hampl (2005:83) delineates 144 elementary functional regions (see also Figure 2).

Sýkora and Mulíček (2009:288) use travel-to-work flows ("commuting to work") as a region-organising spatial interaction. Complex micro-regions are delineated around urban cores and are considered as elemental cells of settlement and regional systems (Sýkora and Mulíček 2009:293). Again, these micro-regions will enter further analyses. Minimum size of micro-regions is set to 6,000 (Sýkora and Mulíček 2009:299). Meeting this criterion 260 complex micro-regions are delineated by Sýkora and Mulíček (2009:300) – see also Figure 3 – although several subjective interventions were included in the process of production of final continuous micro-regions (Sýkora and Mulíček 2009:298, 300).

As mentioned above, the functional regions are basically defined by their self-containment. Naturally this holds true for local labour market areas as well. The size of regions is a further criterion used in most of delineations of LLMAs (e.g. Coombes et al. 1986, Casado-Díaz 2000 etc.). Regarding the criteria used in the three simpler methods it is only size that can serve as a common denominator for our comparisons. However the minimum thresholds set by ČSÚ 2004, Hampl (2005), and Sýkora and Mulíček (2009) concern the total population of a region, while algorithms for LLMA delineation apply only data based on a region-organising process, i.e. the daily travel-to-work flows. This approach basically provides three potential measures of the size: an employed population of a basic spatial zone (region) – $\sum_k T_{jk}$, an employed resident population of a basic spatial zone (region) – T_{jj}, i.e. an inner flow, and a number of jobs in a basic spatial zone (region) – $\sum_k T_{kj}$.

In case there is an attempt to delineate a functional region the number of the employed population is considered the most appropriate as it strongly correlates with the most general size measure of a region – its total population. The differences between regions with low and high levels of unemployment are statistically insignificant. In average there are 45 employed persons per 100 inhabitants in the Czech Republic. Using this percentage it is possible to set the size criterion for the comparisons: in case of ČSÚ (2004) the lower size limit is 4,500, in case of Hampl (2005) it is 6,750, and in case of Sýkora and Mulíček (2009) it is 2,700.

Parameters of the more advanced method

We have used an adjusted second variant of the CURDS algorithm (Coombes et al. 1986). The first step is an identification of potential regional cores. Two parameters that have to be fulfilled simultaneously are applied in order to qualify a basic spatial zone as a potential regional core – job ratio function:

$$\frac{\sum_j T_{ji}}{\sum_j T_{ij}} > 0.8 \qquad [2]$$

and residence-based (or supply-side) self-containment:

$$\frac{T_{ii}}{\sum_j T_{ij}} > 0.5 \qquad [3]$$

Further step is concerned with a level of self-containment of cores and with relations between potential cores and attempts to identify multiple cores. In case a core j does not fulfil requirements for its self-containment, i.e.:

$$\min\left(\frac{T_{jj}}{\sum_k T_{jk}}\,;\,\frac{T_{jj}}{\sum_k T_{kj}}\right) > 0.5 \qquad [4]$$

it is necessary to identify a core i from which more than 10% of flows originates to j and to which more than 1% of flows from j is destined. If there are more cores i fulfilling the requirements a core j is merged with i that maximises [1] and simultaneously [1] exceeds the value of 0.002. The merger of i and j acts as one core in further steps.

The preceding step is repeated then with the exception that apart from cores also remaining basic spatial zones ("non-cores") are taken into consideration and cores are ranked by the objective function controlling the size and self-containment of the cores and defining a trade-off between both parameters. The size parameters entering the objective function have already been discussed. According to an international experience (Coombes et al. 1986; Casado-Díaz 2000; Papps and Newell 2002) we keep the values of self-containment at the levels 0.70–0.75. It means that the lower size limit demands the upper self-containment limit and that the upper size limit allows for the lower self-containment limit when the trade-off between size and self-containment has a linear character. This step forms so called proto-regions (proto travel-to-work areas in Coombes et al. 1986).

Keeping the proportion between lower and upper size limit in the original method that was 3,500 and 20,000 (Coombes et al. 1986) we set these limits at 4,500 and 25,700 for the comparison with ČSÚ (2004), 6,750 and 38,600 for the comparison with Hampl (2005), and 2,700 and 15,400 for the comparison with Sýkora and Mulíček (2009).

The next step takes into account relationships between proto-regions and remaining unallocated basic spatial zones when the maximisation of [1] is the criterion for merger and the objective function either confirms the viability of resulting regions or, when not, the region is dismembered and its constituent basic spatial zones are allocated to successful regions.

DISCUSSION OF RESULTS

Spatial patterns of regional systems of the Czech Republic and their basic characteristics are discussed in this part. The results of each of the simpler methods of the regional taxonomy are compared to the results of the more advanced method that approximates one of its four crucial parameters, i.e. lower size limit, to the particular counterpart of the simpler method. The basic characteristics of the three comparisons are given in Table 1, complete results are given on-line as supplementary materials in Tables S1, S2 and S3. Graphical outcomes of both simpler and more advanced methods are presented in Figures 1, 2 and 3 and also on-line as supplementary materials in Figures S1, S2 and S3.

Regional pattern of 184 regional classes produced by ČSÚ (2004) is presented in Figure 1. The more advanced method has provided for a lower size limit of 4,500 employed 157 regions. The greatest differences between two regional patterns can be identified in the hinterlands of Prague, Brno and Plzeň, wider hinterland of Ostrava and in eastern Bohemia and western Moravia.

Hampl (2005) has identified 144 regions (Figure 2). The more advanced method has provided for a lower size limit of 6,750 employed 138 regions, which is the closest match out of three comparisons. The greatest differences between two regional patterns concern again the hinterlands of Prague and Brno, and for this time also of České Budějovice. Regional patterns of eastern Bohemia (basically from Náchod towards Polička) differ as well.

Sýkora and Mulíček (2009) identify 260 regions (Figure 3). The more advanced method has provided 178 regional classes for a lower size limit of 2,700 employed. Here the regional patterns differ most. Differences are evident in the hinterlands of large cities (Prague, Brno, Plzeň), this time they are not expressed by a different extent of the regions but particularly by their number. Further we bring attention to eastern and north eastern Bohemia and also western Bohemia and parts of southern Bohemia where simpler method has produced scattered regional pattern. Similar pattern is seen along the Bílé Karpaty range at the Czech-Slovak border as well.

The comparisons documented in Table 1 and Figures 1, 2 and 3 identify several traits that are dealt with in the following lines from general to a more specific point of view. First, all three comparisons show that the more advanced method of regional taxonomy applied in this article produces a smaller number of regions with given parameters. However, should regional classes defined by simpler methods meet the self-containment criterion, their number would always be lower than provided by the more advanced method. Second, there is a considerable difference in a size of regions in terms of their population produced by simpler methods and more advanced method, when the size span

Table 1 Overview of results of simpler and more advanced methods of regional taxonomy.
Source: ČSÚ 2004; Hampl 2005; Sýkora and Mulíček 2009; own computations.

	Labour micro-regions (ČSÚ)		Elementary functional regions (Hampl)		Complex micro-regions (Sýkora and Mulíček)	
	S	MA	S	MA	S	MA
Number of regions	184	157	144*	138	260	178
Identical core and delineation	10		3		12	
Identical core, different delineation	138		125		160	
Different core	36	9	19	10	88	6
Fail to meet self-containment	39	–	19	–	109	–
Fail to meet objective function	37	–	21	–	91	–
Maximum size of region (10^3 inhab.)	1,443.0	1,314.5	1,489.2	1,361.4	1,434.9	1,329.6
Minimum size of region (10^3 inhab.)	9.8	11.2	15.6	16.9	6.0	7.1
Number of exclaves**		28 (0.5%)		19 (0.3%)		29 (0.5%)

Notes: S – simpler method, MA – more advanced method

* Three regions are organised by two cores, total number of cores is 147, then.

** In case an exclave occurred within one region it has been amalgamated with it, in case an exclave occurred at a border of two or more regions it has been amalgamated with a region that maximised the interaction measure.

is lower in the latter case. Third, simpler methods favour the influence of larger cores, while the more advanced method, particularly when Smart's measure is applied, somewhat mitigates the influence of larger cores and favours the influence of mid-size and smaller cores in case their regions conform to the objective function. Fourth, simpler methods enable smaller cores to form their regions, which is prevented in the more advanced method by the application of the objective function that combines the size and self-containment criteria.

Of course, results of simpler and more advanced methods and differences between them reflect the nature of the settlement system and relative location of regional cores. Performance of simpler and more advanced methods can be demonstrated on typical examples. Simpler methods enable small cores to form their regions even in the wider hinterland of the largest cities and simultaneously lower the influence of mid-size cores (see for instance the case of Prague and Brno in Figures 1, 2 and 3). The more advanced method performs in the opposite way. Smaller regions do not occur in the vicinity of the largest cores and the influence of these cores is lowered by mid-size cores, which is again seen in case of Prague, Brno and also Ostrava this time (Figures 1, 2, 3).

The same difference applies for lower size levels. Smaller regions are formed by simpler methods in the hinterlands of Náchod, Rychnov nad Kněžnou or Tachov, while the more advanced method does not produce such regions, since they do not conform to the objective function. This holds true also in cases of relatively significant secondary district centres unless they are sufficiently far from the primary centre. Thus for instance Frýdlant nad Ostravicí, Čáslav, Slaný, Přelouč, Nové Město nad Metují (towns with 10–15 thousand inhabitants) have their regions when applying simpler methods, but they are always a part of a region of the primary centre (Frýdek-Místek, Kutná Hora, Kladno, Pardubice, Náchod) when applying the more advanced method.

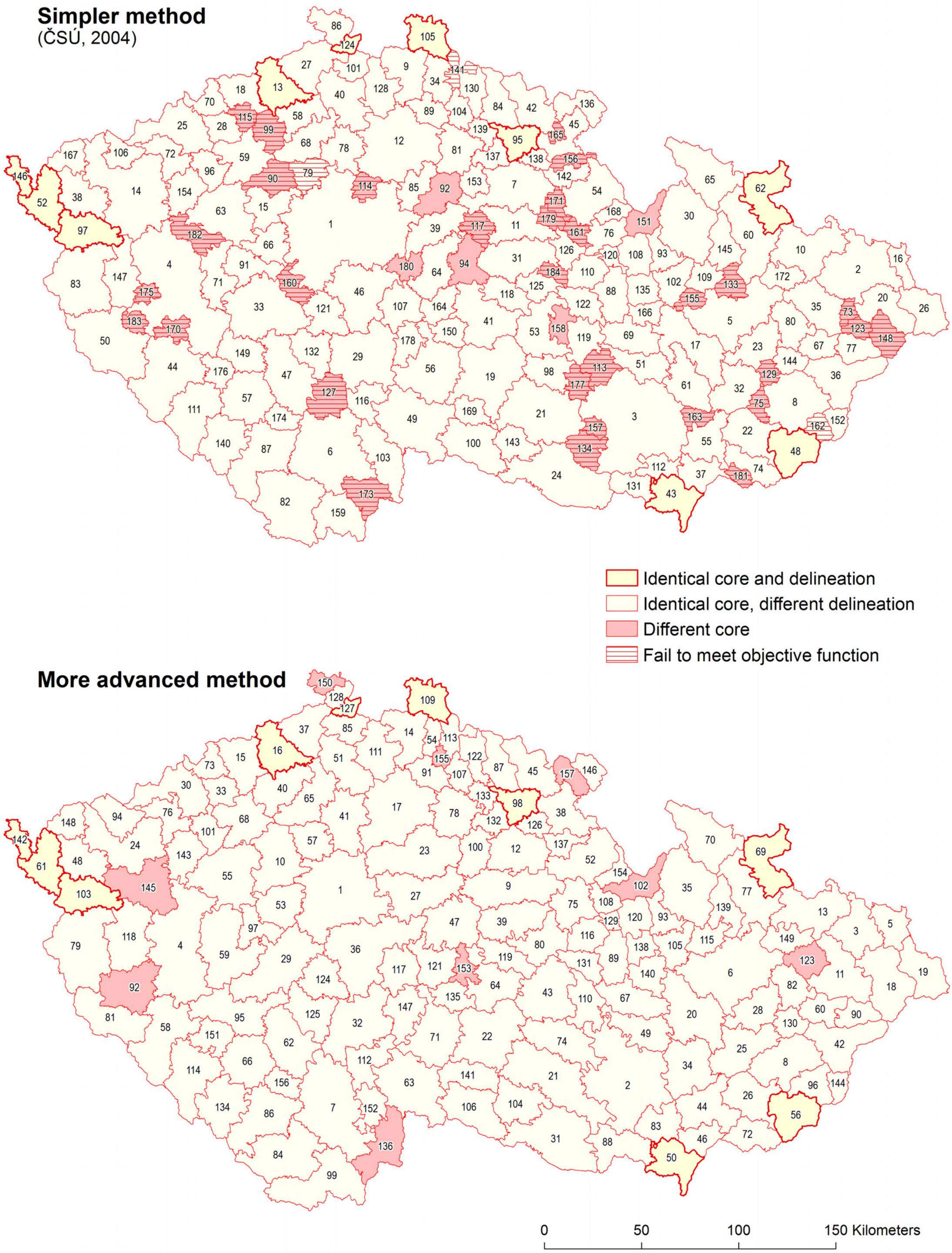

Figure 1 LLMAs and labour micro-regions (ČSÚ). Source: ČSÚ 2004; own design.

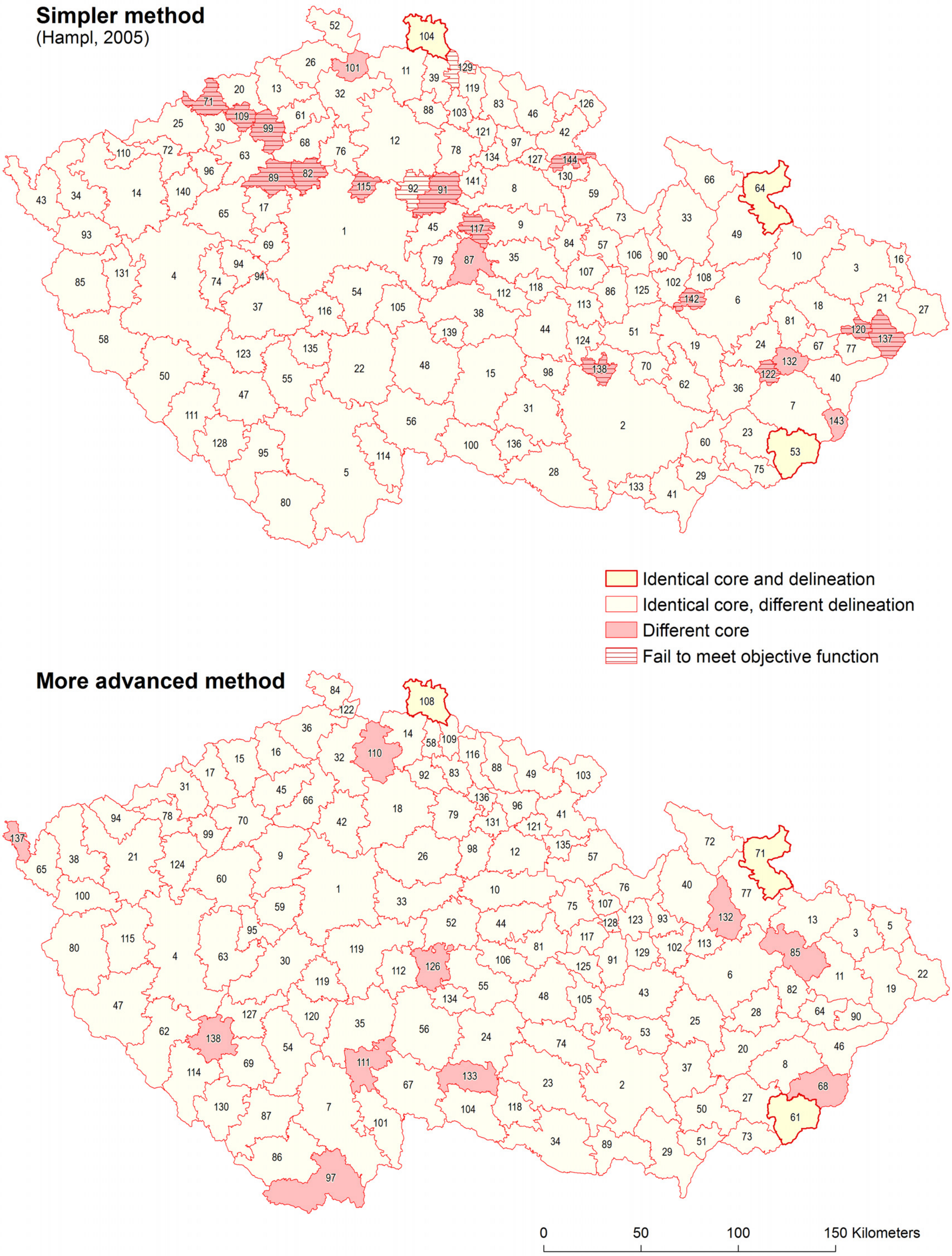

Figure 2 LLMAs and elementary functional regions (Hampl). Source: Hampl 2005; own design.

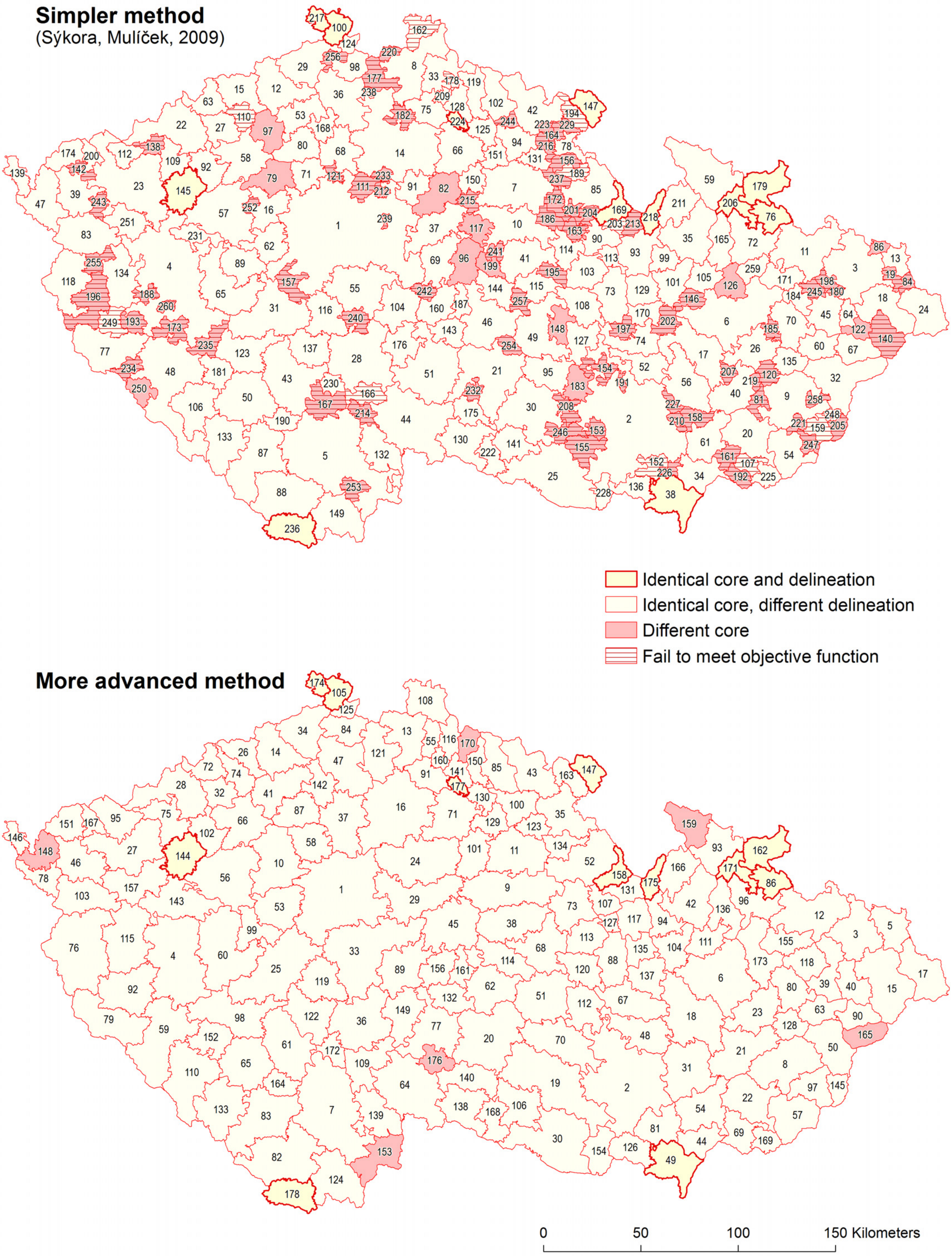

Figure 3 LLMAs and complex micro-regions (Sýkora and Mulíček). Source: Sýkora and Mulíček 2009; own design.

In areas with smaller towns of approximately the same size the simpler methods tend to form a region for each of them, or, if the regions do not exceed the size criterion, these methods divide the whole area between distant larger cores, since based on the primary-flow linkage none of the smaller cores is able to integrate a region. On the contrary, taking into account all relativised flows between all respective basic spatial zones the more advanced method usually delineates the whole area as one (or two) region integrated by the strongest of smaller cores (see for instance Odry – Vítkov – Fulnek, or Slavičín – Luhačovice – Valašské Klobouky – Brumov-Bylnice). Simpler methods could deal with this problem by identification of multiple cores, but this step has been applied only by Hampl (2005) in three cases (Žamberk and Letohrad, Rumburk and Varsndorf, Ústí nad Orlicí and Česká Třebová). It is interesting in this respect that the more advanced method provides regions for last four cases under strict criteria given by the objective function.

Correspondence between regions produced by simpler method and more advanced method occurs only in borderland where the influence of state border and also relief of border mountain ranges is manifested. In the interior of the state territory the delineation of regions differs even though the cores can be identical and the difference is very significant in areas with a dense network of smaller and mid-size settlements.

CONCLUSION

The comparisons of simpler methods and more advanced method of regional taxonomy have manifested significant differences in the resulting regional classes that had been discussed above, and revealed some methodological traits of both types of procedures. First the importance of the analysis of the self-containment of regional classes seems to be assured if functional regions are to be delineated. The self-containment can be tested even when the methods resting in analysis of the primary-flow linkages are applied and unsuccessful regions can be dismembered, which would consolidate the geography of the results. Second the need for a careful estimate of the minimum size criterion in case of simpler methods has proved worthy. If the same estimate is used in the more advanced method as one of the criteria of the objective function the differences between the number of regions is self-evident. In this respect the minimum size estimate made by Hampl (2005) provided the best fit to the results of the more advanced method. On the contrary, 26 complex micro-regions fail to meet the basic trait of a functional region, i.e. the self-containment higher than 50%, which shows that the size criterion applied in this method is too low for the Czech Republic. Third, the more advanced method has appeared to produce geographically more relevant results at given parameters as the size of individual regional classes seems to be more in balance and the basic definition of any type of functional region is fulfilled in terms of the self-containment of the regions. However, the need for a parameters estimation testing seems to be inevitable in order to identify optimal distribution of regional classes.

The advantages of simpler methods rest in the following in our opinion. They are simple, do not demand for a construction and programming of a complex algorithm and if their parameters are carefully estimated they provide relatively precise general view of a regional system. They are able to identify a hierarchical nature of a settlement system and potential centres of functional or administrative regions. The insufficiencies of simpler methods appear to be the application of absolute values and one-way direction of the regionalisation criterion (primary-flow linkage) and of a relatively arbitrary size criterion. The results are hard to be compared in time in case the population, employed or job positions change and in space when in peripheral less populated areas it is more difficult to meet set criteria even for cores that otherwise enjoy a significant position in a settlement system. The primary-flow linkage does not necessarily have to express the regional inclination of a basic spatial zone (this has been partly dealt with in the final controlling mechanism in ČSÚ 2004).

The insufficiency of the more advanced method applied in the article is easy to be overcome, since it concerns just the input data used as a size criterion.

It has been related to employment, which is a characteristic that can manifest significant differences and oscillations in time and space. However, it can be substituted in the algorithm by the total population or economically active population.

The advantages of the more advanced method are as follows. We are able to control both the size and the self-containment of regional classes and the relation between the two parameters. The method uses as a linkage measure relativised and reverse flows between a pair of basic spatial zones (or regional classes), which yields more refined results. The method tends to produce contiguous regional classes even though the contiguity constraint is not comprised in the algorithm (in our case the portion of exclaves did not exceed 0.5% of all the basic spatial zones that had been amalgamated with the cores). If both the size and self-containment parameters of the objective function are set according to the parameters of regions produced by a simpler method, the more advanced method is able to produce larger number of regional classes, which is the trait having been stressed already by Coombes et al. (1982, 1986). If the self-containment is set to 0.60–0.65 for comparisons to Hampl (2005) 181 regional classes are produced (in comparison to Hampl's 144). This assumption requires however further testing.

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Résumé

Funkční regiony České republiky: srovnání jednodušších a pokročilejších metod regionální taxonomie

Cílem článku je porovnat výsledky tří stávajících jednodušších metod vymezování funkčních regionů s výstupem pokročilejší metody nově aplikované na území České republiky. Článek obsahuje tři různá porovnání prostorových vzorů funkčních regionů různého typu a zabývá se výhodami a nevýhodami aplikovaných metod, především mezi metodami jednoduššími a pokročilejšími. Článek přestavuje v českém geografickém výzkumu nový způsob vymezování funkčních regionů. Všechny metody používají jako regionalizační kritérium denní dojížďku za prací ze Sčítání lidu, domů a bytů 2001. Dojížďka za prací je obecně považována za nejefektivnější proces ve funkčních regionálně taxonomických úlohách. Článek analyzuje výsledky vytvořené Českým statistickým úřadem (ČSÚ 2004), Martinem Hamplem (2005) a Luďkem Sýkorou a Ondřejem Mulíčkem (2009).

Jednodušší metody funkční regionální taxonomie jsou inspirovány teorií grafů. V zásadě analyzují orientovaný graf. V českém humánně geografickém výzkumu byly zatím aplikovány při tvorbě funkčních regionů výhradně a poněkud nešťastně se nazývají metodami prvního toku. Tyto metody obvykle spočívají ve výběru potenciálních jader budoucích regionů a ve způsobu přiřazení zbývajících základních prostorových zón k jádrům, v tomto případě podle směru největší vyjížďky ze základní prostorové zóny. V odůvodněných případech bývají výsledky modifikovány, aby poskytly geograficky relevantní obraz. Výsledné regiony pak mají silně nodální charakter.

Pokročilejší metody regionální taxonomie používají pro spojení základních prostorových zón složitější míru, např. v článku použitou míru Smartovu [1]. Tato míra má dvě výhody: jednak uvažuje reversní toky mezi párem základních prostorových zón, jednak tyto toky relativizuje na základě všech příchozích a odchozích toků z dané základní prostorové zóny. Regionálně taxonomická procedura musí

splnit předem definovaná kritéria týkající se identifikace regionálních jader a minimální velikosti a uzavřenosti výsledné regionální třídy. Tento postup je znám jako metoda založená na pravidlech.

Abychom mohli porovnat výsledky jednodušších a pokročilejších metod regionální taxonomie, musíme mezi parametry metod hledat určitý společný jmenovatel. Takovým parametrem je minimální velikost výsledného regionu, respektive regionální třídy. Za základ byly vzaty minimální velikosti regionů všech tří jednodušších metod a jim byly přizpůsobeny parametry algoritmu pokročilejší metody. Algoritmus spočívá ve třech krocích: identifikace regionálních jader, tvorbě regionů a identifikaci hodnot účelové funkce, která hodnotí vzájemně velikost a uzavřenost regionu. Velikost byla odvozena podle velikostních kritérií použitých ve třech jednodušších metodách, uzavřenost byla stanovena na 0,70–0,75. Pokud není hodnota účelové funkce vyšší než zvolený parametr, region je rozpuštěn a jeho základní prostorové zóny přiřazeny k regionům jiným.

Výsledky tří provedených komparací jsou představeny v tabulce 1 a obrázcích 1, 2 a 3. Pokročilejší metoda ve všech případech vymezí menší počet regionů. Velikostní rozmezí regionů vymezených jednoduššími metodami je podstatně větší než v případě aplikace pokročilejší metody. Jednodušší metody zvýrazňují regionální vliv velkých jader, zatímco pokročilejší metoda tento vliv zmírňuje ve prospěch středně velkých a menších jader. Jednodušší metody umožňují vznik malých regionů, čemuž v pokročilejší metodě brání definovaná účelová funkce.

Porovnání jednodušších a pokročilejších metod regionální taxonomie přineslo následující hlavní zjištění. Při vymezování funkčních regionů je velmi vhodné používat kromě velikostního kritéria i kritérium uzavřenosti regionu, protože to je primární znak funkčního regionu. Pokročilejší metody dle našeho názoru poskytují poněkud relevantnější geografický obraz zkoumaného území, zamezují vzniku extrémně velkých či extrémně malých regionálních tříd.

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List of supplementary materials (on-line)

Table S1	Labour micro-regions (ČSÚ) and comparison of results
Table S2	Elementary functional regions and comparison of results
Table S3	Complex micro-regions and comparison of results
Figure S1	LLMAs and labour micro-regions (ČSÚ)
Figure S2	LLMAs and elementary functional regions (Hampl)
Figure S3	LLMAs and complex micro-regions (Sýkora and Mulíček)