Europ. Countrys. · 4· 2016 · p. 333-350
DOI: 10.1515/euco-2016-0024

SMALL TOWNS IN THE CONTEXT OF "BORROWED SIZE" AND "AGGLOMERATION SHADOW" DEBATES: THE CASE OF THE SOUTH MORAVIAN REGION (CZECH REPUBLIC)

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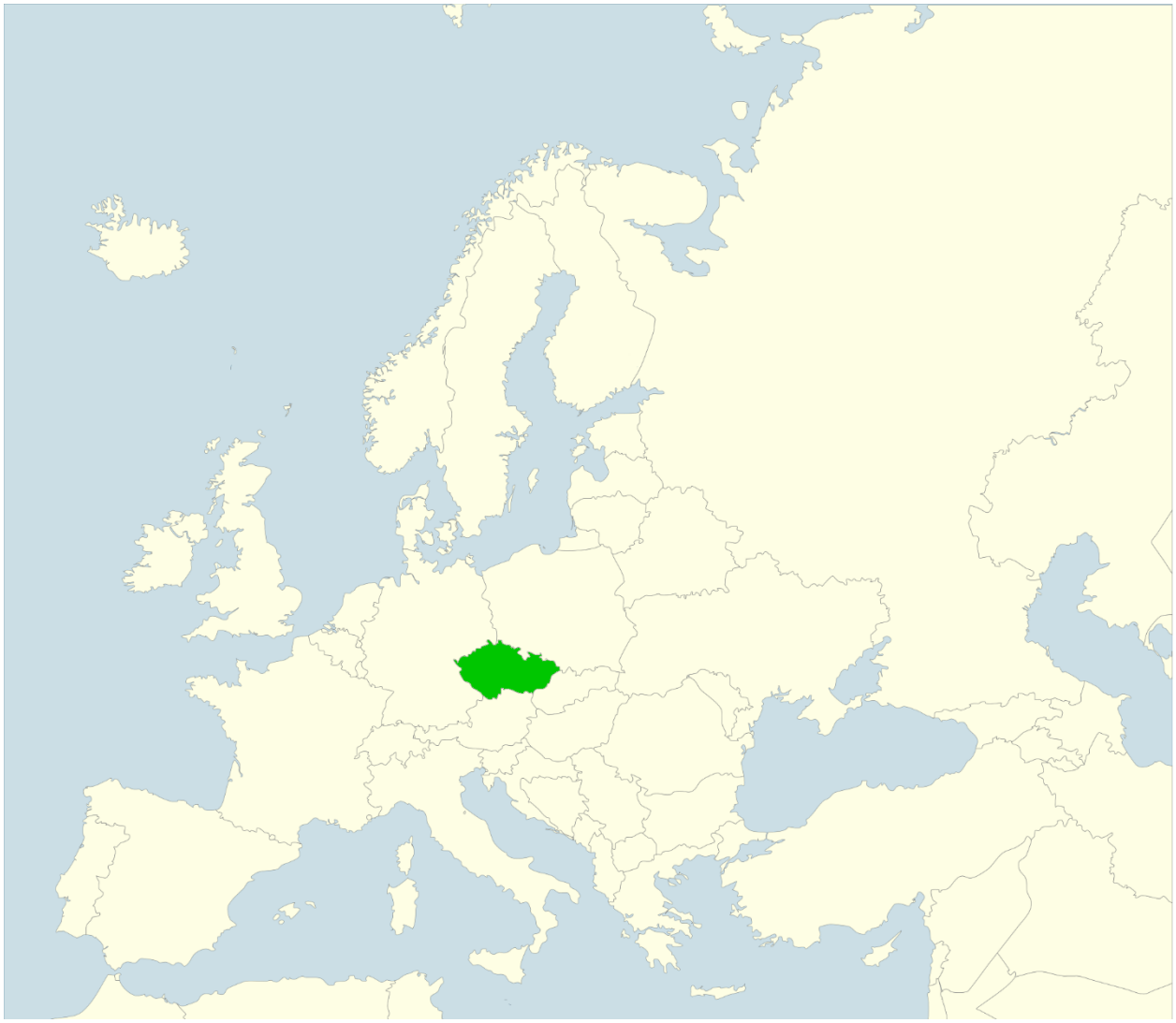

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Received 22 February 2016; Accepted 19 July 2016

Abstract: Small towns play a key role in providing services for its wider hinterland. However, emerging economic importance of the largest agglomerations and increasing involvement of settlements in urban networks have transformed a relationship between the size of settlements and their expected urban function. In this context, the concepts of "borrowed size" and "agglomeration shadow" serve to explain the impact of network externalities on urban function but pay a little attention to service function of small towns. The paper aims at revealing the extent to which the provision of services is determined by location of small towns within a regional urban system strongly affected by a metropolitan area. The results show coexisting occurrence of the processes of borrowed size and agglomeration shadow and the importance of tourist and commercial attractiveness of particular places (towns) to final provision of services.

Key words: small towns, borrowed size, agglomeration shadow, service function, periphery, metropolitan area

Abstrakt: Malá města plní klíčovou úlohu při poskytování služeb pro své širší zázemí. Vzrůstající ekonomická významnost největších aglomerací a hlubší začleňování sídel do městských sítí však mění vztah mezi velikostí sídel a jejich očekávanou nabídkou městských funkcí. V této souvislosti je dopad externalit městských sítí na funkci měst vysvětlován pomocí konceptů „borrowed size" a „agglomeration shadow", avšak pouze malá pozornost je věnována obslužné funkci malých měst. Předkládaný článek si klade za cíl objasnit, do jaké míry je nabídka služeb ovlivněna polohou malých měst v rámci regionálního systému osídlení, který je pod silným vlivem metropolitní oblasti. Výsledky ukazují vzájemné spolupůsobení procesů „borrowed size" a „agglomeration shadow" a vyzdvihují důležitost turistické a komerční atraktivity jednotlivých měst pro výslednou nabídku služeb.

Klíčová slova: malá města, borrowed size, agglomeration shadow, obslužná funkce, periferie, metropolitní oblast

1. Introduction

The hierarchy of urban systems conceptualized by traditional Christallerian "Central Place Theory" has been confronted by models accentuating complexity of urban networks emerging from the processes of globalization and growing mobility of contemporary society (van der Laan 1998). While the role of the largest agglomerations is emphasized by proponents of the new economic geography (Fujita and Krugman 2004; Glaeser 2011) and the most of the leading urban system theories are focused on densely populated areas acting as the economic growth poles in regional development, e. g. "mega-city regions" (Hall and Pain 2006; Florida et al. 2008), "polycentric urban regions" (Kloosterman and Musterd 2001; Parr 2004), the role of small towns seems to be neglected despite their importance especially in rural areas.

Until recently, attention dedicated to small and medium-sized towns appeared to be closer in studies focusing on the issue of rural development (Zekeri 1994; Courtney et al. 2007). However, the resumption of a discussion about the concept of "borrowed size" (Phelps et al. 2001; Meijers et al. 2015) contested by the "agglomeration shadow" effect (Burger et al. 2015) has brought the issue of the role of small towns in regional development to wider research interest including urban and economic geography. An urban function of small towns is relativized by the position within an urban network and the access to socio-economic resources. Put it simply, population size of a particular place does not have to correspond to its expected urban function due to an advantage stemming from the proximity of an urbanized area (borrowed size) or due to a competition with larger urban centre (agglomeration shadow). The most of studies deal with the (inter)national scale where the higher-ranked functions are at the forefront of interest and

the basic spatial unit very often represents larger spatial entity (Partridge et al. 2009; Tervo 2010; Burger et al. 2015; Meijers et al. 2015).

Hence, this paper intends to focus on regional dimension allowing to explore the spatial urban pattern more deeply and on wide spectrum of services contributing to the functioning of small towns as urban centres with different intensity. The main aim of the paper is to evaluate the service function of small towns (on the case of the South Moravian Region, Czech Republic) with regard to their location within the urban and the transport network, their historical importance and tourist attractiveness. The hypothesis is related to the concept of agglomeration shadow and it claims that the service function of small towns is affected, next to its own population size, also by the position of the town towards the core city of a metropolitan region and the transport infrastructure. The results of this relationship are interpreted with respect to the site-specific features forming the spatio-functional dynamic of the region.

2. Theoretical background

The role of small towns within urban systems has been partly overlooked by urban researches in recent scholarly debates about regional development. However, their importance for rural areas are crucial in order to maintain balanced spatial development and to avoid spatial discrepancies (Hinderink and Titus 2002). The specific role of small towns consists of the sufficient provision of jobs and services for their mostly rural hinterlands (Heffner and Solga 2006; Vaishar and Zapletalová 2009). This assumption is reflected in normative practices of spatial planning authorities at different hierarchical levels. Regarding non-binding platform of the "European spatial planning policy" the Territorial Agenda 2020 suggests that "in rural areas small and medium-sized towns play the crucial role; therefore it is important to improve the accessibility of urban centres from related rural territories to ensure the necessary availability of job opportunities and services of general interest" (EU Ministers responsible for Spatial Development 2011: 8). Improved living conditions in rural and peripheral areas related to the role of small towns has become a strong part of the territorial cohesion discourse shaping EU regional and sectoral policies in recent years (EC 1999; EC 2008). At the Czech national level, the highest ranked spatial planning document called Spatial Development Policy refers to small towns in the context of better access to basic infrastructure. It states that one of the priorities is to "create conditions for the improvement of transport accessibility of municipalities (towns) that are natural regional centres (while benefit from their location and infrastructure) in order to improve conditions for the development of surrounding municipalities localized in rural areas and areas with specific geographic features" (MMR ČR 2015: 15).

Although the undisputable position of rural and peripheral areas in spatial development is well formulated in debates about territorial cohesion and embedded in spatial planning documents (EU, national level), recent trends characterised by increasing globalization, mobility and growing importance of large agglomerations in overall development tend to enhance polarization patterns and spatial disparities (Ezcurra et al. 2005). From the perspective of balanced development, polarization between particular territories or places is seen as undesired feature of spatial development and is very often understood as a stimulus for growth of regional inequalities (EC 2008). Molle (2007: 90) argues that polarization "implies not only the aspect of geographical concentration but also the accentuation of the differences in endowments, equipment and hence disparities in wealth between the core and the periphery." Indeed, spatial disparities are closely linked to the social welfare and have strong impact on socio-economic situation of communities and individuals (and vice versa). As a part of prevailing neoliberal economic model of contemporary European society, complex system of socio-spatial interdependencies face challenges produced by global market forces, changing spatial divisions of labour and demographic structure affected by population aging. Increasing emergence of socio-spatial disparities among the European territory gave rise to discussion about the theoretical concepts of "polarization" and "peripheralization" - attempts to explain socio-spatial imbalances and their origins (Hudson 2015; Kühn 2015; Lang 2015).

Despite the complexity of production of peripheries, its spatial dimension is very often linked to the structure of urban system and especially to metropolitan and non-metropolitan areas and core-periphery relation (Claval 1980; Copus 2001; Krätke 2007). Although urban systems are

characterized by significant stability in time, recent changes in communication technologies, transportation systems and production modes resulted in a transformation of urban systems with varied impacts at different spatial scales (Castells 1996; van der Laan 1998). During recent decades of more intensive research on urban systems, the structure and functioning of urban systems have been described by large number of theoretical frameworks (Meijers 2007 provides an overview), ranging from Christaller's 'Central Place Theory' (Christaller 1933), general 'hierarchical urban models' (Berry & Parr, 1988), 'network models' (Batten 1995; Camagni and Salone 1993), to the concept of 'polycentricity' (Kloosterman and Musterd 2001; Parr 2004). Theoretical models based on hierarchical order and size of cities indicating their centrality have been replaced by network paradigm emphasizing interactions among cities, specialization of centres and importance of horizontal linkages in terms of human activities (Capello 2000). Morphological approaches have been enriched with functional dimension of urban system's structure (Green 2007). In this context, position of places within horizontal linkages creating integrated network of cities and their functional connection to metropolitan areas have become crucial aspects of economic development and potential success in regional competition.

In contrast with rather schematic conceptualization of urban systems from the perspective of theories emphasizing a hierarchical order and a linear connection between size and function of a particular settlement unit, the models operating with the concepts of network or polycentricity provide a basis for contesting the linkage between the size of settlement and its function within an urban system. As Batten (1995) argues, the position of a particular place within an urban network is crucial for its function (in terms of e. g. economic or cultural importance). Not only the own size but also the size of its hinterland affects the centrality of a particular place. Consequently, "due to the presence of spatial interdependencies, smaller places can borrow size and host functions that they could not have hosted in isolation" (Burger et al. 2015: 1092). Although the concept of borrowed size is not new in geographic and economic research, only a few studies reflecting its impact on urban systems have been conducted (Alonso 1973; Phelps et al. 2001; Meijers et al. 2015). While even small towns may benefit from higher population density beyond their administrative borders and therefore attract people (e.g. workers, consumers) from wider urban network, the effect on the function of a particular town could be exactly opposite. In this respect, the concept of agglomeration shadow aims at explanation of fewer functions that are provided by a town located in a proximity to larger centre compared to a town isolated from other urbanized parts of a given territory (Fujita et al. 1999; Burger et al. 2015). In the context of borrowed size versus agglomeration shadow discussion, metropolitan processes including residential and commercial suburbanization become highly relevant. Studies researching agglomerations and metropolitan zones are mostly focused on social and spatial changes in the service (shopping) function of hinterland (Heffner and Twardzik 2013; Maryáš et al. 2014) or travel-to-work behaviour (Schwanen 2002).

At the international level, Burger et al. (2015) have explored the linkage between an urban function of cities (provision of high-end cultural amenities) and their (inter)national accessibility. They conclude that places lying in a shadow of larger cities are characterized by lower levels of high-end cultural amenities than could be expected considering their size. However, borrowing size of smaller cities from the larger ones has not been proofed. Hence, in general, "central place" logic still persists, at least in the case of high-end cultural amenities in North-West Europe. On the example of the American urban system, Partridge et al. (2009: 461) suggest that "rural counties and smaller urban centres have significant positive interactions with their nearest higher–tiered urban areas". Deconcentration tendencies supporting urban sprawl significantly contribute to intensive commuting linkages between urban cores and peripheries. In this context, lower–ordered places benefit from closer accessibility of urban amenities in terms of population dynamics (Partridge et al. 2009). While provision of high-end cultural amenities is subject to agglomeration shadow effect, population growth of places situated in the hinterland of urban cores may persist.

In fact, borrowing size versus agglomeration shadow effects are strongly dependent on a type of amenities and other aspects (population growth, housing projects) used in an analysis as the urban function indicator. Moreover, a proximity to larger agglomerations should be complemented by other factors (such as connection to transport infrastructure, historical aspects,

cultural differences or tourist attractiveness) that may have an impact on the overall urban function of a particular place. In this context, Knox and Mayer (2012) see the comparative advantage of small towns specifically in their cultural heritage, potential for liveability and sustainability, and attractiveness for leisure. Additionally, the issue of geographical scale predetermines the scope and type of analysed functions and therefore the final conclusions about agglomeration shadow intensity. Thus, the next parts of the paper aims at the regional scale, where the service function of small towns is evaluated reflecting not only agglomeration shadow and borrowing size debate but also other factors that could play a role in the level of an urban centrality. The next section presents the case study area and the research methods, the empirical results are presented in the following section, and the main conclusions are summarized at the end of the paper.

3. Study area, methodology and data

The South Moravian Region situated in the south-eastern part of the Czech Republic has been chosen as a case study area mainly due to its monocentric urban system structure that is strongly influenced by an agglomeration of the regional capital Brno (Malý 2016). The rest of the region is composed predominantly by a large number of small and medium-sized towns that create scattered urban system with high density of rather small municipalities (see Fig 1). The methodology consists of the four main steps. Firstly, the services and their values used to calculation of the service function have to be defined. Secondly, specification of parameters defining small towns is essential for their selection and calculation of their service function centrality. Thirdly, the variables with potential impact on service function centrality of small towns are determined. Finally, a relationship between the variables and the scores of service function centrality of small towns is evaluated using regression analysis.

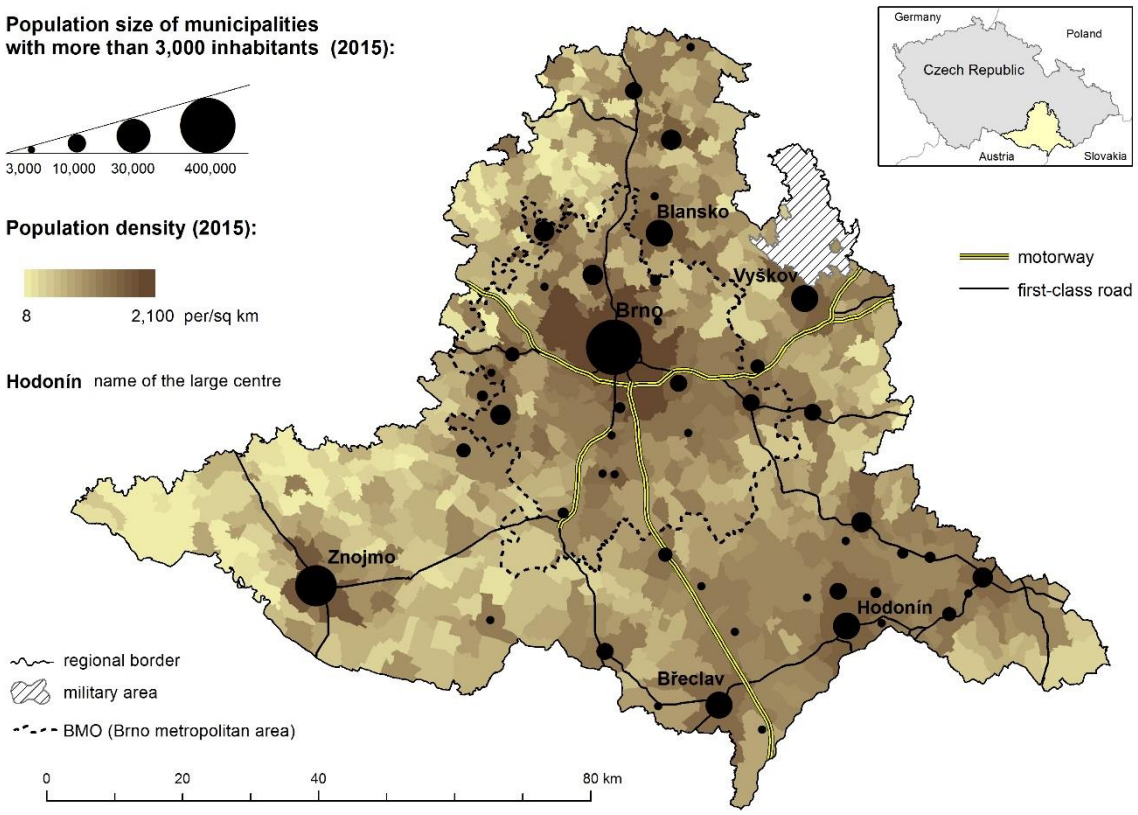

Fig 1. The urban system of the South Moravian Region. Source: Data collected from Czech Statistical Office (2016b); BMA delimitation by Mulíček et al. (2013); author's processing

Tab 1. Distribution of services among the municipalities in the South Moravian Region. Source: Data collected from The South Moravian Region (2012); Czech Statistical Office (2013); Banky (2015); Czech Post (2015); CzechPoint (2015); author's calculation

Services (2012-2014)	Number of municipalities with particular facility	Average size of municipality with particular facility	Service's value
Public library	628	1,855	1
Grocery shop	605	1,917	1
Pub	592	1,956	1
CzechPoint[2]	591	1,952	1
Cultural centre	563	2,009	1
Early childhood education	423	2,626	5
Primary education	334	3,167	5
Restaurant	310	3,264	5
Post office	293	3,482	5
Bank	280	3,618	5
General practitioner	210	4,508	10
Paediatrician	161	5,582	10
Low-secondary education	153	5,814	10
Dentist	140	6,308	10
Drugstore	109	7,656	10
Museum and gallery	71	10,031	15
Nursing home	71	10,172	15
Cinema hall	65	11,233	15
ATM	61	12,320	15
Insurance company	53	13,644	15
Upper secondary education	31	20,266	20
Retirement home	29	19,937	20
Grammar school	21	28,516	20
Emergency medical service	20	29,892	20
Hospital	12	46,186	20
Facility for physically disabled people	12	35,638	20
Shelter	9	57,912	25
Low-threshold facility for children and youth	8	60,719	25
Shopping centre	7	68,047	25
Theatre	4	108,350	25

The final list of 30 basic and higher-ranked services together with the number of facilities localized within the South Moravian Region territory (calculation for 672 municipalities) has been used to design service's value. In line with the 'Central Place Theory' a distribution of services is not spatially balanced but is rather hierarchical respecting the urban system structure (see Tab 1). While the most common services, e. g. public library, grocery shop, and pub, are characterized by the largest number of facilities and are provided by even small municipalities, services with a limited number of facilities are concentrated into the largest cities. A hierarchical order is also reflected in a transportation accessibility of particular services (see Fig 2). A comparison of the access to the nearest grocery shop, hospital and theatre indicates the differences based on

[2] assisted place of public administration

the range of services. The lowest threshold of grocery shops is related to smaller distances (range) that are needed to reach the service (the shortest time and the largest number of public transport connections). On the contrary, the largest distances of theatres reflects higher threshold and specialty of the service. The service's value has been determined according to the number of municipalities with particular facility (the first numeric column in Tab 1 – over 500 = service value 1; 250-499 = 5; 100-249 = 10; 50-99 = 15; 10-49 = 20; less than 10 = 25). Such rating aims at capturing the threshold and range of services in a particular territory. The final index of service function centrality for each municipality is based on the service's value and is calculated as the sum of the number of facilities of each service provided by a particular municipality multiplied by the service's value[3]. The index of service function centrality is calculated for each municipality.

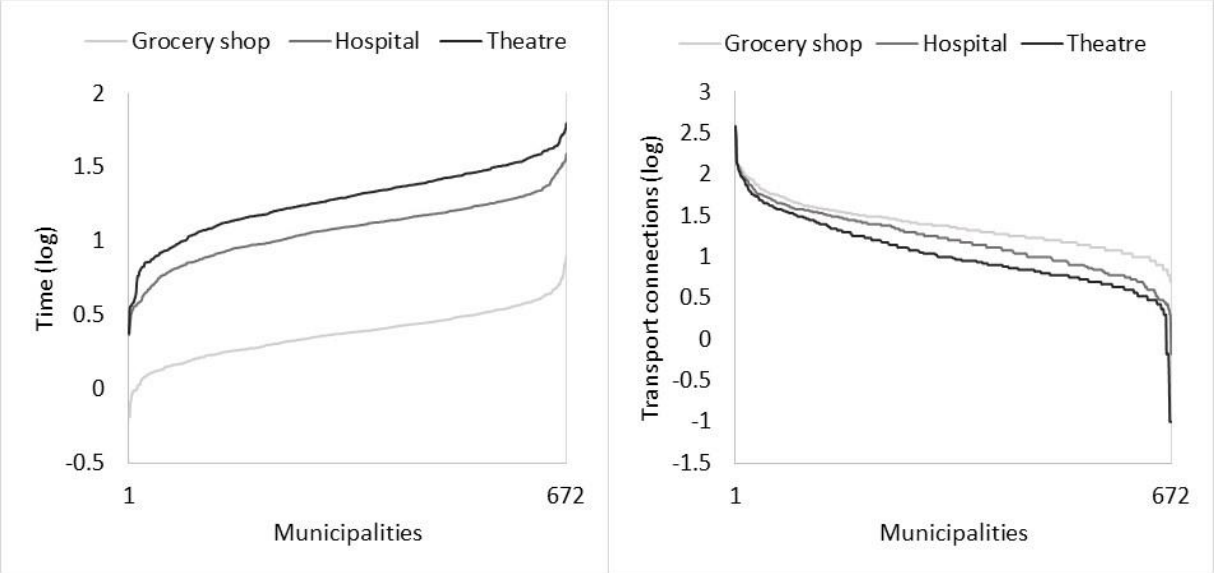

Fig 2. Transportation accessibility of selected services – the nearest facility of a particular service for each municipality in the South Moravian Region measured by the car time distance (left) and the number of public transport connections during a week-day (right) and sorted from a municipality with the highest accessibility (1) to a municipality with the lowest accessibility (672). Source: Data collected from The South Moravian Region (2012); Czech Statistical Office (2013); IDOS (2015); author's calculation

Definition of small towns is the crucial issue and it is strongly dependent on a particular urban system hierarchy. In the case of the South Moravian Region, the maximum population size is set to 15,000 inhabitants (besides the metropolis of Brno with almost 400,000 inhabitants, there are five settlements with population size between 20,000 and 35,000 that are considered, together with Brno, large centres) which is in accordance with the studies made by Cigale et al. (2006) and Vaishar et al. (2015). However, the minimum population size is not defined. The main reason is to consider the possible effect of borrowed size issue in the case of a relatively numerous group of municipalities with approximately 3,000 (and less) inhabitants and to examine the differences in service function centrality of the smallest centres. Thus, the lower limit is based on the index of service function centrality – the value has to be 80 at minimum. The rest of municipalities (with the value lower than 80) are predominantly small villages with almost no service function and including them into analysis does not change the results. The final set of municipalities will be termed "small centres" because of relatively considerable number of municipalities without the "town" status serving as centres for their hinterland and providing urban functions. Moreover, the status of a "town" is one of the independent variables entering regression analysis and therefore labelling the selected municipalities "towns" would be confusing. The index of service function centrality of the final list of small centres is then described according to population size categories and analysed through the relative values of the index (since the population size of

[3] For example, the index of service function centrality for a municipality providing 2 pubs, 1 grocery shop and 2 restaurants is calculated as follows: (2 x 1) + (1 x 1) + (2 x 5) = 13.

small centres varies to a great extent, service function centrality is relativized by the number of inhabitants in order to conduct more efficient comparison of data).

The next step is to define variables that could have an impact on the service function of small centres. Regarding a discussion about the concepts of borrowed size and agglomeration shadow the characteristics reflect spatial position of small centres within the urban system and interaction with higher-ranked centres (area: Position within the urban system); transport infrastructure and connection of small centres to other urbanized parts of the territory (area: Access to transport infrastructure); as well as their tourist attractiveness and historical importance (area: Inner potential) that also might be the factors contributing to different levels of service function centrality (see Tab 2). Particular variables are set up for each of these areas capturing the main characteristics that fit into a particular area of interest.

Tab 2. The independent variables used to regression analysis. Source: Data collected from TERPLAN (1985); MFČR (2013); IDOS (2015); Czech Statistical Office (2011, 2016a, 2016b); author's calculation

Areas of interest	Characteristics and variables
Inner potential	▪ Historical importance – Town status – Centre delimitated by socialist central planning ▪ Tourist attractiveness – Accommodation facilities (per 1,000 inhabitants)
Position within the urban system	▪ Rural character – Employment in agriculture (% of total employment) ▪ Peripherality – Population density of hinterland (the area accessible in 20 minutes) – Car time distance to the nearest large centre ▪ Importance within the network of higher-ranked centres – Share of work commuters from large centres in the total number of employees in a municipality ▪ Suburban character – Crude net migration rate (period 1990 - 2015)
Access to transport infrastructure	▪ Access to the nearest motorway – Car time distance to the nearest motorway (entrance) ▪ Functional polycentricity – Number of public transport connections[4] to the three large centres that are best connected – the coefficient of variation as an indicator of mono/polycentric structure ▪ Network density – Number of public transport connections[5] to the three large centres that are best connected – the sum of the values as an indicator of the town's integration into the urban network

As regards inner potential, the historical importance is defined by two variables – town status and the role of small centre during the period of socialist central planning. While the town status stems from a significant role of a particular centre in the deeper history, the socialist period had an impact on urban system hierarchy especially by defining centres for rather planning and ideological purposes (Malý and Mulíček 2016). Tourist attractiveness is measured by the number of accommodation facilities. Position of small centres within the urban system include, besides

[4] to the date: 18 March 2015

[5] to the date: 18 March 2015

the evaluation of rural character of centres and their peripherality, also the importance of small centres at higher geographical scale by measuring their interaction with large centres in the region. While the existence of out-commuting flows to higher-ranked centres are common to most of small centres, in-coming flows of work commuters from large centres to smaller municipalities in their hinterland present more sporadic aspect of spatio-functional dynamic of territories. In this sense, share of work commuters from large centres in the total number of employees in a particular small centre is the variable assessing the importance of small centre within the network of large centres. The level of crude net migration rate is examined in order to explore whether the increase of population size (suburbs) have a positive or negative impact on the service function. The access to transport infrastructure is based on the accessibility of motorways and public transport, the characteristics of functional polycentricity and network density reflect plurality of choices and the overall provision of public transport connections respectively (preconditions for borrowing size).

The mutual relationship between spatial characteristics and service function centrality of small centres is evaluated by using a multinomial logistic regression which is able to predict a dependent variable given one or more independent variables. The relative values of the index of service function centrality were classified into three categories (high centrality, medium centrality, low centrality) which serve as the dependent variable. The variables focusing on spatial characteristics of small centres are predictor (or independent) variables. The main aim is to better understand the relationship between spatio-functional context and service function centrality of small centres. In other words, regression analysis can provide an important information if there are variables that increase the probability of having higher service function centrality than other similar-sized centres. Variables were checked and corrected in order to meet all assumptions that are required for multinomial logistic regression to give us a valid result where it was necessary. Regression analysis is conducted for the entire region and Brno metropolitan area (BMA) separately in order to reflect stronger interactions and specific dynamic of the closest hinterland of the regional capital Brno. The main findings are presented in the next section.

4. Empirical findings

The final number of small centres in the South Moravian Region, which stems from the methodological procedure described above, is 113. In contrast with the rest of municipalities, these small centres may act as local or micro-regional centres since higher service function is assigned to them. In general, provision of services is characterized by a strong spatial differentiation in the South Moravian Region (see Fig 3). While the urbanized parts of the territory (medium-sized towns and the city of Brno) keep higher-ranked services and thus the highest values of service function centrality, small municipalities situated mostly in western rural part of the region are distinguished by very low values of service function centrality. In these rural areas, small centres are very important places that provide basic services for their hinterland but also the places that are not able to satisfy human needs when higher-order services (specific culture, social, and health care facilities) are taken into account.

Small centres in the South Moravian Region represent only marginal part of the territory if the number of municipalities is considered (approximately one sixth of municipalities). The vast majority of settlements are small municipalities with less than 3,000 inhabitants. Besides BMA, mostly rural municipalities are functionally dependent on local centres. In general, the average absolute value of the index of service function centrality of small centres is greater when the population size increases (as “Central Place Theory” suggests). However, if centres are to be compared by using the relative values of service function centrality, different results will be gained. In other words, relativizing the absolute value by the number of inhabitants allows us to mutually compare the values of the index between municipalities (belonging to small centres) with different size. The relative values give us a clearer picture of actual service function centrality since they are able to say that, for example, service function centrality of a centre A (in absolute terms lower centrality than centre B) is higher within the framework of similar-sized municipalities, than if we have a look on a position of a centre B within a distinct group of municipalities characterized by similar size to the centre B. In this context, it seems to be efficient to classify small centres into

particular population size categories in order to show that even similar-sized centres may differ by service function centrality to a great extent.

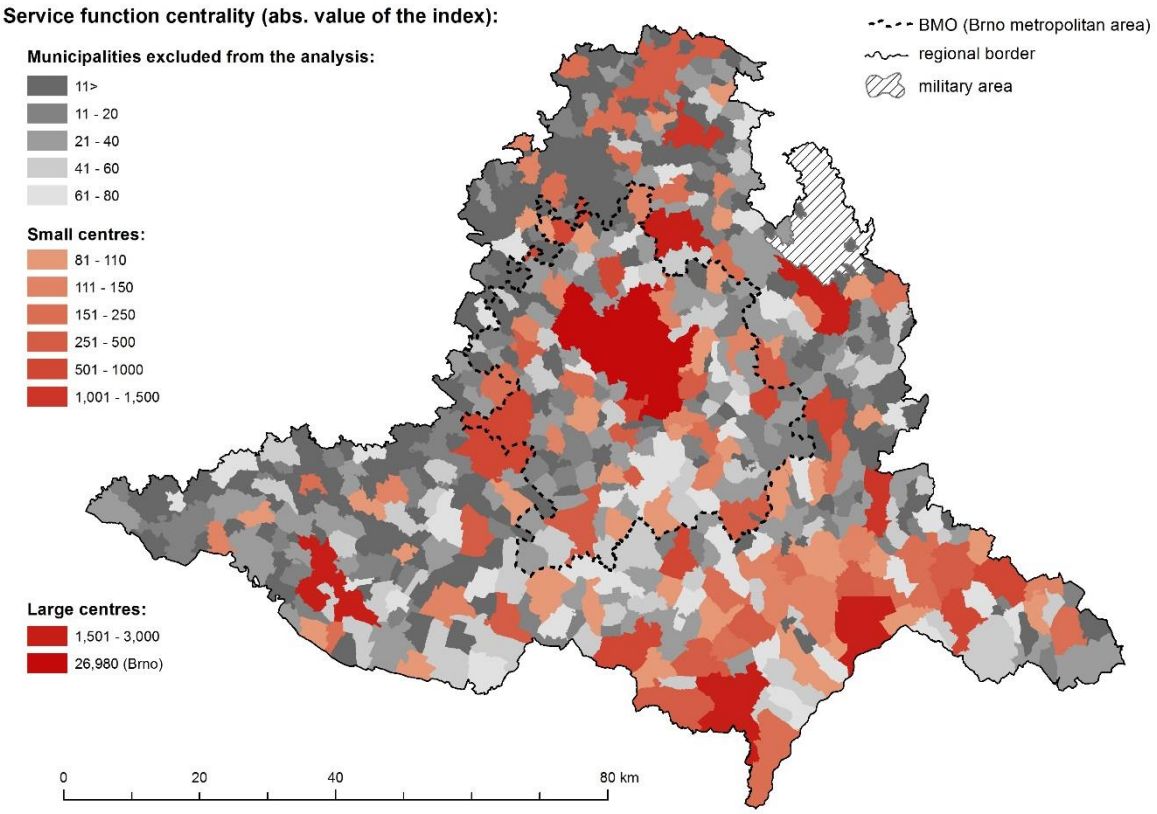

Fig 3. The index of service function centrality for municipalities in the South Moravian Region. Source: Data collected from The South Moravian Region (2012); Czech Statistical Office (2013); Banky (2015); Czech Post (2015); CzechPoint (2015); author's processing

Tab 3. The index of service function centrality for small centres in the South Moravian Region. Source: Original data collected from The South Moravian Region (2012); Czech Statistical Office (2013, 2016b); Banky (2015); Czech Post (2015); CzechPoint (2015); author's calculation

Municipalities				The index of service function centrality				
Population category (2015)		Number		Average		Max. (rel.)	Min. (rel.)	Coefficient of Variation (rel.)
		abs.	rel. (%)	abs.	rel.[6]			
370,000 <		*1*	*0.1*	-	-	-	-	-
20,000 - 35,000		*5*	*0.7*	-	-	-	-	-
Small centres	9,000 - 11,999	5	0.7	877	7.9	10.3	5.5	27.0
	6,000 - 8,999	7	1.0	549	7.6	11.0	4.6	31.3
	4,000 - 5,999	12	1.8	386	7.5	11.9	3.9	36.5
	3,000 - 3,999	17	2.5	213	6.0	12.1	2.4	44.6
	2,000 - 2,999	31	4.6	154	6.2	12.9	3.7	34.3
	1,000 - 1,999	29	4.3	111	8.0	16.2	4.8	35.4
	600 - 999	12	1.8	109	14.2	30.6	9.7	38.8
non-central		*559*	*83.2*	-	-	-	-	-

[6] The index of service function centrality per 100 inhabitants

Each population category is composed of centres with different levels of centrality and thus the inner variability of centrality for each category is significant (see Tab 3). According to the results, the maximum value of relative service function centrality in the lowest population category (30.6) is even greater than the maximum value within the “largest” of small centres (10.3). This is in accordance with a previous example about centres A and B. Together with the information provided by the coefficient of variation we can observe that each population category of small centres is characterized by the presence of centres providing diverse spectrum of services and different number of particular service facilities.

Based on the inner variability of service function centrality of similar-sized centres we can state that the population size can serve only as a general indicator of the urban function and it is unable to explain differences regarding towns of comparable population size. The relative values and variation measures give us a reason to perform a regression analysis which is able to evaluate association between the service function variability and independent variables (spatial characteristics). In the case of all small centres, there are couple of factors affecting the levels of service function centrality. As regards logistic regression model for medium service function centrality (see Tab 4), small centres with stronger tourist attractiveness situated rather in peripheral areas in terms of low population density and greater distance to the nearest large centre are more likely to keep the medium centrality than the low. This model applies to centres with high centrality as well. In this case, service function is based even more on tourist attractiveness and the importance within the network of higher-ranked centres plays also a significant role. The model shows that the odd of having higher service function increases when a particular centre has a strong functional linkage with a higher-ranked centre, i.e. small centre attract large number of commuters from a nearby large urban centre. Although the existence of in-coming flows seems to be a logical precondition for growth of the service function, the model points to a fact that especially the flows originated in large centres have a crucial impact on service function centrality of small centres. Considering the odds ratio value of the access to the nearest motorway is very close to 1, position towards motorway infrastructure does not have a considerable effect on service function centrality.

According to the results of regression analysis for all small centres, it can be claimed that variables of historical importance do not have an impact on service function centrality. In other words, being a town or a centre supported by centrally-governed state during the socialist era does not necessarily mean that a particular centre still keeps also higher level of service function. Similarly, the variables indicating rural and suburban character of small centres are not associated with service function centrality when the entire region is analysed. Based on the results, interaction potential of small centres expressed by functional polycentricity and network density does not represent a significant variable. The service function is therefore not affected by the quality of public transport connections to large centres which is the factor entering the analysis as a potential precondition for borrowing size effect.

Spatial pattern of the relative values of the index of service function centrality for small centres helps to imagine the results of regression analysis in a real territory (see Fig 4). The resulting spatiality of service function centrality together with the spatial characteristics of small centres suggests the existence of towns suffering from lying in the shadow of a larger centre (in terms of the own service functions) as well as towns benefiting from the proximity of higher-ranked centres and their workforce and borrowing size from larger urban centres. Small centres situated in the southwestern (e.g. Jevišovice, Mikulovice, Šumná) and the northern part (e.g. Lysice, Olešnice, Nedvědice) of the region as well as those located close to the BMA southern borders (Hustopeče, Klobouky u Brna), which is the area further away from large centres, represent municipalities whose high levels of service function centrality stem from their peripheral position where they serve as local centres. On the contrary, service function of small centres near Brno, Hodonín and Vyškov is lowered by the proximity of higher-ranked centres. Municipalities with the highest service function centrality are places with a strong tourist attractiveness. In this case, a location within an urban system is not so relevant. These are rather independent spatial units with a strong inner cultural and economic potential (e.g. Mikulov, Valtice, Lednice in the south; Vranov nad Dyjí in the southwest). Some of small centres situated in a close proximity to agglomerations of large urban centres are able to borrow size. A strategic location of centres

Modřice and Rajhrad (south from Brno) or Chvaletice (south from Znojmo) is the main reason for still ongoing intensive commercial suburbanization taking place in these areas which contributes to higher levels of the service function.

Tab 4. Logistic regression model for the factors (independent variables) affected service function centrality of small centres in the South Moravian Region and BMA. Note: Bold coefficients are statistically significant. Source: Original data collected from The South Moravian Region (2012); Czech Statistical Office (2013, 2016a); MFČR (2013); Banky (2015); Czech Post (2015); CzechPoint (2015); author's calculation

Independent variables	All small centres		BMA small centres[7]	
	Exp(B)	Sig.	Exp(B)	Sig.
Medium centrality				
Historical importance - town status	2.278	0.304	-	-
Historical importance - socialist centre	0.617	0.571	-	-
Tourist attractiveness	**2.202**	**0.007**	1.253	0.199
Rural character	1.007	0.942	-	-
Peripherality - density	**0.579**	**0.038**	1.114	0.623
Peripherality - distance	**1.190**	**0.011**	**1.270**	**0.024**
Importance for higher-ranked centres	1.530	0.178	**2.190**	**0.000**
Suburban character (net migration)	1.504	0.122	**0.678**	**0.016**
Access to the nearest motorway	1.039	0.186	0.993	0.893
Functional polycentricity	0.887	0.582	1.152	0.305
Network density	1.237	0.456	1.470	0.038
High centrality				
Historical importance - town status	2.996	0.258	-	-
Historical importance - socialist centre	0.804	0.829	-	-
Tourist attractiveness	**3.075**	**0.000**	**2.159**	**0.001**
Rural character	0.999	0.994	-	-
Peripherality - density	**0.522**	**0.033**	0.666	0.233
Peripherality - distance	**1.288**	**0.002**	**1.489**	**0.020**
Importance for higher-ranked centres	**3.936**	**0.001**	**2.279**	**0.008**
Suburban character (net migration)	1.406	0.259	0.776	0.316
Access to the nearest motorway	**1.077**	**0.027**	0.898	0.185
Functional polycentricity	1.052	0.843	0.809	0.336
Network density	0.982	0.959	**2.537**	**0.001**
N (cases)		113		166[8]
- 2LL		175.396		247.803
Nagelkerke R Square		0.529		0.479
Percentage Correctly Estimate		64.6%		64.5%
Reference Category				*Low centrality*

Regarding BMA, high service function centrality is closely related to the position of a particular municipality within the urban system network. If a municipality is sufficiently connected to other large centres (especially Brno) by public transport and attract commuters from the core city, service function centrality will more likely increase. Simultaneously, the service function tends to be higher when tourist potential increases and when a municipality is situated further away from

[7] Variables of historical importance and rural character are excluded because of their irrelevance in the case of BMA.

[8] Regression analysis for BMA includes all municipalities in order to ensure a sufficient sample size.

Brno. While certain municipalities profit from being a part of BMA, some centres in the Brno hinterland host less service facilities compared to other similar-sized municipalities within BMA. An agglomeration shadow of Brno affects municipalities that are located in the immediate neighbourhood of Brno and partially municipalities that have experienced a growth of population in recent years due to the process of residential suburbanization not supported by adequate increase of a number of service facilities (only when medium centrality is compared to low centrality; the case of e.g. Kuřim, Šlapanice, Mokrá-Horákov). However, the city of Brno provides a wide spectrum of urban functions substituting a lower service function of small centres to a great extent.

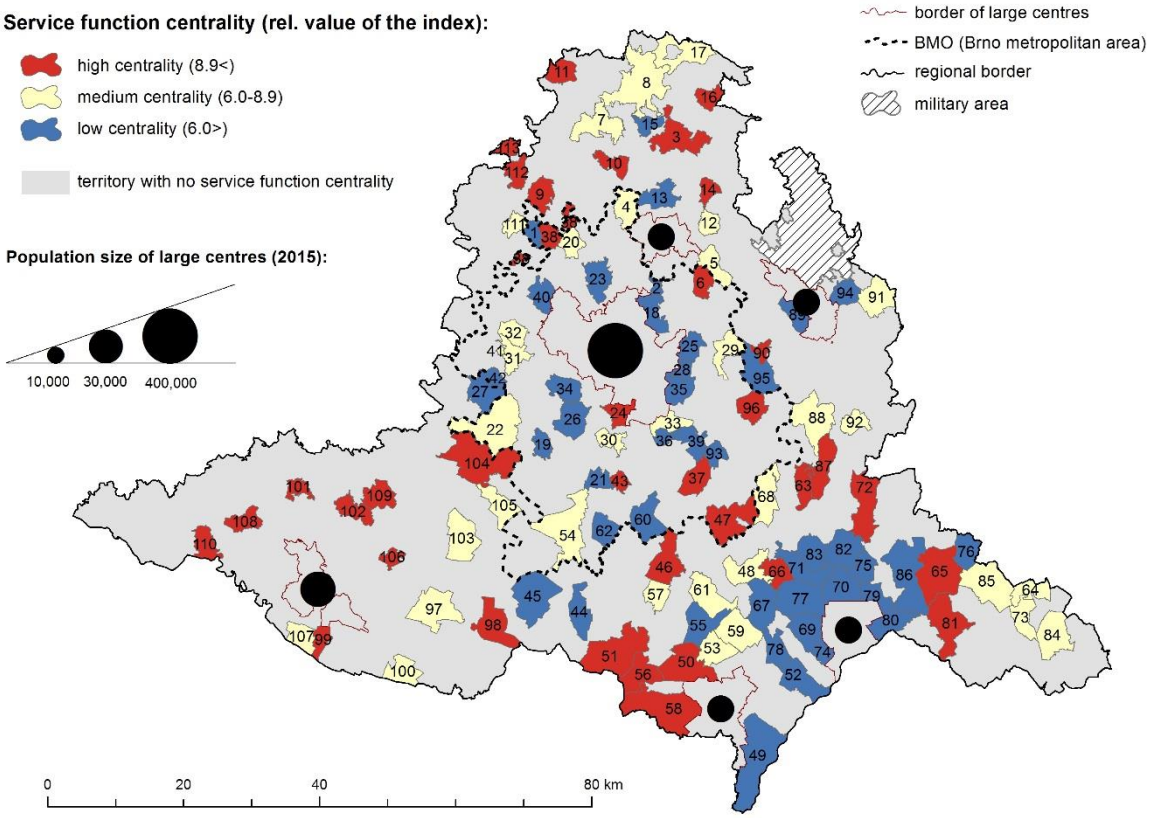

Fig 4. Relative values of the index of service function centrality for small centres in the South Moravian Region. Source: author's processing

1-Předklášteří, 2-Adamov, 3-Boskovice, 4-Černá Hora, 5-Jedovnice, 6-Křtiny, 7-Kunštát, 8-Letovice, 9-Lomnice, 10-Lysice, 11-Olešnice, 12-Ostrov u Macochy, 13-Rájec-Jestřebí, 14-Sloup, 15-Svitávka, 16-Šebetov, 17-Velké Opatovice, 18-Bílovice nad Svitavou, 19-Dolní Kounice, 20-Drásov, 21-Hrušovany u Brna, 22-Ivančice, 23-Kuřim, 24-Modřice, 25-Mokrá-Horákov, 26-Ořechov, 27-Oslavany, 28-Podolí, 29-Pozořice, 30-Rajhrad, 31-Rosice, 32-Říčany, 33-Sokolnice, 34-Střelice, 35-Šlapanice, 36-Telnice, 37-Těšany, 38-Tišnov, 39-Újezd u Brna, 40-Veverská Bítýška, 41-Zastávka, 42-Zbýšov, 43-Židlochovice, 44-Dolní Dunajovice, 45-Drnholec, 46-Hustopeče, 47-Klobouky u Brna, 48-Kobylí, 49-Lanžhot, 50-Lednice, 51-Mikulov, 52-Moravská Nová Ves, 53-Podivín, 54-Pohořelice, 55-Rakvice, 56-Sedlec, 57-Šakvice, 58-Valtice, 59-Velké Bílovice, 60-Velké Němčice, 61-Velké Pavlovice, 62-Vranovice, 63-Archlebov, 64-Blatnice pod Svatým Antonínkem, 65-Bzenec, 66-Čejč, 67-Čejkovice, 68-Dambořice, 69-Dolní Bojanovice, 70-Dubňany, 71-Hovorany, 72-Kyjov, 73-Lipov, 74-Lužice, 75-Milotice, 76-Moravský Písek, 77-Mutěnice, 78-Prušánky, 79-Ratíškovice, 80-Rohatec, 81-Strážnice, 82-Svatobořice-Mistřín, 83-Šardice, 84-Velká nad Veličkou, 85-Veselí nad Moravou, 86-Vracov, 87-Ždánice, 88-Bučovice, 89-Drnovice, 90-Habrovany, 91-Ivanovice na Hané, 92-Nesovice, 93-Otnice, 94-Pustiměř, 95-Rousínov, 96-Slavkov u Brna, 97-Božice, 98-Hrušovany nad Jevišovkou, 99-Chvalovice, 100-Jaroslavice, 101-Jevišovice, 102-Mikulovice, 103-Miroslav, 104-Moravský Krumlov, 105-Olbramovice, 106-Prosiměřice, 107-Šatov, 108-Šumná, 109-Višňové, 110-Vranov nad Dyjí, 111-Dolní Loučky, 112-Doubravník, 113-Nedvědice

5. Concluding remarks

The spatial dynamic of the South Moravian Region is strongly dependent on the regional capital Brno which can be considered a focus of rather monocentric pattern of the regional urban system. Although small towns (labelled as small centres in the paper) represent rather marginal part of the total number of municipalities, their role as centres for many smaller and rural settlements is therefore of even greater importance. A distribution of basic as well as higher-ranked services (as a number of facilities) has been analysed in order to evaluate the relationship between the service function of small centres and their position within a specific urban system. In line with the "Central Place Theory" the services are spread in a territory according to their threshold and range reflecting their purpose and a hierarchical order of urban system. However, a large number of centres with similar population size differ in terms of their service function to a great extent.

The study confirmed the assumptions arising from both borrowed size and agglomeration shadow concepts. A provision of services is affected not only by the population size of towns but it is also related to other factors explaining the differences of the service function of similar-sized towns. Service function centrality of small centres is associated predominantly with their importance for higher-ranked centres (interaction based on work commuting flows), tourist attractiveness (accommodation facilities) of places, and position of small centres towards large centres and population density of their hinterlands. Based on the results of the regression analysis the main findings could be summarized into following points: the service function is higher in centres situated in more peripheral areas where other stronger centre is mostly absent, and those situated in urbanized areas and in a close proximity to urban agglomerations are more likely to lack sufficient service function centrality (agglomeration shadow effect); the service function of small centres in the suburbs of BMA depends on the axis of the development of commercial zones, where small centres with higher service function centrality are located (borrowing size effect); being networked with large centres has a positive impact on service function centrality of small centres in BMA (borrowing size effect); the service function is higher in centres characterized by tourist attractiveness (fulfilling inner potential).

The service function of rather peripheral centres with higher tourist potential is high despite these centres are not well embedded in regional network. On top of that, their centrality is not exposed to competition of other centres. In this context, the areas of a higher concentration of small centres are characterized by persistent hierarchical structure. The smallest municipalities provide only basic services and commuting to other larger centres is necessary. Regarding BMA, the most of towns in a close proximity to the main urban centre (Brno) do not borrow size in terms of the service function which is in accordance with findings by Meijers et al. (2015, p. 15) that "being well embedded in regional networks generally does not translate into a higher level of metropolitan functions". Although some of these centres experience population growth due to the process of residential suburbanization, their service function remains lower because of the competitive advantage of the nearest metropolitan centre. Using subdivision of borrowed size made by Meijers and Burger (2015), such centres "borrow performance" (positive net migration in suburbs) but remain underserviced by selected functions. However, metropolitan functions can be observed in centres attracting commercial activities and work commuters from large urban centres. These centres are able to "borrow functions" since they host more functions than other similar-sized municipalities.

The service function deficit in centres affected by an agglomeration shadow is compensated by urban functions in a core city. A more frequent service-related commuting to the urban centre is an integral part of spatial-functional dynamic between the core and its hinterland. An evaluation of (dis)advantages stemming from such spatial configuration should reflect different levels of individual mobility as well as the access and ability to use technologies (transport, telecommunications, broadband access) that are crucial in production of socio-spatial relations. Centres with insufficient service function resulting from agglomeration shadow effect very often borrow performance (in terms of population growth). Hence, as Meijers and Burger (2015) point out, the debate about the concepts of borrowed size and agglomeration shadow should not lead to a dichotomous separation of both phenomena but rather to their interdependence and mutual conditionality. The results show that the complementarity of urban functions within the metropolitan area largely explains the relationship between the both concepts which verifies

the assumption suggested by Burger et al. (2015, p. 1104) that „perhaps a place faces an agglomeration shadow in one respect, but borrows size in another". While in the context of a metropolitan area a potential complementarity can be found between residential function and provision of higher-ranked services (specific cultural and social care facilities), rural areas with higher concentration of similar-sized small centres are characterized more by local specifics (spatial, physical, social) affecting mutual relations which probably mostly take form of an urban competition. However, an underlying mechanisms standing behind different forms of cooperation and competition need to be further investigated, preferably involving urban systems with preconditions for polycentric arrangement.

Acknowledgements

This work was supported by the specific research project MUNI/A/1315/2015 „Integrovaný výzkum environmentálních změn v krajinné sféře Země".

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