

Global integration versus polycentric approach in the Central European urban structure

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Abstract

The paper focuses on the urban hierarchy of Central European cities with a twofold approach: it compares the urban hierarchy based on the concentration impacts of global economic development (taking advanced producer services as indicator) and the urban hierarchy based on the polycentric approach.

The paper studies how the cities of Central Europe can be integrated into the global networks of advanced producer services, what kind of spatial structural impacts they have, and how it affects the position of the cities in the region. Hundred advanced producer services working in the field of management consultancy and accountancy identify seventy-nine cities in sixteen countries of Central-Europe as an empirical base for the study. The APS indicator is developed according to their locational status, nodal value and relational matrix (Taylor 2001). On the other hand, I study the same sample of cities according to polycentric indices, and identify the urban hierarchy accordingly.

The paper discusses - based on the empirical evidences - what are the implications of global economic and polycentric development approaches in the sixteen countries identified as examination area for the purposes of this study, where are the centres identified by the different approaches, and what are the underlying factors. The paper also offers an answer to whether the region has remained homogeneous, if certain cities could close the gap with Western European cities, and if certain cities form new peripheries as a consequence of being unable to integrate into the global processes.

Keywords: advanced producer services, urban hierarchy, Central Europe, polycentric development

INTRODUCTION

Along with the strengthening of the globalization process since the 1980s, the role of the cities becomes ever more important. In the last 35 years a transnational urban network has developed worldwide, where the economically strongest cities of the global economy form the nodal points. These cities as nodal points have a central role in the flows of international networks of capital, information and labour, and thus gain even more powerful positions. In this respect, it is important that the position of these cities is not defined by their connectedness to their surroundings, but rather by the speed and depth of their integration into different networks. Global cities are normally not embedded into their region, the focus of their relationships fall out of the geographical space physically surrounding them (De Vos et al., 2012).

There is a huge development gap among the regions of the European Union. Differences between the Western and Eastern subregions are significant, but there is also a huge gap within the Eastern sub-region, between the Central and the South-Eastern sub-regions. The European Union is able to represent an economic and political power in the global world only in cases when there is balanced development in the European Union countries and the neighbouring countries. The member states declared first time in the European Spatial Development Perspective (ESDP 1999) that focus should be given to the strengthening of the spatial awareness of development policy. Incentives for polycentric urban network development and levelling the urban-rural relationships were identified as instruments for balanced development. In order that the European Union preserves and strengthens its world economic positions, and remains a decisive actor in the global power structure, the EU should avoid significant inner peripheries within its territory, outstanding economic performance should be spread among several centrum areas, and not just the so called Pentagon area as it characterises the EU territory at present. The main development centre is bordered by London, Paris and Milan. The regions outside this central space are significantly lagging behind in development.

The research focus shifted to the functional characteristics of cities in the 1990s. Researchers aimed at studying primarily the connectedness of European cities to the global urban network, and pulled attention to the importance of international urban network relations. At the same time national urban networks lost emphasis in the research agenda. The model of specialized urban networks is related to this agenda, which is characterized by common patterns of material or non-material products, like exchange processes of commerce, or analysing economic, financial or scientific networks (Hall 1992). A strongly related, but independent model is that of the cooperations among capital cities, or stating it in a wider scope cooperation networks of central cities with political and/ or economic power. The interactions among these nodal points of urban networks are the most intense in their volume.

During the 2000s when development goals had already been adapted to development processes, the process of globalization was also reflected in the urban network development policies and goals. The European Union put emphasis on the main metropolises where economic and innovation capacities are concentrated. Metropole regions are getting integrated to the global urban network, and the polycentric urban network development goal should be implemented on the level of small and medium sized cities (Leipzig Charter, 2007). As the larger cities are the venues of the majority of economic performance, some large cities could become key actors in the international economic processes and thus joined the global urban network. The main challenge is to avoid the split of the European urban network regarding the metropolises and the small and medium sized cities.

The paper intends to provide empirical analyses for the above statements by comparing two different urban network development policies and identifying the similarities and differences. The two development approaches are the global economic cooperation approach based on the networks of advanced producer services and the polycentric urban network development involving sixteen countries from Central Europe. For the global economic development approach the paper studies the networks of advanced producer services present in the Central European macro-region identifying 79 cities in the region, and identifying an APS location index indicating the location strategies of consultancy and accountancy companies present in the global economic processes. Further analyses were focused on the sample of these 79 cities, for which also a polycentric index is calculated. For the polycentric index the reference point is the index system of the ESPON (2006) project, but with adaption to the city level also paying attention to availability of data. Final part of the paper analyses the results, conclusions and justifications of the two different development approaches.

The examination area referred to as Central Europe in the paper includes the following countries: Hungary, Czech Republic, Slovakia, Poland, Austria, Slovenia, Croatia, Romania, Bulgaria, Moldova, Serbia, Kosovo, Montenegro, Macedonia, Bosnia-Herzegovina, Albania.

CENTRAL-EUROPEAN URBAN HIERARCHY BASED ON THE LOCATION DECISIONS OF ADVANCED PRODUCER SERVICES

It can be stated that the number and complexity of business transactions has multiplied in the process of economic globalization, which contributed to the growth of the complexity and volume of central functions of multinational companies. This resulted in the extension of advanced producer services. Another important impact of globalization is that the service intensity of industrial production activities also significantly increased, which multiplied the demand for services (Johnson, 1998). Cities are usual venues of service development and provision,

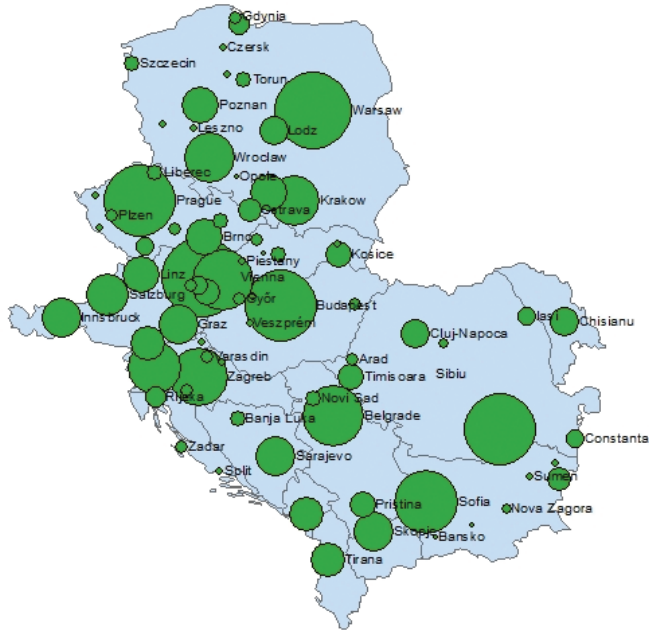
and economically stronger, more competitive cities are in better positions with advanced producer service location decisions (Taylor 2001, Sassen 1991). At the same time service extension taking place up to present takes place not only at the top of urban hierarchy, but on every level of national urban networks. Some cities only appear in the regional markets and others in the national and international markets, while the group of cities on the global scene are highly concentrated and it includes only some capital cities in the Central European macroregion. Researchers study the geography of advanced producer services since the beginning of the 1990s (Daniels és Moulaert, 1991), the methodology examining urban network cooperations and their relatedness based on advanced producer services was elaborated by Taylor and his research group (2001). The success of service providers is usually determined by their locations and which cities they choose to include in their networks.

Further examinations are carried out based on 100 advanced producer services, out of which 64 have a Central-European office. The 64 APS networks are present in 79 cities in the examined macroregion, and further analyses are based on a sample of these cities. As regards the consultancy companies, the list is based on the widely accepted rankings of Forbes, Vault and the Global Consulting Network.

The altogether 79 cities include all of the cities above 500,000 inhabitants, but only 39 cities out of the 91 cities with inhabitants totalling between 100,000 and 500,000 host an APS office. In case of cities with 50.000 – 100.000 inhabitants 13 cities are included in the sample out of the 149 cities, and 9 cities with a population lower than 50.000 are involved. This already reflects that the APS location decisions are influenced by the special characteristic of the Central European urban network and the lack of the medium sized cities as defined in Western Europe (above 500,000 inhabitants). In case of cities with 100.000 – 500.000 inhabitants a concentration can still be seen, however in case of cities with lower population number it is not the size of the city but other special features that primarily attract APSs.

The impact of advanced producer services on cities, city hierarchy can be examined from three aspects: presence, service value of the city and the connectedness of the city into the network. The complex index was calculated with the summarizing of the three part-indices with an even weight. The APS location index expresses the location strategy of advanced producer services in Central Europe. In the next part of the paper the analyses of the APS index follows and will also be applied for the comparison with the polycentric index.

Figure 1.: APS index of Central-European cities



Source: own editing based on data from webpages of advanced producer services

The location strategies of the advanced producer services identified 34 cities where there are at least five APS networks present, which already indicates a concentration of APS networks in a city. These cities can be regarded as cities at the top of the Central-European urban hierarchy from this aspect. A strong hierarchical relationship can be seen regarding the integration into the global and to the different regional level processes. The figure shows the outstanding position of the capitals of the economically stronger countries. Based on the examinations Moldova, Albania, Montenegro, Kosovo, Macedonia and Bosnia-Herzegovina can be regarded as marginal countries (not a periphery, but only included through their capital cities). There is also a strong hierarchical order among the ten most powerful capitals. Vienna, Warsaw, Prague, Budapest and Bucharest are at the top, but Sofia, Bratislava, Belgrade, Ljubljana and Zagreb have already fallen behind. Kraków, Wrocław and Salzburg emerge from among the secondary cities and precede Sarajevo, Skopje, Podgorica and Tirana among the capital cities, and also the other Austrian regional centres and Brno. This group represents 30% of the cities in the sample, and reflects the strong hierarchical order among the cities


in the macro-region regarding the integration to global or different regional level cooperations. Only one-third of the examined cities are able to join a regional level network cooperation of advanced producer services. Pristina and Kisinyov, the economically weakest capitals and other secondary cities are lagging behind. The weakest 22 cities (28%) appear only marginally in the location strategies of advanced producer services. However, this group has a great significance, these cities ensure that no new peripheries occur in the macro-region.

Legend

APS



0,5

 Countries selection

An expressive data example for the high concentration of APSs is that Salzburg with the second highest Austrian APS index value after Vienna has a value of 29% of Vienna's value. Concerning the secondary cities, the high ranking of the Polish cities are not surprising regarding the size of both the country and of the cities, and also their metropolis status. The secondary cities fulfil an important role in cases of several countries, like Brno, Cluj Napoca, Timisoara, and with a less important role Kosice and Varna. The role of the secondary cities is more marginal in the case of Hungary, Slovenia, Croatia and Serbia. In the case of Moldova and the other Western-Balkans countries, only the capital is involved in the sample (Banja Luka's involvement is justified by its secondary capital function.).

The results of the examination support the fact that mainly the capital regions and further metropole regions are able to get integrated to the global urban network. The lack of medium-sized cities with Western European definition limits increases the group of cities that are capable of joining. Although there is no periphery on the level of countries, there is a significant difference among the secondary cities regarding their positions and geographical locations. An important question regards the role of geographical distance in the location decisions of APSs. The analyses show that geographical proximity has a negative impact on the position of cities. Bratislava is an expressive example, its proximity to Vienna, Prague and Budapest has a contra-effect on the location decisions of APS networks, and thus its weight is weaker than that of the other Visegrad capitals. However, the ranking of Sofia is outstanding, it also precedes Bratislava, which is rather justified by its geographical location than its economic performance. On the level of secondary cities the position of Salzburg and Graz is interesting. Geographical proximity of Graz to Vienna offers a better position for Salzburg regarding the location decisions of advanced producer services. To sum up, the Central European macro-region could join the global structures via Vienna, Warsaw, Prague, Budapest and Bucharest in recent decades and advanced producer services were able to identify cities with economic potential, which thereby led to a minor modification of the urban hierarchies in the macroregion.

CENTRAL-EUROPEAN URBAN HIERARCHY BASED ON THE POLYCENTRIC INDEX

The Urban Agenda 2020 approved as Amsterdam Pact in 2016 also confirms the intention of polycentric development in coherence with the ESDP. The territory of the European Union is very diverse socially, economically, culturally, regionally and historically, and the development of the whole settlement structure is significant for the future position of the European Union. The majority of emerging challenges is local in its scope, however solution can only be provided with a wider spatial cooperation. It also means that the solution of a local problem may provide positive impacts for the wider surrounding of the city as well. Emphasis should be put on cooperation of cities and on the strengthening of urban - rural relations for this reason.

Along with the modification of the ESDP, the Urban Agenda of the European Union applies a twofold approach regarding the development of the European urban network. While large cities, mainly metropolises can join global economic cooperation networks, small and medium sized city networks need more of a polycentric development approach. Strengthening of the network of small and medium sized cities contributes to a strong relationship with its region and thus the split of urban network and the development of new peripheries can be avoided.

Examinations related to advanced producer services show that 51 cities in 16 countries of the macroregion could become an APS location hosting more than one APS network, and further 28 cities could join the cooperation network of the global terciar sector mainly through an accountancy network office. This also means that only a small sample of the cities of the macroregion ensure the connectiveness to the European and global urban structures, but they do not contribute to the balanced development of the cities of Central Europe. It is important to emphasise here that polycentricity is not a goal in itself, but rather an instrument for reaching economic competitiveness, social cohesion and sustainable development (ESDP 1999).

Without inciting polycentric development a strengthening concentration would occur, as it has happened since the beginning of the 1990s (Illés 2006, Szabó 2005). Enduring advantages in competitiveness concentrate geographically, and metropolises become centres of economic development. Metropolises dispose on several economic advantages resulting from concentration, like positive local externalities, agglomeration advantages, economies of scale, and positive spillover effects of knowledge. Naturally, negative impacts also occur, e.g. crowdedness causes higher costs, there is more pressure on the environment, lack of labour in the metropolises and underutilised potentials in the peripheries (Faragó 2006). The theory of polycentric development aims at balancing these positive and negative impacts through influencing the spatial aspects of economy and through strengthening the spatial awareness of development policy. More instruments exist for influencing the spatial processes of the economy, but it is

evident that large cities and metropolises have a key role in the production of GDP. Small and medium sized cities can gain position in case developments are spread regionally on several centres, and development policy ensures accessibility of services in these centres. The size of the network with several nodal points should reach a critical mass and the main instrument is multilevel hierarchical network development in this respect (Espon 2006). Thus the distribution of economic and economically relevant functions occur over the urban system where several urban centres gain significance.

In order to interpret polycentricity all functions defining a city's role should be identified. One of the main characteristics is the population number and prospective demographic tendencies. Other relevant factors influencing the position of a city in the urban hierarchy are the functions fulfilled by the city, public services, presence and number of public authority provided by the city. A further aspect is the city's economic power, if it has an industrial production base, logistic function, innovative - knowledge base function and a strong entrepreneurship. If these functions are concentrated in one, characteristically in the capital city, the urban structure is monocentric. In this case services (both public and profit-oriented) and regional management are supplied from one centre (Espon 2006).

Dimensions of polycentricity applied by the Espon research include weight, accessibility, public administration power, decision-making function, knowledge, industry, tourism. The paper identifies these dimensions as a starting point, however the exact indices are modified due to the examination level of cities and to availability of data. Thus the following data are applied for the calculation of the the polycentric index^{[1] [2]}:

Weight is calculated with population number (scale: cities with a population above one million, 500.000 - one million, 100.000 - 500.000, 50.000 - 100.000).

Accessibility: several factors: if a city is along an already functioning TEN-network, if it is a port city, the traffic of international airport (NUTS2 level data, however cities with an international airport can be identified).

Public administration weight: if it is a capital city, if it is at least a NUT3 seat.

Decision-making: cities with a seat of a multinational company based on the ranking of the TOP500 multinational companies of Central- and South-Eastern Europe by Deloitte (2015).

Knowledge: if it is a university city, share of students in tertiary education among the population of 20-24-year-old (% NUTS2 level), share of people with a

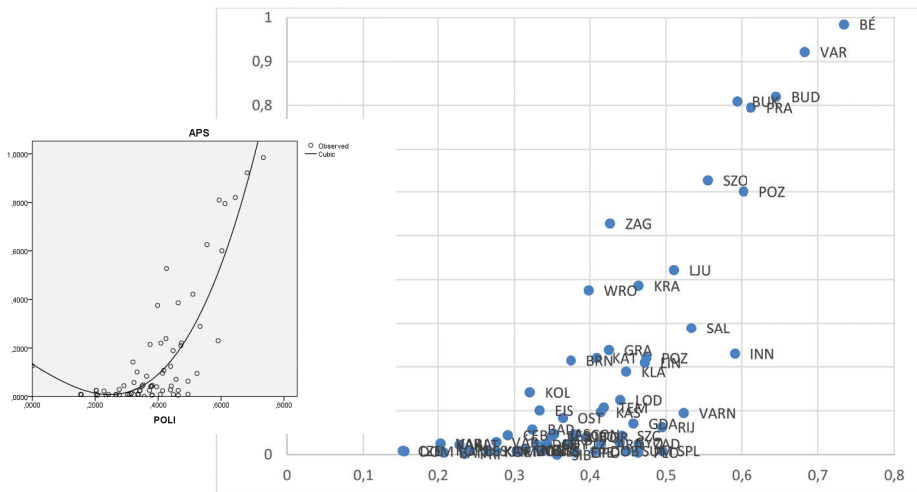
[1] Western-Balkan countries (Serbia, Montenegro, Macedonia, Kosovo, Albania, Moldova, Bosnia-Herzegovina) are not included in the sample because of missing data.

[2] The relatively higher minimum level can be explained by the fact that certain data of the knowledge and industry dimensions refer to NUTS2 level, thus the data of the city is distorted upwards. However this margin of error does not influence the ranking, only causes higher values for the lowest rankings.

Another important factor is that the geographical location of higher education institutions is not concentrated in the Central European macroregion and NUTS3 seats usually host a university or college, and that strengthens the social factors. In this respect the high ranking of Varna is to be mentioned on the same level with Bucharest and two Austrian regional centres, and also the relatively high ranking of Timisoara, Arad, Kosice and the Adriatic Croatian cities that all have a weaker economic performance. The lower position of Wroclaw, Brno, Plzen and Ostrava in the polycentric ranking is justified by these underlying factors with a weaker level of spatial organisational power of social factors. In this case, the stronger economic position of the cities was insufficient for countervailing the lower position in the polycentric methodology. Cities in the lowest positions in the ranking are also smaller in inhabitant number, their inclusion to the APS sample is justified by special factors. For this reason their weak position in the polycentric ranking is a natural symptom consequence.

COHERENCE OF APS LOCATION INDEX AND POLYCENTRIC INDEX

Figure 3.: Coherence of APS location index and polycentric index



Axis X: values of polycentric index, Axis Y: values of APS location index,
Source: own editing

Main results of regression analyses: R2 = 0,767, adjusted R2 = 0,756

$$Y = \beta_0 + (\beta_1 * t) + (\beta_2 * t^2) + (\beta_3 * t^3)$$

Coefficients					
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
POLI	-,794	,962	-,427	-,825	,412
POLI ** 2	,251	2,733	,110	,092	,927
POLI ** 3	3,681	2,379	1,141	1,548	,126
(Constant)	,133	,111		1,200	,234

The table shows the main results of non-linear regression analyses done with SPSS.

The above explanation is nuanced by regression analyses, and the main capitals of the macroregion show an outstanding performance both regarding the APS location and polycentric indices. The sample based on APS locations includes primarily cities that are at the top of their country urban hierarchy. This fact results in a correlation between the two types of examinations, the polycentric and the economic power analysis. At the same time, it can be stated that the connection is not linear, but tertiary. Flexible, gradually accelerating with a high correlation coefficient means that the higher the degree of a polycentric position a city has, the higher its potential will be for joining international economic integrations. Whether a city can exploit this potential, depends on its economic structure's diversity, and on the ratio of market performance within the overall economic performance of the city. The urban hierarchy of Central Europe based on the administrative structure is path dependent, the majority of cities in the sample fulfilled a significant role already in the second half of the 19th century. The analyses highlights that first of all those cities can be regarded as economically successful which can become part of international and transnational economic cooperations. Tourism as a special feature can highlight certain cities with favourable geographic locations, however city development based on only social factors cannot result the city's involvement into economic integrations.

Cities that are part of global economic cooperation function in a way that they are "split" up in their region as regards their participation in business networks, which results in the formation of new centres and peripheries. All cities hosting advanced producer services become part of urban network cooperations although on different levels, based on the number of APS networks presence, on their service value and on their network connectedness. This also means that integration into global business cooperations happens also on the level of small and medium sized cities that also function as nodal points of polycentric development. It is to be emphasized that these cities represent a new type of hierarchy as regards economic

network cooperations, however it does not result in integrated development of Central European urban network. Small and medium sized cities that are out of business cooperation networks fulfil central network functions as regards public administration and public services and are thus centers of polycentric development.

Based on the regression analyses APS locational index and the polycentric index raises different cities to the top of urban hierarchy. As regards the polycentric approach the social - economic factors represent a more balanced weight, this means that cities significant in the national urban hierarchy being NUTS3 seats but with a limited economic potential have a weaker position in the hierarchy defined by the APS locational index. At the same time these cities show a significant spatial organizational power in the polycentric approach. Capital cities are at the top of the hierarchy, while small cities that are involved in the sample with a special locational factor appear at the lowest segment in both aspects. Examples here are Timisoara, Arad, Kosice, Debrecen, Plovdiv, Split and important cities in their countries, but with a marginal position in APS locational strategies. Those cities that could not accomplish a successful economic restructuring in the 1990s or could not attract foreign direct investments, or where the main economic sector is the public sector could not gain a favourable position in the city competition for APS locations. It can also be stated that NUTS3 seat cities being economically successful and appearing as APS locations have a larger spatial organisational power in their relationships with their surroundings. Cities that are not able to become an APS location can only fulfil a marginal incentive role in the economic development of their surrounding region, and their spatial organisational role appear primarily in public administration and public service provision. Naturally, the small size of the countries also influences the number of cities that have the opportunity for integrating with APS networks, and that suggests a strong city competition. After the opening up in the 1990s economic processes were characterised by foreign direct investments, application of Western paradigms, export-oriented growth. This resulted in excessive dependence of FDI, banks and the Eurozone in most of the countries (Simai - Gál 2000). Naturally with a different emphasis in the different countries, but characteristically for the whole macroregion. The in-country market relations need more attention, as the in-country economic cooperation and growth opportunities are valorised. This economic policy approach can bring further medium sized cities into position and enable their integration to economic cooperation.

CONCLUSIONS

The paper studied two different urban network development concepts based on empirical data, and compared the results of the APS location index based on the location strategies of advanced producer services and of the polycentric index related to the urban hierarchy in the Central-European macro-region.

Advanced producer services decide upon the locations where economic performance is outstanding, the labour force is highly qualified and broadband accessibility is at stake (Sassen 2005). In examining the urban hierarchy based on the APS location, it can be stated that the sample includes all the capitals of the macroregion, all cities above 500,000 inhabitants, the majority of cities above 100,000 inhabitants and, among them, all metropolises (36 cities according to Eurostat methodology). All the countries of the macroregion host APS offices, although in cases of some peripherally located countries, the capital city is the only city chosen as the APS location (Kisinyov, Podgorica, Pristina, Tirana, Sarajevo). Mainly advanced producer services offering a complex service portfolio choose the capitals of these countries which contributes to the involvement of all the countries of the macroregion to APS networks thereby avoiding the formation of new inner peripheries. At the same time, it is important to state that the embeddedness of the sub-regions differ a lot.

Advanced producer services as an index for centers of gravity of the urban network have a twofold role: on the one hand they reflect the complex economic relations of the macro-region as consultant companies choose cities with high economic potential as office locations. On the other hand advanced producer services may have an incentive role towards the urban policy of the countries as APSs open offices only in cities with global or at least regional functions. Advanced producer services concentrate their capacities geographically, and cover a market from a certain low number of offices in a country based on their business strategy. If the critical mass of economic activity is present in a city, it becomes a potential venue for an APS which can further strengthen its regional economic role.

APS location decisions show a strong correlation with the monocentric or polycentric kind of the urban structure of the countries. The Central European urban structure is fragmented, there is no integrated urban network. Most of the countries are small countries regarding territory and population in European comparison (with the exception of Poland and Romania). Countries with a polycentric urban network host more APS offices in several cities, like in Austria, Czech Republic and Poland. APS location decisions reflect also the traditionally monocentric urban structure of some countries, like Hungary, Slovakia, Bulgaria. The accountancy networks offer opportunities for secondary cities in these countries for getting integrated into the APS networks, mainly with one presence (like Debrecen, Komárom, Veszprém in Hungary).

It can be stated as a conclusion, if monocentric structures became more resilient and cooperation strengthened between cities that are geographically

connected in neighbouring countries, APS locational decisions would adapt to the processes. A more intense cooperation among national urban networks could result in the increasing economic weight of the macro-region by attracting more advanced producer services. Currently the cities do not have cross-border impacts.

The distance of a city from the capital also appear as an important factor when talking about the opportunity for the formation of secondary centers. Service providers settle into regional centers in order to supply the national market. In Austria it was not just Vienna's geographical location, but also the morphological characteristics of the country that justified the development of secondary centers already in the previous centuries. Kosice is a secondary center in Slovakia, there is a Plovdiv – Varna development axis in Bulgaria, while in Croatia Split can fulfil the role of a secondary centre. These factors also appear in case of Poland and Romania as the size of these countries is outstanding and the advanced producer service market cannot be covered only from the capitals. In case of Poland an even distribution of cities with APS location can be seen in the Western and central parts of the country. It is important that a certain minimal critical distance is needed for the advanced producer service for opening up a new location besides the capital. This fact suggests that regional centres further away from the capital have a higher potential for concentrating APS consultancies. This justifies the higher APS index for Salzburg in Austria contrary to Graz, which has a higher economic performance. Geographical and morphological characteristics of a country are also significant location factors in APS location, although only as secondary factors besides economic performance.

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ANNEX

Table 1: APS locational index of cities

City	APS index	City	APS index	City	APS index
Vienna	0,9847	Presov	0,0062	Arad	0,0239
Graz	0,2385	Banska Bystrica	0,0429	Targu Mures	0,012
Linz	0,2098	Povazska Bystrica	0,0289	Sofia	0,6261
Salzburg	0,2891	Prievidza	0,0019	Varna	0,095
Innsbruck	0,23	Piestany	0,0075	Plovdiv	0,0052
Klagenfurt	0,1892	Warsaw	0,9219	Nova Zagora	0,012
Eisenstadt	0,101	Kraków	0,3861	Bansko	0,0052
Altenmarkt	0,0227	Lodz	0,1245	Sumen	0,0087
Baden	0,0577	Wroclaw	0,3755	Dobrics	0,0087
Budapest	0,8201	Poznan	0,2206	Kisinyov	0,1267
Győr	0,0277	Gdansk	0,071	Ljubljana	0,4218
Komárom	0,0075	Szczecin	0,0433	Murska Sobota	0,0091
Debrecen	0,0231	Katowice	0,2203	Zagreb	0,5276
Veszprém	0,0083	Torun	0,04	Koprivnica	0,0103
Prague	0,7951	Opole	0,0052	Varsdin	0,0256
Brno	0,2147	Bydgoszcz	0,0091	Rijeka	0,0631
Ostrava	0,0837	Czersk	0,0091	Zadar	0,0252
Liberec	0,0417	Leszno	0,0091	Karlovac	0,0252
Olomouc	0,0417	Zielona Gora	0,0091	Split	0,0091
Jihlava	0,0248	Gdynia	0,0239	Sarajevo	0,237
Plzen	0,0256	Bucharest	0,8095	Banja Luka	0,0408
Ceske Budejovice	0,0446	Cluj Napoca	0,1422	Belgrade	0,59
Karlovy Vary	0,0087	Timisoara	0,1075	Novi Sad	0,0431
Domazlice	0,0079	Iasi	0,0474	Pristina	0,1084
Bratislava	0,6006	Constanza	0,0458	Podgorica	0,1706
Kosice	0,0967	Sibiu	0	Skopje	0,2473
				Tirana	0,1801

Source: own calculation with application of Eurostat data, and data from the webpages of the advanced producer services

Table 2. Polycentric indices of cities

City	polycentric index	City	polycentric index	City	polycentric index
Vienna	0,73	Zagreb	0,43	Eisenstadt	0,33
Warsaw	0,68	Graz	0,42	Debrecen	0,34
Budapest	0,65	Timisoara	0,42	Baden	0,32
Prague	0,61	Kosice	0,41	Cluj Napoca	0,32
Bratislava	0,6	Arad	0,41	Nova Zagora	0,31
Bucharest	0,59	Katowice	0,41	Targu Mures	0,31
Innsbruck	0,59	Dobrics	0,41	Bydgoszcz	0,31
Sofia	0,56	Wroclaw	0,4	Murska Sobota	0,3
Salzburg	0,53	Torun	0,4	Ceske Budejovice	0,29
Varna	0,52	Olomouc	0,38	Povazska Bystrica	0,28
Ljubljana	0,51	Liberec	0,38	Karlovy Vary	0,27
Rijeka	0,5	Presov	0,38	Komárom	0,27
Split	0,5	Opole	0,38	Piestany	0,28
Poznan	0,47	Constanca	0,38	Leszno	0,24
Linz	0,47	Ostrava	0,36	Prievidza	0,23
Kraków	0,46	Brno	0,37	Altenmarkt	0,23
Plovdiv	0,46	Plzen	0,37	Bansko	0,21
Gdansk	0,46	Sibiu	0,36	Karlovac	0,2
Zadar	0,46	Iasi	0,35	Koprivnica	0,2
Sumen	0,45	Banska Bystrica	0,35	Varasdin	0,2
Klagenfurt	0,45	Jihlava	0,34	Domazlice	0,16
Szczecin	0,44	Gdynia	0,34	Czersk	0,15
Győr	0,44	Zielona Gora	0,34		
Lodz	0,44	Veszprém	0,33		

Source: own calculation with application of Eurostat data