How to Measure the Local Economic Impact of Universities? Methodological Overview

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Today, the realization that certain economic units, such as universities or other large tertiary educational institutions have an impact on the economy of their region has gained prominence. There is a growing demand for precise studies on the economic impact of such entities, and the issue has attracted considerable attention in the scientific community. The examination of their economic impact is especially interesting when we compare regions with different levels of development, characterized by a successful international university. The different methods used in the literature render comparisons difficult; therefore, our focus is to recommend a method for investigating universities in different countries. In the absence of regional input-output matrices, a multiplier based approach is suggested for the first and second mission (education and research), while the application of a set of indicators is recommended for the third mission (knowledge transfer-related). There are several substantial problems in assessing the economic impact of universities. First, the definition of impact; second, measuring and estimating first-round expenditures and avoiding double-counting; third, estimating the model parameters (e.g. multipliers); fourth, the quantification of third mission activities. In this paper, we clarify theoretical definitions, resolve some contradictions, and consequently, recommend a feasible method considering the circumstances in Hungary.

Introduction

In the modern globalized world, there is even stronger competition to obtain highly qualified workforce and create economically potent intellectual capital. The presence of a university *in a given territorial unit*[1] can create value in many ways: One type of value can be measured relatively easily, while for other types of values, we face several challenges. The first question we address is how universities affect the economy; then, we ask on what scale we can measure direct and indirect effects that would not be present if there was no university. The advantages of education primarily emerge in the long term, assuming graduates settle in the same place where they attended university. The results from research can also be sources of competitiveness, as long as they are utilized by the local economy. However, their impact is greatly influenced by the local context, hence some professional measurement methodologies may present general elements, but others may include context-specific features.

Our research question is as follows: *What methodological alternatives exist to measure the impact of universities on local economies? Which method is suitable for Hungary, and to what extent?*

The goals of this study are to review systematically such methodologies, to highlight the limits of the related literature, and to improve the measurement of the impact of universities.

This study is organized as follows: In the first chapter, we explore the literature on universities, mainly focusing on their advancement, their types, and their potential connections with the local industry and the government. In the second chapter, we address the diverse classifications of regional effects of universities, and we attempt to create a unified system of definitions. In the third chapter, we review both international and Hungarian empirical benchmarks, and we examine the methodologies used to quantify the economic impact of universities on local economy. The fourth chapter focuses on methodological suggestions, based on the limitations we identified in the previous chapters.

Function and mission of universities

According to Wissema (2009), universities advance from one generation to the other. Nowadays, most higher education institutions have the characteristics of second generation universities, and many are transitioning into third generation universities. While the main purpose of second-generation universities is education and research, the commitment of third generation universities includes the third mission: creating and maintaining partnerships with economic actors outside the university, absorbing the existing knowledge. The enhancement of a region's competitiveness can be

[1] Universities may create value all over the world, but we are only interested in local impacts. The definition of 'local' will be discussed later in this paper.

expected from third generation universities, in which the third mission has a central role, besides education and research (Lukovics 2010).

However, it is important to emphasize that today's higher education institutions are far more heterogeneous than the theoretical systematization in Wissema (2009) suggests. The order lines are not so sharp and obvious, but a number of third generation characteristics are present in today's higher education institutions.

Pawlowski (2009) writes about the 'fourth generation' universities, and examines their impact on local development. Second and third generation universities also influence their environment, but the purpose of fourth generation universities is to expedite significant changes in the environment, responding to the needs of a knowledge-based economy.

Lukovics and Zuti (2014) proposed a systematic classification of the four generations of universities (Table 1). The authors described the essence of the fourth generation universities as follows: both society and the economy are in a phase of globalization, and intensively use information technologies, where the strategic approach is a key feature. Besides discussing the three primary missions, the conscious and future-oriented development of the local economy is present as well.

Table 1

Characteristics of first, second, third and fourth generation universities

Aspect	First generation universities	Second generation universities	Third generation universities	Fourth generation universities
Goal	Education	Education and research	Education, research, and utilization of knowledge	Education, research, Research & Development & Innovation, utilization of knowledge, and proactive economic development
Role	Protection of truth	The cognition of nature	Creation of value added	Local economic accelerator, strategy determination
Output	Professionals	Professionals and scientists	Professionals, scientists, and entrepreneurs	Professionals, scientists, entrepreneurs, and competitive local economy
Language	Latin	National	English	Multilingual (national and English)
Management	Chancellor	Part-time scientists	Professional management	Professional management and local experts

Source: Based on Lukovics–Zuti 2013 and Lukovics–Zuti 2014.

Universities can be considered both catalyst and engine of the economy; they create strategic aims, operate in a multilingual environment, and require professional management and experts with experience in economic development.

To be able to measure the impact of universities on the economy, first, we need to define the types of activities we would like to measure. One possible way is addressing their missions, whose definitions and limits are surveyed in the following paragraphs.

Regarding the first mission of universities, Jaeger and Kopper (2013, pp. 3) provide a proper definition: '*the dissemination and diffusion of knowledge via tertiary education*'. These activities include BA/BSc, MA/MSc, PhD programs, contents of the program portfolio, and student mobility programs.

The second mission of universities covers all university-initiated and research-focused activities connected to basic research and researcher mobility programs. Jaeger and Kopper (2013, pp. 3.) define this as '*the generation and accumulation of knowledge*'; suggesting that even though knowledge is created within the second mission, it can spread to the first mission.

The third mission of universities includes '*all activities concerned with the generation, use, application and exploitation of knowledge and other university capabilities outside academic environments*' (Molas-Gallart and Castro-Martínez 2007, pp. 322.).

According to Bajmócy (2011, pp. 130), the third mission is '*the direct contact of universities with the economic and social actors. The fostering of the socially significant impact of university output*'. From these definitions, we can clarify that the third mission is closely connected to the business-related activities of universities.

The impact of the first and second mission can be measured with relative ease, as the necessary data can be obtained upon request. Despite this, in case of the second mission, we may face challenges, as the definition of the word 'research' is on the borderline between the second and third mission. Regarding the second mission, we refer to research activities that are initiated by the university and cannot be connected to an outside client. If research is initiated by an outside client but conducted within the university, it must be connected to the third mission. From this perspective, quantifying separately the economic impact of each mission is very challenging, as universities generally do not have information systems that could handle this categorization (Zuti–Lukovics 2014).

Another concern is that a number of studies identify the third mission with the third generation of universities, as if they were synonyms. Even though these two concepts are not the same, there is some overlap. Third generation universities offer more than simply adding the third mission to a second-generation university. Wissema (2009) provides a detailed comparison of first, second and third generation university characteristics.

The orientation of third generation universities is global, meaning that, if second generation universities are primarily active on local markets, third generation universities are characterized by an international presence. These institutions compete to obtain the best teachers, researchers, and students. This is a pillar of their development; however, it is not mandatory for second-generation universities that are only expanding towards third mission activities.

International second generation universities and third generation universities can be considered global institutions. One of their important characteristics is that the common language of all their lectures is English. The third mission of universities can be hardly attached to this third generation characteristic, as this mainly affects the education pillar, while they do not affect the execution of third mission activities, such as local, social, and economic actions.

In summary, despite the potential for third mission activities in a certain university, that institution cannot be considered a third generation university in all cases. A third generation university offers much more than the expansion of education and research with the third mission. The presence of third mission activities is necessary for a third-generation university; however, it is not a sufficient condition.

Net and gross; direct, indirect, induced, and catalytic effects

Johnson (1994) argues for the division of local and non-local impacts (it is better a choice on which territorial level we identify impacts (see Chapter 4 for details), and direct and indirect impacts; further, he refers to various negative impacts of universities, and the necessity of a net approach. For instance, individuals could spend more if the government did not tax them for the expenditure of universities. The double net question arises in the form of 'Where live people taxed for the expenditures of the university?' The question of gross or net impacts can be analysed from several perspectives. Generally, a gross impact is easier to define and compute, as calculation of net impact requires answering questions such as follows:

– In absence of university, where would its staff work, and in which occupation?
– In absence of university, where would students pursue their studies (if at all)?
– In absence of university, how large the level of knowledge in the local economy would be? To what extent is it different from the current situation?
– In absence of university, would house prices be lower and by how much?

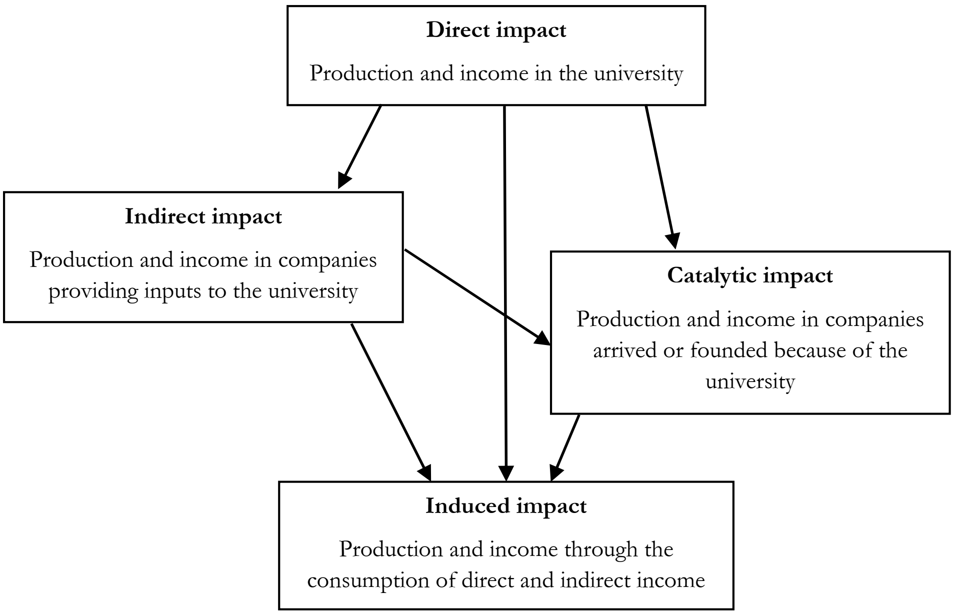
Further, these questions are linked to the territorial level we chose to focus on. The impact we are interested in can be observed when new universities are investigated: most academic staff is from other (national) universities, while non-academic staff can be hired locally. Local house prices change slowly, and only complex comparative analysis, such as panel regression analysis, can detect the impact of universities (Varga 2001).

The classification of the type of economic impacts depends on how the impact is related to the activity of universities, and it varies significantly in the literature. We can find twofold, threefold, and fourfold classifications, with contradictory names and contents. Our aim is to show the absence of a widely accepted classification in the studies focusing on the economic impact of universities.

A common feature is the separation of direct and indirect impacts, where direct impacts include the expenditure on staff and students. In larger classifications, we find induced impacts (Klophaus 2008), and catalytic impacts (Lukovics–Dusek (2014a) and Lukovics–Dusek (2014b) for university-related research; Dusek–Lukovics (2011) for business services). Figure 1 shows the modified version of these classifications for universities.

Figure 1

Direct, indirect, induced, and catalytic effects



Source: own construction.

In this figure:

– Direct impact: output, income and workplaces created on-site, owing to the investments and operations of the university;
– Indirect impact: income and employment generated in the companies providing inputs for the university;
– Induced impact: income and employment subject to the multiplier effect of spending such incomes;
– Catalytic impact: productivity growth achieved through the operation of the university, income, and employment created through the companies settling because of the university, and spending of the visitors arriving in the area because of the university.

The contradictory and, sometimes, misleading mélange of the existing classifications of the economic impact of universities is shown in Table 2, by juxtaposing the classification proposed by Garrido-Yserte and Gallo-Rivera (2010) and the alternative proposed by the French school, as in Gagnol–Héraud (2001) and Baslé–Le Boulch (1999). The former is quoted more than 70 times in similar studies, while the French literature uses the latter as standard.

Table 2

Regional/local economic impacts of universities

Impact	Meaning	
	Garrido-Yserte–Gallo-Rivera	*Gagnol–Héraud*
Direct	related to the local expenditures of the university, staff and students of the university	consumption of the university, staff and students of the university
Indirect	multiplied income (each euro spent in the location by the university community (university, staff and students) generates indirect transactions in the location linked to businesses that do not have a direct relation to the university	impact through education of the work-power, development of synergies of R&D with regional enterprises
Induced	the expenditures of the people that visit the university, the effects upon financial institutions, the effects upon property value, and the impact upon location of new companies and so on	multiplier effect

Source: Garrido-Yserte and Gallo-Rivera (2010) and the Gagnol–Héraud (2001).

In this confusion, we chose to use induced impact for all the effects generated by the multiplication process. In the Lukovics-Dusek classification, the separation of direct and indirect impacts is artificial: we separate personal expenses from the purchase of assets and from investments. The rationale for this can be the local analysis: on-site created income is always local, even though not necessary locally spent, like in the case of professors who spend only 4-8 hours a week in the university town. Adding the special situation of students, we consider *primary impact* the sum of the local parts of direct and indirect impacts in Figure 1. The *catalytic impact* of Lukovics-Dusek, the indirect impact of Gagnol–Héraud and the induced impact of Garrido-Yserte and Gallo-Rivera have almost the same content. While it is not widespread in the literature, the catalytic expression better describes the content of this category.

Benchmark examples

The analysis of the eight benchmark examples show that various methodologies are available for measuring the economic impact of universities. In other words, we cannot talk about a unified methodology. We compare the eight examples considering eight aspects, demonstrating that the methodologies are quite different, despite the presence of some common features.

Difficulties emerged because the available data were quite different, in many ways, such as their reference period. To be able to compare the different methods, we created two specific indicators, using data regarding the total impact, total number of students and regional GDP, expressed in USD. These results must be interpreted carefully, due to the previously mentioned measurement limits (Molnár–Zuti 2015).

The eight universities were: Izmir University of Economics (Turkey), Pennsylvania State University (USA), University of Alcala (Spain), University of Portsmouth (United Kingdom), Valencia Public Universities (Spain), South Dakota Public University (USA), Xavier University (USA) and the Kodolányi János University of Applied Sciences (Hungary). The reference periods vary significantly: we can find studies focusing on the period 1994–1995, while others focus on 2009, or 2012. We aimed at analysing examples on a global scale.

The universities were compared based on their sample size, source of data, applied methodology, applied multiplier, impact per student, rate of university impact regarding regional GDP.

All studies used a survey to obtain student related information, especially on their consumption habits. We were unable to acquire data for three institutions, while in all other cases the number of students participating in the questionnaire is between 125 and 2038. The Kodolányi János University of Applied Sciences had a sample of 125 (Kotosz 2013a), the Izmir University of Economics had a sample of 200 students, while the Valencia Public University and the South Dakota Public University interviewed 2000 and 2038 students, respectively. For most examined universities, all data were part of university databases, university documents, and financial statements, besides the questionnaires. The basis for the quantification of the impact was different, but the most commonly used was the input-output model. The ACE model, the Ryan 'shortcut' method, the REMI model, the RIMS-II model and the models of Huggins and Cooke (1997), Elliot et al. (1988) and Dusek (2003) were also used. Next, we provide a brief introduction of these models.

Garrido-Yserte and Gallo-Rivera (2010) divided the methodologies that are capable of measuring economic impacts into 2 groups: direct and indirect methods. The ACE (American Council of Education Method) is considered a direct estimation method. With this method, the impact is estimated by detailed primary information, gathered from local agents. The ACE method (also known as Caffrey-Isaacs method) was created in the 1970s, with the purpose of enabling the measurement of local economic impacts. The authors differentiate three types of economic impacts: impact on local enterprises, impact on local individuals, and impact on local public administration.

The Ryan 'shortcut' model uses secondary, indirect information for the estimation, and it is an adaptation of the ACE model by Ryan–Malgieri (1992). Ryan simplified the model of Caffrey and Isaacs, using local, regional, and national sources instead of questionnaires (Garrido-Yserte and Gallo-Rivera 2010).

The REMI method is a dynamic input-output model to estimate the forecasted values of the economy, using a mix of times series analysis and general equilibrium modelling. For the South Dakota Public University, this tool was used to analyse the current state of the economy, and assess the economic structure in the absence of the university. The difference between these two values measures the impact generated by the institution (Allgurn 2010).

The RIMS-II model is a regional input-output model. With this method, we can quantify both direct and indirect effects. In order to progress with the calculations, the authors needed to gather data from several areas. They needed data regarding the students, their spending habits, where they lived before they went to university and which higher education institutions they would have chosen, if the analysed university did not exist. In addition, they also needed data regarding the budget of the institution, including both the income and the expenditure side. In case of some higher education institutions, the larger income comes from tuition fees, events, industrial contracts, and state or local government benefits. The authors highlight the importance of the multiplier effect, which depends on the territorial scope and the rate of local consumption. Based on their experience, indirect effects can increase the impact on local economy by 50 to 100% (Blackwell et al. 2002).

The model of Huggins and Cooke (1997) analysed the connections between the expenditure structure of the university and its region. This study used a sophisticated version of the models previously applied by Bleaney et al. (1992) and Armstrong et al. (1994).

The applied methodology of D'Allegro and Paff (2010) is based on the model of Elliot et al. (1988), which is a modified version of the model of Caffrey and Isaacs (1971), differentiating the impact of local and non-local students. They estimate the economic impact through three steps: first, they calculate the direct spending; second, they estimate the indirect and induced effects with a multiplier, and finally, they sum the direct and indirect effects. This final number represents the estimated economic impact of the university.

Most calculations use Keynesian-type of multipliers, including output and employment multipliers. The multipliers range from 1.4 to 2.39 in different studies. In some cases, the multiplier is not a number, but an interval (e.g. 1.24–1.73).

One of the indicators used in most studies is the impact per student. The results differ significantly, and they need to be handled carefully because of the different reference periods. The impact per student in case of universities in the United States was generally higher (Xavier University, 10,153 USD; Pennsylvania State University, 23,695 USD; South Dakota Public University, 59,800 USD) compared with Western European universities (University of Portsmouth, 3,440 USD; University of Alcala, 15,574 USD; Valencia Public University, 29,961 USD), while the lowest impact was reported in the Eastern regions (Kodolányi János University of Applied Sciences, 4,453 USD; Izmir University of Economics, 7,096 USD).

The institutional share of regional GDP reveals the significance of the university impact in the region. The Kodolányi János University of Applied Sciences has a value of 0.1%, and the University of Alcala has a value of 0.12%. The Valencia Public University has the highest share (3%), while the University of Portsmouth has the lowest (0.02%), with the Izmir University of Economics (0.03%). Based on these results, there are significant differences in the impact of universities, but this measure is very sensitive to the territorial scope.

Measuring limits in Hungary

Higher education in Hungary went through significant changes in the 1990s, which had an overall impact on the entire Hungarian society. *Since the regime change, the number of students has risen significantly,* and has nearly quadrupled. This tendency was noticeable both in the OECD and in the EU countries. However, in Hungary, *after the 2005/2006 academic year, the number of students began to decrease.* In 2008 data, Hungary lags behind all the examined countries in number of state-funded students per one million inhabitants. While this number corresponded to 21,324 in Hungary, we observe 24,639 students in Germany, 28,974 in Austria and 38,409 in Norway (Harsányi–Vincze 2012).

In recent years, the decrease in headcount, due to the contraction in the number of births, has affected the higher education sector: while in 2010 the number of 18-year-old was around 126,000, according to Hungarian Central Statistical Office data, in 2015 this number dropped to 105,000, decreasing by 20% in a few years. This trend has substantially decreased and in subsequent years will further decrease the demand for Hungarian higher education, at least in this age group.

When we mention local or regional impacts, a more precise definition of the territorial scope is necessary. In most cases, this choice has serious consequences, not only on the possible set of applicable methods, but also on the results. The literature shows many examples of Hungarian (Mezei 2006, Kollár 2011, Nemes Nagy 2009, Székely 2013) and international (Armstrong–Taylor 2000, Arthur 1990, Blair–Caroll 2009, Bryden 2010) studies where this question is analysed. Sometimes, regional areas are considered (Pálné Kovács 2003), or functional urban areas (Lengyel–Szakálné Kanó 2012, Lengyel–Rechnitzer 2004, Bajmócy 2011, Székely 2011). The territorial levels used in impact studies are of the sub-local, local, regional, and national levels.

For universities, the sub-local level is generally not meaningful, as universities are often multi-campus institutions, jeopardized in their hometowns. The local level is useful for single-town universities, or only for local impacts, for example, when a mayor commissions a study (Kotosz 2013b). Generally, choosing the functional urban area is theoretically more efficient; however, when the key figures are based on sample surveys, this delimitation causes problems in gathering correct answers, as people generally do not know the boundaries of their functional urban area. Administrative regions (at NUTS3 or NUTS2 level) are often used for their simplicity and availability of the necessary statistical data and information. In the United States, state level studies are common. The state level allows the adaptation of input-output based models, as the essential matrices are available at this level. Up-to-date, regional (NUTS2, but preferably NUTS3 level) sectorial input-output matrices (West–Jackson 1998) in Europe are not available, with the exception of large, regional, econometric models (Varga et al. 2014).

In Hungary, both local and regional level impact studies are feasible, but in absence of a widespread secondary background dataset, a mixture of ACE-type (direct) model and local Keynesian multiplier estimation is recommended (Kotosz 2014). These types of models, with adequately estimated flows and parameters, may achieve accurate results on short-term impacts: direct, indirect, and most induced impacts. The main shortcoming of this model type is the impossibility of estimating a significant part of the catalytic impacts, externalities, worker productivity changes, and local welfare effects of R&D activities (Garrido-Iserte–Gallo-Rivera 2010).

While a partial set of third mission activities are included in the above recommended estimation method, these activities are particularly interesting from a methodological point of view.

Many universities try to deal with potential methods to measure and quantify third mission activities. Laredo (2007), Molas-Gallart et al. (2002), Polt et al. (2001) attempt to quantify the impact of the third mission. Laredo (2007) introduces a study from 2004–2006 that tries to create a framework for research activities, differentiating each of the eight dimensions of the third mission with a specific indicator. Molas-Gallart et al. (2002) categorized third mission activities into twelve groups, based on the activities of universities. They created a list of indicators and highlighted the need for better measures. Polt et al. (2001) also created a set of indicators for nine target areas. However, Lengyel (2009) argues for the primary use of cluster mapping.

Assigning specific and quantifiable indicators to the dimensions of third mission activities is challenging. These indicators have a theoretical use, and their practical applicability is questionable. In addition, some indicators measure in currency, while some others rely on different measurement units: a neat comparison is impossible, and we are not able to create a final and transparent measure (Molnár 2015).

In connection with the measurements of the University of Szeged, the VIR (EIS, Executive Information System) have collected suitable data since 2011. The third mission is present in five specific goals and nine indicators (IFT, 2012). Most of these indicators can be related to both the second and third mission, not allowing the authors to disentangle the impact of third mission activities (Molnár 2015).

Table 3

Suggested third generation indicators

Target area / Activity	Suggested indicators
Technology transfer	Income realized by the university from the utilization of intellectual capital
	Number of joint research contracts with innovative companies
	Number/regional rate of innovation-oriented companies created at the university
Counselling	Number of economic development strategies created
	Number of enterprises resorting to counselling services
Spin-offs and start-ups	Percentage of university spin-off/start-up companies in the agglomeration
	The number of spin-offs/start-ups per 1000 university staff
	The number of spin-offs/start-ups created in the last 5 years
	The revenue of spin-offs/start-ups
	The number of employees of the spin-offs/start-ups in the last 5 years
	The number of enterprises created by students or graduates of the last 5 years
University – Industry – Government relations	Number of industrial R+D connections
	Number of R+D actors
	Number of joint projects carried on by university and industry in the last 5 years
	Percentage of innovative companies (as a share of all companies) cooperating with the university
	Percentage of industry-financed university R+D activities
Commercialization of academic facilities	Revenue from rent (e. g. laboratories)
	Number of public events organized by the university
Enhancement of the social engagement of the university	Number of cultural events
	Number of internal visitors
	Number of external visitors
	Number of press releases in a given time period (university staff, researchers in regional and national media)
	Number of university events promoting social responsibility (e. g. green programs)
	Number of dissemination programs (science to general public)

Source: Based on Molnár (2015, pp. 41).

Molnár (2015) made an effort to systematize a possible third mission indicator framework, based on the experiences of the University of Szeged and previous theories exposed in the international literature. The author grouped the third mission activities of universities into six categories, based on domestic and international benchmarks: technology transfer, counselling, spin-offs and start-ups, university-industry-government relations, commercialism and utilization of university property, and the enhancement of the social engagement of the university. All categories have a number of indicators, some of which are creations of the author, while others have been already used in the international literature. Table 3 summarizes such indicators.

It is important to emphasize that only some indicators provide a currency measure, while others represent a simple number, without a definite unit of measurement. Therefore, until now, the creation of a uniform measure has not been successful. (Molnár 2015). Repeated measurements would allow us to follow potential changes of intensity in third mission activities.

In summary, a number of complex methodological opportunities are available to measure the impact of universities and third mission activities. In addition, we can create a systematized collection of indicators that can help us in such measurements (Molnár 2015). However, even though the commonly used methods are capable of measuring third mission activities in the short term, generally including them in the direct or indirect impacts, the measurement of the long-term impacts, such as the catalytic impact, remains challenging.

Conclusion

In our paper, we presented an overview of the methodological possibilities of measurement of the local economic impact of higher education institutions. To achieve this goal, first, we mapped the functions of universities, to see which activities should be considered in the calculations. The roles of universities are changing and broadening; new functions and missions have increasing impacts that can be captured only in the long run. Short-run impacts are often already included in computations made for first and second missions, as expenditures cannot be separated. In the second part of this study, we showed that the estimation of gross impacts is more straightforward than net ones, as the latter needs more sophisticated primary data. We also addressed some contradictions in the definition of direct, indirect, induced, and catalytic impacts, and offered a framework for further analysis. In the third part of the analysis, a series of worldwide benchmark examples has been compared. They offer different methodologies, using primary and secondary data, with different results regarding the relative impact of universities, per student or via GDP that are partly explained by the diverse methodologies. In the last chapter, we analysed the situation of Hungarian higher education to find the appropriate measurement tools and a set of indicators to catch the intensity of third mission activities in the country.

Finally, as we discussed in the paper, in small, Eastern European countries we recommend applying a multiplier and primary data based models to estimate short-run gross primary and induced impacts on local and regional level. A multi-country comparative study with these recommendations would be an efficient tool to explore the background differences in the impact of universities. However, the difficulties in disclosing long run and catalytic impacts are not yet resolved, and only partial results (multidimensional indicator systems) and non-university targeted solutions (general regional economic simulation models) are available.

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REFERENCES

ALLGURN, M. (2010): The Economic Impact of the South Dakota Public University System Government Research Bureau, The University of South Dakota, Vermilion, South Dakota, USA.

ARMSTRONG, H. W.–DARRALL, J.–GROVE-WHITE, R. (1994): Building Lancaster's future: economic and environmental implications of Lancaster University's expansion to 2001 Department of Economics and the Centre for the Study of Environmental Change, Lancaster University, Bailrigg UK.

ARMSTRONG, H. W.–TAYLOR, J. (2000): Regional Economics and Policy Blackwell, Oxford.

ARTHUR, W. B. (1990): Positive Feedbacks in the Economy Scientific American 262 (2): 92–99.

BAJMÓCY, Z. (2011): Bevezetés a helyi gazdaságfejlesztésbe JATEPress, Szeged.

BASLÉ, M.–LE BOULCH, J-L. (1999) L'impact économique de l'enseignement supérieur et de la recherche publique sur une agglomération de Rennes Revue d'Economie Régionale & Urbaine 1: 115–134.

BLACKWELL, M.–COBB, S.–WEINBERG, D. (2002): The Economic Impact of Educational Institutions: Issues and Methodology Economic Development Quarterly 16 (1): 88–95.

BLEANEY, M. F. – BINKS, M. R. – GREENAWAY, D. – REED, G. – WHYNES, D. K. (1992): What does a university add to its local economy? Applied Economics 24 (3): 305–311.

BLAIR, J. P.–CAROLL, M.C. (2009): Local Economic Development. Analysis, Practices and Globalization SAGE, London.

BRYDEN, J. M. (2010): Local Development In: Hart, K.–Laville, J-L.–Cattani, A. D. (eds): The Human Economy pp. 248–260., Polity, Cambridge.

CAFFREY, J.–ISAACS, H. H. (1971): Estimating the impact of a College or University on the Local Economy American Council on Education, Washington, DC.

D'ALLEGRO, M.–PAFF, L. A. (2010): Estimating the Economic Impact of Higher Education: A Case Study of the Five Colleges in Berks County, Pennsylvania Professional File 117: 1–17.

DUSEK, T. (2003): A felsőoktatás lokális termelésre és jövedelmekre gyakorolt hatása In: Rechnitzer, J.–Hardi, T. A Széchenyi István Egyetem hatása a régió fejlődésére pp. 60–71., Széchenyi István Egyetem Gazdaság- és Társadalomtudományi Intézet, Győr.

DUSEK, T.–LUKOVICS, M. (2011): Analysis of the economic impact of the Budapest Airport on the local economy 58th Annual North American Meetings of the Regional Science Association International (RSAI). Miami, Florida, USA

ELLIOT, D.–LEVIN, S.–MEISEL, J. (1988): Measuring the economic impact of institutions of higher education Research in Higher Education 28 (1): 17–33.

GAGNOL, L.–HÉRAUD, J-A. (2001): Impact économique régional d'un pôle universitaire: application au cas strasbourgeois Revue d'Economie Régionale & Urbaine 4: 581–604.

GARRIDO-ISERTE, R.–GALLO-RIVERA, M. T. (2010): The impact of the university upon local economy: three methods to estimate demand-side effects Annals of Regional Science 44: 39–67.

HARSÁNYI, G.–VINCZE, S. (2012). A magyar felsőoktatás néhány jellemzője nemzetközi tükörben Pénzügyi Szemle 57 (2): 226–245.

HUGGINS, R.–COOK, P. (1997): The economic impact of Cardiff University: innovation, learning and job generation Geojournal 41 (4): 325–337.

IFT (2012): Szegedi Tudományegyetem Intézményfejlesztési Terv Szegedi Tudományegyetem, Szeged.

JAEGER, A.–KOPPER, J. (2013): Measuring the Regional "Third-Mission-Potential" of Different Types of HEIs Niederrhine Institute for Regional and Structural Research (NIERS). Hochschule Niederrhein - University of Applied Sciences, Mönchengladbach, Germany.

JOHNSON, T. M. (1994): Estimating the Economic Impact of a College or University on a Nonlocal Economy. PhD dissertation, Texas: Texas Tech University.

KLOPHAUS, R. (2008): The impact of additional passengers on airport employment: The case of German airports Airport Management 2 (3): 265–274.

KOLLÁR, K. (2011): A helyi gazdaságfejlesztés szereplőinek vizsgálata In: Róbert, P. (szerk): Magyarország társadalmi-gazdasági helyzete a 21. század első évtizedeiben. http://kgk.sze.hu/images/dokumentumok/kautzkiadvany2011/kreativgondolkodas/KollarKatalin.pdf (downloaded: 01/03/2016)

KOTOSZ, B. (2013a): The Local Economic Impact of Higher Education Institutions in Hungary. In: Khavand, K. J. (ed): Intellectual Capital Management. Global Perspectives on Higher Education, Science and Technology pp. 45–60., IICM, Zanjan.

KOTOSZ, B. (2013b): Regionális multiplikáció és egy alkalmazása Jelenkori társadalmi és gazdasági folyamatok 8 (1-2): 39–45.

KOTOSZ, B. (2014): L'impact économique local des universités: le cas de la Hongrie Paper presented at Métropolisation, cohésion et performances: quels futurs pour nos territoires – 51ème colloque de l'ASRDLF, Marne-la-Vallée (France), 7-9 juillet 2014.

LAREDO, P. (2007): Toward a third mission for Universities UNESCO Research Seminar for the Regional Scientific Committee for Europe and North Amerika, 5-6 March 2007, Paris.

LENGYEL, I. (2009): Knowledge-based local economic development for enhancing competitiveness in lagging areas of Europe: the case of the University of Szeged: In: Varga, A. (ed): Universities, Knowledge Transfer and Regional Development pp. 321–349., Edward Elgar, Cheltentam.

LENGYEL, I.–RECHNITZER, J. (2004): Regionális gazdaságtan Dialóg-Campus Kiadó, Budapest- Pécs.

LENGYEL, I.–SZAKÁLNÉ KANÓ I. *(2012): Competitiveness of Hungarian Urban Micro-regions: Localization Agglomeration Economies and Regional Competitiveness Function. Regional Statistics* 2 (1): 27–44.

LUKOVICS, M. (2010): Az egyetemek lehetséges szerepe a régiók versenyképességének javításában Kézirat, SZTE GTK, Szeged.

LUKOVICS, M.–DUSEK T. (2014a): Economic Impact Analysis of the ELI R&D Infrastructure and Science Park Journal Mittelforum and Next Europe 1 (1): 72–85.

LUKOVICS, M.–DUSEK, T. (2014b): The Economic Impact of the ELI R&D Infrastructure and Science Park in the Szeged sub-region Diverse Regions: Building Resilient Communities and Territories. Regional Studies Association Annual International Conference 2014, Izmir, Turkey.

LUKOVICS, M.–ZUTI, B. (2013): Successful universities towards the improvement of regional competitiveness: "Fourth Generation" universities Paper presented at the "European Regional Science Association (ERSA) 53th Congress „Regional Integration: Europe, the Mediterranean and the World economy" 53th Congress of the European Regional Science Association, Palermo, Italy.

LUKOVICS M.–ZUTI B. (2014): Egyetemek a régiók versenyképességének javításáért: „negyedik generációs" egyetemek? Tér és Társadalom 28 (4): 77–96.

MEZEI, C. (2006): *A helyi gazdaságfejlesztés fogalmi meghatározása Tér és Társadalom* 20 (4): 85–96.

MOLAS-GALLART – CASTRO-MARTÍNEZ (2007): Ambiguity and conflict in the development of 'Third Mission' indicators. *Research Evaluation*, 16(4): 321–330.

MOLAS-GALLART, J.–SALTER, A.–PATEL, P.–SCOTT, A.–DURAN, X. (2002): Measuring Third Stream Activities SPRU, University of Sussex, Brighton.

MOLNÁR, G. (2015): Egyetemek gazdaságfejlesztési hatásainak számszerűsítése: a harmadik misszió mérési lehetőségei Szakdolgozat, Szegedi Tudományegyetem, Szeged.

MOLNÁR, G.–ZUTI, B. (2015): Egyetemek gazdaságfejlesztési hatásainak mérése XXXII. OTDK április 10-12. Budapesti Gazdasági Főiskola KKK, Budapest.

NEMES NAGY, J. (2009): Terek, helyek, régiók Akadémiai Kiadó, Budapest.

OECD (2004): On the Edge: Securing a Sustainable Future for the Higher Education Paris.

PALSSON, M. – GÖRANSSON, B. – BRUNDENIUS, C. (2009): Vitalizing the Swedish university system: implementation of the 'third mission' Science and Public Policy 36 (2): 145–150.

PÁLNÉ KOVÁCS, I. (2003): A területfejlesztés irányítása PTE KTK Regionális Politika és Gazdaságtan Doktori Iskola Habilitációs Előadások sorozata. PTE KTK, Pécs.

PAWLOWSKI, K. (2009): The 'fourth generation university' as a creator of the local and regional development Higher Education in Europe 34 (1): 51–64.

POLT, W.–RAMMER, C.–GASSLER, H.–SCHIBANY, A.–SCHARTINGER, D. (2001): Benchmarking Industry-Science Relations: the role of framework conditions Report to the Federal Ministry of Economy and Labour, Austria and to the European Commission, Vienna.

RYAN, J.–MALGIERI, P. (1992): Economic Impact Studies in Community Colleges: The Shortcut Method. National Council for Resource Development Resource Paper 48: 23.

SZÉKELY, A. *(2011): A határon átnyúló agglomerációk turizmusának típusai. Jelenkori társadalmi és gazdasági folyamatok* 6 (1-2): 126–131.

SZÉKELY, A. (2013): Regionális multiplikáció a szegedi Árkád példáján In: Rechnitzer, J., Somlyódiné P. E.–Kovács, G. (eds): A hely szelleme – a területi fejlesztések lokális dimenziói pp. 565–573., Széchenyi István Egyetem, Győr.

VARGA, A. (2001): Universities and Regional Economic Development: Does Agglomeration Matter? In Johannson, B.–Karlsson, C.–Stough, R. (eds): Theories of Endogenous Regional Growth pp. 345–367., Springer, Berlin.

VARGA, A.–HAU-HORVÁTH, O.–SZABÓ, N.–JÁROSI, P. (2014): Environmental Innovation Impact analysis with the GMR-Europe Model Regional Statistics 4 (2): 3–17.

WEST, G. R.–JACKSON, R. W. (1998) Input-output+econometric and econometric+input-output: model differences or different models? Journal of Regional Analysis and Policy 28 (1): 33–48.

WISSEMA, J. G. (2009): Towards the third generation university. Managing the university in transition Edward Elgar, Cheltenham.

ZUTI, B.–LUKOVICS, M. (2014): "Fourth Generation" Universities and Regional Development In: Hamm, R.–Kopper, J. (eds.): Higher Education Institutions and Regional Development pp. 14–31., Mönchengladbach.

Urban Sprawl and Loss of Agricultural Land in Peri-urban Areas of Lagos*

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Examinations of 'peri-urban' remain elusive and often neglected by urban planners. However, these transitional zones are constantly under pressure by increasing populations from inner cities and migrants from the surrounding rural areas. The result in most developing countries is uncontrolled or unplanned landscapes. Although urban growth is inevitable and land use changes are imminent as peri-urban expansions of cities, peri-urban areas are pivotal regarding the agricultural resources necessary to urban survival. Understanding the development patterns, emerging urban forms, and their influences on peri-urban areas require an understanding of development decisions. Such knowledge will help decision makers and urban managers develop appropriate policies to address growth in 'edge' cities. This study focuses on the organic growth of Ikorodu, a peri-urban municipality on the outskirts of Lagos that emerged from a sleepy farming community with a population less than 100,000 in 1975 to a vibrant city exceeding one million residents in 2015. The study employs a multi-temporal remote sensing and GIS analysis to detect the urban pattern and emergent form over a 40-year period from 1975 to 2015. An empirical analysis was performed using survey data on 300 homeowners in 61 communities to identify the influences of rapid growth and the responses of planners to the city's growth.

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Introduction

Urban growth in developing countries is dynamic and diverse; however, it is also disordered and disturbing. This growth is synonymous with sprawling fractals compared to the compact aggregations observed in the global North. The cost of sporadic growth in rapidly growing metropolitan areas is enormous, evidenced by consistent diminution of high-quality agricultural land and forests in the peripheral areas of cities and in rural areas by residential and manufacturing incursions (Jiang–Deng–Seto 2013, Martellozo et al. 2014). This process is referred to as 'peri-urbanization', and it mostly occurs in non-contiguous transitional zones between rural areas and cities (Iaquinta–Drescher 2000). Significant research has focused on the peri-urban interface, land use changes, and agricultural economics (Bell–Irwin 2002, Theobald 2005, Buxton–Low 2007, Lawanson–Yadua–Salako 2012).

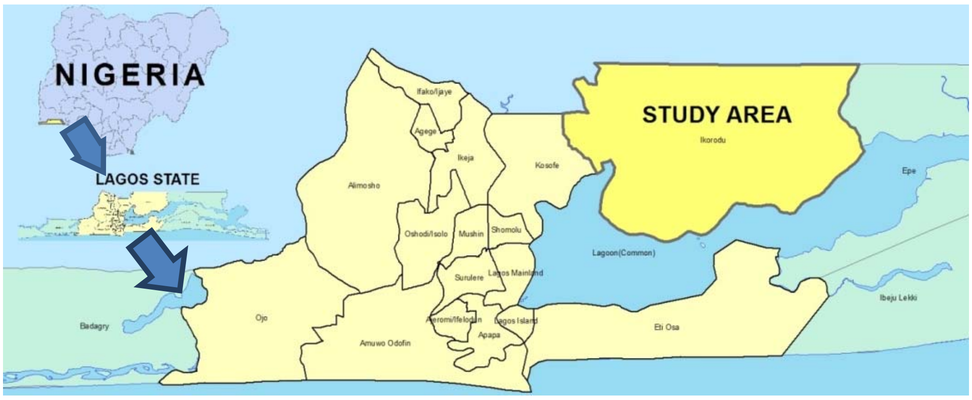
Studies of urban forms, spatial patterns, and processes that influence these changes are rooted in North American and European scholarship. Examples include Burgess' work on the concentric growth of cities inferred from his research in Chicago and Hoyt's 'Sector Theory' regarding the influences of linkages and geographic features on urban structures. Other notable studies are Christaller's 'Central Place Theory', which emphasises the spatial equilibrium of urban structure and pattern, and Harris and Ullman's 'Multi-Nuclei Theory' of the polycentricism of cities. However, since the 1990s, studies on urban morphology have focussed on cities' fractal geometry (Batty–Longley 1994, Frankhauser 1994, Terzi–Kaya 2011). Few studies have investigated the morphological processes associated with peri-urbanization (Tannier–Pumain 2005, Lagarias 2007, Terzi–Kaya 2011). The relevant studies focused on the global North and did not comparatively assess similarities and differences between Northern and Southern countries in the speed, scope, and experience of peri-urbanization (Fragkias et al. 2012). Therefore, a need exists for studies on peri-urbanization and morphological processes in the African context to close the gap in the literature. Furthermore, those empirical studies that examined the mechanisms of and policy responses to peri-urban growth in African cities are not well documented. This study aims to identify the urban pattern and emergent form of a non-contiguous peri-urban city on the outskirts of the Lagos metropolis over a 40-year period spanning 1975 through 2015. The study further aims to identify the factors related to the land use pattern and the responses of land use planners to these emerging forms.

The Study Area

This study's site is Ikorodu, a municipality (Local Government Area) on the outskirts of Lagos Metropolis approximately 36 km northeast of Lagos between longitude 3.43° W and 3.7° W and latitude 6.68° N; it is 6.53° north of the equator. Its area is approximately 396.5 km^2, with landmass of 368.5 km^2. Since its creation in 1968 as one of five administrative divisions of Lagos State, Ikorodu has been characterised by its extensive farmlands. It includes several hectares of land for farming settlements acquired by the defunct government of Western Region of Nigeria and, in the 1980–2000 Regional Plan of Lagos State, about 180 km^2 (49%) of its landmass was zoned for agricultural use. Although farming, fishing, and trading are the basic means of indigenous livelihood, a 1,582.27 ha industrial estate (the largest in Nigeria) established by the Lagos State Government in 1976 is a major pull factor leading to population growth. Other pull factors include a light port terminal at Ipakodo, the expanded Lagos-Ikorodu road, and established secondary and tertiary sector activities. The municipality recorded a 186% population increase between the 1991 and 2006 censuses (i.e., from 184,674 to 527,917), and its population is estimated at 1.5 million based on the United Nations Urbanizations Prospects projection for Lagos State of 12.9 million (United Nations, Department of Economic and Social Affairs, Population Division, 2014).

Figure 1

Map Showing the Study Area within the Lagos Metropolitan Area



Methodology

Fractal analysis has been widely used during the past three decades to shed light on urban patterns and morphologies. Fractals suggest complexities, hierarchies, and self-similarities, across scales and time, and they have been helpful for understanding peri-urbanization processes (Batty–Longley 1994, Tannier–Pumain 2005, Thomas–Frankhauser–De Keersmaecker 2007, Lifeng–Fang– Zengxiang–Xiaoli 2015). Fractal analysis describes spatial arrangements of built-up areas as well as their quality. Highly fragmented built-up areas representing sprawling patterns have low fractal dimensions, whereas compaction and regularity yield higher figures. Fractal dimensions could range from 1 to 2 for simple geometric objects and from 0 to 2 for urban geometry, similar to Sierpinski carpets (Tannier–Pumain 2005).

This study employed a five-year interval multi-temporal analysis; the data used were multi-spectral remote sensing data for the available periods (1984, 1990, 2000, 2006, 2011, and 2015) as shown in Table 1. However, Landsat imageries for 1975, 1980, and 1995 were not available, and the Land Use/Land Cover Map of 1976/1978 was used for 1975 and 1980. RGB composite rasters were developed from multi-spectral Landsat imageries that were further classified by means of an ISODATA unsupervised algorithm.

Table 1

Data Source

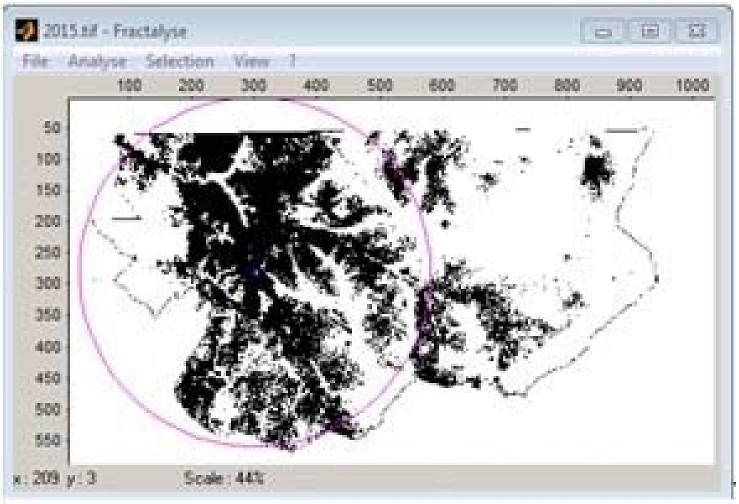
Acquisition Date	Satellite Number	Sensor Type	WRS Path/ Row	UTM Zone	Datum	Spatial Reso-lution (M)	Sources and Year
18-12-1984	Landsat 5	TM	191/55	31 N	WGS84	28.5-30	USGS, 1984
27-12-1990	Landsat 4	TM	191/55	31 N	WGS84	28.5-30	USGS, 1990
06-02-2000	Landsat 7	ETM+	191/55	31 N	WGS84	28.5-30	USGS, 2000
07-12-2006	Landsat 7	ETM+	191/55	31 N	WGS84	28.5-30	USGS, 2006
03-01-2011	Landsat 7	ETM+	191/55	31 N	WGS84	28.5-30	USGS, 2011
06-01-2015	Landsat 8	OLI_ TIRS	191/55	31N	WGS84	28.5-30	USGS, 2015
Supporting Spatial Data /Demographic Data							
1976/78	Land Use/Land Cover Map					FORMECU, 1978	
1980	The Lagos State Regional Plan (1980–2000)					Doxiadis Associates, 1980	
	National Population Census 1963, 1991, 2006					NPC 1991, 2006	

Data on built-up urban areas were extracted from ISODATA classified rasters by coding built-up pixels as black and other land cover types as white. The classified images were subsequently analysed for their fractal dimensions using the software package *Fractalyse (version 2.3.2)*. The software uses numerous methods to measure fractal dimensions; these include box counting, radius mass, dilation, and correlation. For this study, the radial mass measure was employed, which analyses by the iteration principle whereby the total number of built-up pixels are counted within the circle from a specified point (the counting centre).

As shown in Figure 2, urban core area of Ikorodu shown on the 1976/1978 land use map is the counting centre. At each step, the radius r is gradually increased, and the total number of occupied points $N(\varepsilon)$ inside the circle is counted (where ε equals $2.r+1$).

Figure 2

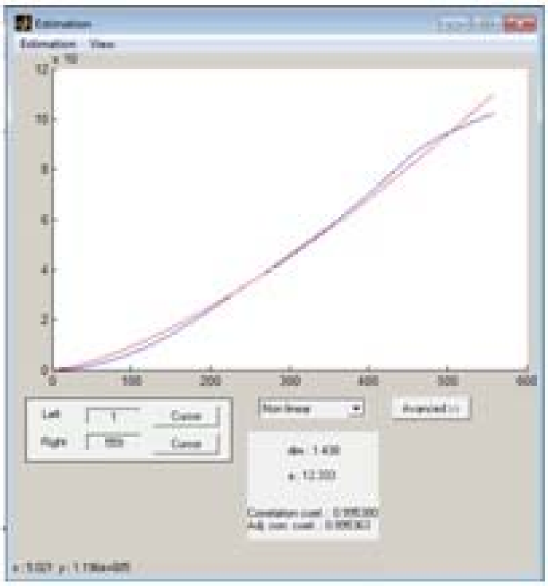
Screen print of radial mass method in Fractalyse



e series of points obtained is represented by a Cartesian graph (Figure 3) with the Y-axis corresponding to the number of counted elements (*N)* and the X-axis corresponding to the value of the reference element *ε*.

Figure 3

Screen print of fractal analysis 'D' estimation in Fractalyse



The empirical curve of the plot is then fitted to the estimated curve. A good fit indicates fractality; however, the quality of the estimation was verified by correlation analysis. A non-linear regression derives the value of the three parameters: *a, D,* and *c*, where *a* is the pre-shape factor and *c* is the point of origin on the Y-axis ($c = 0$) (Tannier–Pumain 2005). Thus, the fractal dimension *D* is determined by the following equation:

$$N = a\varepsilon^{D} + c \qquad (1)$$

where

$$\varepsilon = 2.r + 1 \qquad (2)$$

Fractal dimension values close to two indicate regularity and orderly development whereas values close to one or zero indicate a sprawling and leapfrogging pattern of development. Furthermore, to ascertain the extent of sprawling development in the agricultural land, the urban extent layers were extracted in ArcGIS by intersecting geo-processing with the agricultural land zone of the Regional Plan of Lagos State of 1980.

The relationship between the fractal dimension and the dynamics index of agricultural change was determined by regression analysis. The dynamic index was calculated (Zhu–Li 2003) to derive change in allocated agricultural land by the following equation:

$$CDI = \frac{U_a - U_b}{U_a} x100\% \qquad (3)$$

where *CDI* is the change dynamic index for a single land use *U* between starting period *a* and ending period *b*.

Morphological Process and Spatial Patterns

The peri-urbanization process in Ikorodu over the past four decades shows dynamic urban changes and a sprawling development pattern. The fractal analysis of the study area based on remotely sensed images from 1984 to 2015 found steady organic growth in which sprawling precedes infilling. The values of the fractal dimension increased steadily from the lowest 0.41 in 1975 to a low 1.44 value in 2015 (see Table 2). Values less than one indicate lack of connectivity among elements in the built-up space, whereas values slightly greater than one indicates sprawl (Thomas–Frankhauser–Biernacki 2008).

As seen in Table 2, the highest fractal dimension (*D*) value in this study is 1.44, which indicates sprawl. The implication of this pattern is loss of valuable agricultural land to urban development, which could have major repercussions on sustainable food production and security.

The continuous urban expansion of the past four decades in Ikorodu shown in Table 2 has resulted in no less than 25.8% of the total land area allocated to agriculture and food production. Moreover, the annual urban growth rate in the study area tripled from 316 ha/year in 2011 to 1171 ha/year in 2015, creating significant concern.

Table 2

Urban Growth and Fractal Dimensions of Ikorodu

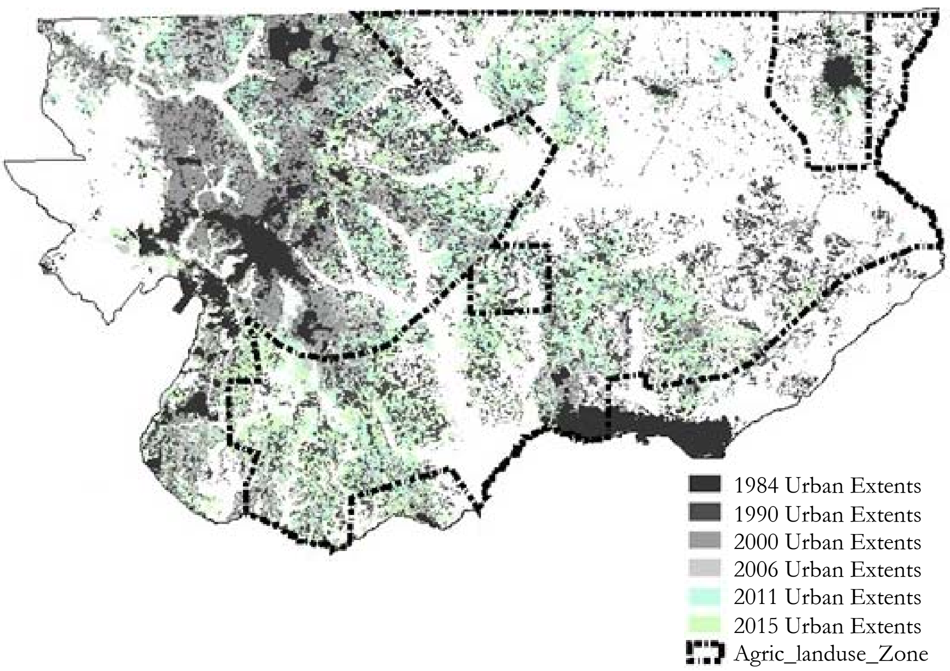
Year	Pop.	Pop. Density per sqkm.	Urban Area (Ha)	Annual Urban Change Rate	Allocated Agric. Land Change to Urban (Ha)	Alloc. Agric. Land (Ha)	% of Allocated Agric. Land Loss.	Agric. Land CDI	D	a	Corr. Coeff.
1975	154 377	389	419.00	0.00	0	17 903	0.0	0.0	0.411	172.16	0.86
1984	170 535	430	2 252.05	229.13	274	17 629	1.5	1.5	0.788	108	0.98
1990	182 654	461	2 961.83	118.30	707	17 196	3.9	2.5	0.924	66.07	0.99
2000	390 620	985	4 587.01	162.52	871	17 032	4.9	1.0	0.933	109.5	0.98
2006	527 917	1 331	7 506.12	486.52	1 425	16 478	8.0	3.3	1.194	34.04	0.99
2011	946 722	2 388	9 087.45	316.26	2 293	15 609	12.8	5.3	1.308	19.15	1.00
2015	1 510 594	3 810	13 772.10	1 171.16	4 615	13 288	25.8	14.9	1.438	12.33	1.00

The dotted lines in Figure 4 represents areas zoned for agricultural land use in the regional plan. This area is about 18,000 hectares of land and approximately 49 percent of the total local government land mass. However, in order to determine the extents of urban development in the areas zoned for agriculture, urban pixels in the classified imageries were extracted for periods under consideration and layers were created in ArcGIS.

The result indicates that there has been uncontrolled urban development on land zoned or allocated for agriculture in the regional plan for Lagos State. Figure 4 also reveals that these uncontrolled expansion has taken place especially in the post 2006 periods, as patches indicates more diminution of agricultural lands after this period. suggests that controls on development have been ineffective and urban spatial expansion has not followed the requirements of the existing regional plan.

Figure 4

Map of Ikorodu Showing Urban Growth and Extents in Agricultural Zone (1984–2015)



A regression model was applied to determine the relationship between the fractal dimension and the change dynamic index for allocated agricultural lands. The regression model results found a strong positive correlation of 78% between fractal dimension *D* and the change dynamic index (CDI) for allocated agricultural land such that 60% of the variation in agricultural land is explained by the sprawling expansion of urban land uses ($r = 0.78, p = .04$). In order to determine the statistical significance of the variation, a one way F-Test Analysis of Variance (ANOVA) was used; The result indicated statistical significance (F=7.67 and P<0.05).

Table 3

Summary Outputs:

Regression Statistics for Agricultural Land CDI and Fractal Dimension 'D'

Regression Statistics	
Multiple R	0.776
R Square	0.602
Adjusted R Square	0.522
Standard Error	3.502
Observations	7

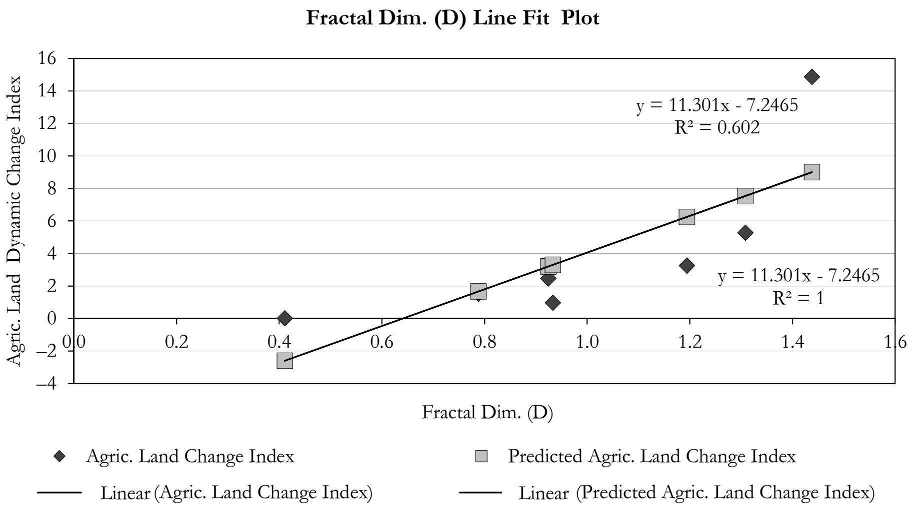
ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	92.775	92.775	7.564	0.040
Residual	5	61.327	12.265		
Total	6	154.101			

	Coeff.	*S. E.*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	–7.247	4.315	–1.680	0.154	–18.338	3.845	–18.338	3.845
Fractal Dim. (D)	11.301	4.109	2.750	0.040	0.738	21.863	0.738	21.863

Figure 5 shows that sprawled areas are initially dispersed, but due to infilling or increased densities such areas becomes compact, the values of the fractal dimension (*D*) tend to increase in relationship with increased loss of peri-urban agricultural land. Although this pattern of growth is historically observed in most cities' growth (*D* increases over time), the important question concerns the extent to which the growth is guided by or compliant with existing regional plans.

Figure 5

Regression model showing a positive correlation between Fractal Dimension and Agricultural land Change Dynamic Index during the study period (1984–2015)



e unguided spatial pattern found by this study is inevitable because the survey finds that only 39% of the respondents had obtained building permits, and inspectors of the development controls or planning agencies had never visited the remaining 61%. The ineffective development control system is partly responsible for the uncontrolled expansion.

Influences on the Peri-urban Growth and Spatial Pattern

Urban morphology cannot be divorced from anthropogenic factors. Therefore, questionnaires were distributed to 300 homeowners in an estimated population of 120,000 housing units across 61 communities in the six Local Council Development Areas (LCDAs) of the study area (the total number of homeowners identified in 2012 by the Lagos State Government for Land Use Charge was 89, 609).

To determine the influences of peri-urban growth and the effectiveness of existing land use planning policies for managing the sprawling pattern of development, questions were asked regarding: (1) the motivations for developing in the peri-urban municipality, (2) types of land use, (3) timing of property development, and (4) awareness of planning regulations and development control agencies' controls on home construction. About 90% (270 homeowners) responded and data was analysed using the SPSS and Excel statistical programs.

A factor analysis was performed to determine key influences on urban morphology, and the suitability of the data was determined by the Kaiser-Meyer-Olkin Measure of Sample Adequacy (KMO) and Bartlett's test of sphericity. The KMO result is 0.930 and Bartlett's significance value is zero. This initial result confirms the suitability of the data for factor analysis (the KMO statistic must be no greater than 0.6 and Bartlett's significance value must be 0.5 or less). Three factors with eigenvalues greater than 1.0 explained 59.9% of the variation in the data; however, using the scree plot and the component matrix, two factors have the highest loadings and explain 54.2%. Therefore, Principal Components Analysis with Direct Oblimin rotation and Kaiser Normalization were applied to extract the highest loading factors, which were identified as the major influences on morphological changes. Furthermore, descriptive and inferential statistics were used to assess the effects of implemented policies on managing sprawl and land use change.

Table 4

Pattern Matrix*

Reasons for residential development		Component	
		1	2
1	Less time and money spent from location	**.899**	
2	Proximity to work	**.888**	
3	Good health and less stress than city	**.829**	
4	Lower cost of living than city	.731	
5	Purchased through cooperative	.725	
6	Closeness to leisure and nature	.711	
7	Land speculation/investment	.673	
8	Affordable land	.582	
9	Proximity to family and friends	.451	.304
10	Obtained by inheritance	.444	
11	Invited to purchase by someone close	.377	
12	Personal achievement of a lifetime		.766
13	Proximity of site to urban infrastructure		.750
14	Site access to transportation infrastructure		.727
15	Security of land tenure		.718
16	Adequate security of life and property		.683
17	Inheritance to leave for children		.494
18	Land free of government acquisition	.301	.482

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.
* Rotation converged in seven iterations.

The factors that influence continuous growth were reduced from 18 to 10 using Principal Component Analysis (Table 4 below); however, three of the highest loading factors (those > 0.70) were selected as the major influences on peri-urban growth in Ikorodu. These factors are: (1) less time and money spent on transportation from location (0.899), (2) proximity to work (0.888), and (3) good health and less stress than the city (0.829). That proximity to work and ease of transportation are principal influencing factors is corroborated by the survey results, which indicate that 50% of the Ikorodu respondents reported that their workplaces are located in the Ikorodu municipality. As stated above, Ikorodu has the single largest industrial estate in Nigeria and is home to many secondary and tertiary activities that attract housing and other types of development.

Conclusion

This study examined the growth and morphology of a peri-urban city spanning a period of forty years. The results of its fractal dimension analysis indicate rapid urban changes that correlate with the pace of agricultural land loss. Moreover, ineffective controls and lack of policy implementation or enforcement has resulted in sprawling and unguided development in the urban fringe areas of the Lagos metropolitan area of Ikorodu. The implication of this continuous change in the absence of archaeological evidence and the confidence placed in this study's inferences suggests that these land use changes of uncontrolled expansion result in the diminution of precious agricultural and forested lands.

Previous efforts have been made to quantify global peri-urban croplands (Thebo–Drechsel–Lambin 2014). However, this study attempted to quantify the allocated agricultural land and found that such lands in the study area were reduced by the significant extent of 25%. If nothing is done to alter that trend, the food security of the Lagos metropolitan region could be at risk. Therefore, we recommend that urban and regional planners in developing countries similar to Nigeria incorporate real-time remote sensing data and geospatial technology to monitor urban expansion, particularly in the peri-urban areas, which are presently neglected. Furthermore, comparative morphological studies of other peri-urban settlements in developing countries should be undertaken to develop theories relevant to these phenomena.

REFERENCE

BATTY, M. – LONGLEY, P. A. (1994): *Fractal Cities: A Geometry of Form and Function* Academic Press, London.

BELL, K. P. – IRWIN, E. G. (2002): Spatially Explicit Micro-Level Modelling of Land Use Change at the Rural–Urban Interface *Agricultural Economics* 27 (3): 217–232.

BURGESS, E. W. (1925/1967): The Growth of the City: An Introduction to a Research Project In: Park, R. E. E. – Burgess, W. – McKenzie, R. D. *The City* pp. 47–62., University of Chicago Press, Chicago, IL.

BUXTON, M. – LOW, C. D. (2007): Change in Peri-urban Australia: Implications for Land Use Policies *State of Australian Cities (SOAC) Conference.* Adelaide: Australian Cities and Regions Network) from http://soac.fbe.unsw.edu.au/2007/papers/include.asp (downloaded: June 12, 2012).

CHRISTALLER, W. (1933): *Die zentralen Orte in Sud deutschland* Prentice Hall, Inc., Englewood Cliffs, NJ.

FRAGKIAS, M. – LANGANKE, T. – BOONE, C. G. – HAASE, D. – MARCOTULLIO, P. J. – MUNROE, D. –SIMON, D. (2012). *Land Teleconnections in an Urbanizing World – A workshop Report* GLP-IPO/UGEC-IPO, Copenhagen.

FRANKHAUSER, P. (1994): *La Fractalité des Structures Urbaines* Economica, Paris.

HARRIS, C. D. – ULLMAN, E. L. (1945): The Nature of Cities *Annals of the American Academy of Political and Social Science* 242: 7–17.

HOYT, H. (1939): *The Structure and Growth of Residential Neighborhoods in American Cities* U.S. Federal Housing Administration, Washington.

IAQUINTA, D. L. – DRESCHER, A. W. (2000): Defining periurban: understanding rural-urban linkages and their connection to institutional contexts *Tenth World Congress of the International Rural Sociology Association* International Rural Sociology Association, Rio de Janeiro.

JIANG, L. – DENG, X. – SETO, K. (2013): The Impact of Urban Expansion on Agricultural Land Use Intensity in China *Land Use Policy* 35: 33–39

LAGARIAS, A. (2007): Fractal Analysis of the Urbanization at the Outskirts of the City: Models, Measurement and Expalnations *Cyber Geo: European Journal of Geography*, document 391.

LAGOS STATE GOVERNMENT (2013): *Digest of Statistics 2013* Lagos Bureau of Statistics, Lagos.

LAWANSON, T. – YADUA, O. – SALAKO, I. (2012): Environmental Challenges of Peri-Urban Settlements in the Lagos Megacity In: SCHRENK, M. –POPOVICH, V. V. – ZEILE, P. –ELISEI, P. (Ed.) *17th International Conference on Urban Planning, Regional Development and Information Society* pp. 275–285., CORP Association, Schwechat.

LIFENG, S. – FANG, L. – ZENGXIANG, Z. – XIAOLI, Z. (2015): Monitoring Urban Expansion and Morphology Changes of Tangshan by Using Remote Sensing In: Bian, F. – Xie, Y. *Geo-Informatics in Resource Management and Sustainable Ecosystem, Communications in Computer and Information Science* 482: 625–634., Springer, Berlin–Heidelberg.

MARTELLOZO, F. – RAMANKUTTY, N. – HALL, R. J. – PRICE, D. – PURDY, B. – FRIEDL, M. (2014): Urbanization and the Loss of Prime Farmland: A Case Study in the

Calgary-Edmonton Corridor of Alberta *Regional Environmental Change* 15 (5):881–893.

TANNIER, C. – PUMAIN, D. (2005): Fractals in Urban Geography: A Theoretical Outline and an Empirical Example *Cybergeo: European Journal of Geography*, document 307.

TERZI, F. – KAYA, H. S. (2011): Dynamic spatial analysis of urban sprawl through fractal geometry: the case of Istanbul *Environment and Planning B: Planning and Design* 38 (1): 175–190.

THEBO, A. L. – DRECHSEL, P.– LAMBIN, E. F. (2014): Global Assessment of Urban and Peri-urban Agriculture: Irrigated and Rainfed Croplands *Environmental Research Letters* 9 (11): 1–9.

THEOBALD, D. M. (2005): Landscape Patterns of Exurban Growth in the USA from 1980 to 2020 *Ecology and Society* 10 (1): 32–66.

THOMAS, I. – FRANKHAUSER, P. – BIERNACKI, C. (2008): The morphology of built-up landscapes in Wallonia (Belgium): A classification using fractal indices *Landscape and Urban Planning* 84 (2): 99–115.

THOMAS, I. – FRANKHAUSER, P. – DE KEERSMAECKER, M.-L. (2007): Fractal Dimension Versus Density of the Built-up Surfaces in the Periphery of Brussels. *Papers in Regional Science* 86 (2): 287–308.

UNITED NATIONS, DEPARTMENT OF ECONOMIC AND SOCIAL AFFIARS, POPULATION DIVISION. (2014): *World Urbanisation Prospects: The 2014 Revision, CD-ROM Edition.* United Nations, New York.

ZHU, H.-Y. – LI, X.-B. (2003): Discussion on the Index Method of Land Use Change *Journal of Geographical Science* 58 (5): 634–650.

Spatial Layers and Spatial Structure in Central and Eastern Europe

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This paper analyses the special features that characterise the spatial structure of Central and Eastern Europe, a region still in the phase of transformation. This topic has already been discussed by numerous authors (Gorzelak 1997, Rechnitzer et al. 2008); the corresponding studies have identified both greater and lesser developed areas, as well as other intermediate areas, leading to various 'geodesigns', figures, and models. First, a brief description of the main studies of spatial structure affecting the macroregion is given; then our definition of the spatial structure of Central and Eastern Europe is outlined. This is not only based on the main traditional development indicators (e.g. GDP per capita, unemployment rate, and business density), but also considers the spatial structure layers (economy, society, concentration, settlement pattern, network, and innovation).

Keywords:
Central and Eastern Europe,
spatial layers,
spatial structure,
spatial autocorrelation

Introduction – Spatial structure in Central and Eastern Europe

Many spatial structure figures and models have already been developed to describe the macroregion of Central and Eastern Europe, mostly on the basis and under the influence of Western European territorial concepts (Brunet 1989, EC 1999, Hall 1992). In terms of socio-economic development, the most successful and well-known core area is named as '*Eastern European*' or the '*red banana*' (or *'boomerang')* (Cséfalvay 1999, Gorzelak 1997, 2001, 2006, Rechnitzer et al. 2008). According to the authors, the near-uninterrupted zone of development is formed by city regions, including, in particular, Budapest, Vienna, Bratislava, Brno, Prague, Poznan, Wroclav, and Gdansk. The banana model also demonstrates the future development zones: one includes Berlin and Leipzig with the Warsaw axis, while the other comprises the Adriatic region (Slovenia and Croatia) and the southern and eastern provinces of Austria. In addition, there are temporary regions (e.g. industrial districts and tourism zones) and peripheral rural areas, such as the eastern wall at the bottom of the development slope. The success of the banana model is clearly demonstrated by the appearance of its revised version, i.e. the '*new banana*' (SIC! 2006). The main feature of the region is Pan-European Corridor IV: this is the axis along which we find the countries and regions under review, which has the 'potential for the second economic core area within the EU'. Compared to the concept developed by Gorzelak, the new banana takes a 180-degree 'turn' towards the west with the addition of Slovenia and the regions of (the former) East Germany. Although the development direction heads towards Warsaw, its starting point is not Berlin but the Brno-Warsaw transport axis which also crosses Silesia. The Western European polygon concepts (Hall 1997, ESDP 1999) have also left their mark in the region in the form of a pentagon. The main cornerstones, or gravitation zones, of the *Central European pentagon* are Berlin, Prague, Vienna, Budapest, and Warsaw; in fact, a similar concentration is seen in the region surrounded by these cities, as in the case of the 'big brother' (Egri–Litauszky 2012).[1] The polycentric spatial concept ('bunch of grapes', Kunzmann–Wegener 1991) arrived in the form of MEGA[2] regions where the actual 'grapes' (capital cities and large cities) fall into potential and weak categories[3] only.

When examining the spatial structure of the region in comparison to Western European regions, we should not ignore the fact that Central and Eastern Europe can be considered only as a periphery since the economic field of force is almost entirely dominated by wider European impacts (Nemes-Nagy–Tagai 2009, Kincses–Nagy–Tóth 2013). Although it appears in many figures of the European spatial structure – mostly as a target direction, or part of a corridor, or as an attachment to more developed regions[4] – the region cannot be verified as having a major independent spatial structure form, at least according to our sources that also feature methodological components (Kincses–Nagy–Tóth 2013a, 2013b).

Spatial structure analyses

In his in-depth study providing a systematic approach to spatial structure figures, Szabó (2009) describes the main directions in the research and processing work of this topic. Spatial structure research can be categorised according to geographical and regionalist aspects. According to advocates of the former approach, the elements of geographical environment (region types) and the networks (e.g. settlements and infrastructure) qualify as spatial structure units used for the representation of socio-

[1] The main spatial structure models can be seen in the Annex.

[2] Metropolitan Growth Areas.

[3] See EC 2007 for details.

[4] As in the case of, e.g., the 'Red Octopus' (Van Der Meer 1998), the 'Blue Star' (Dommergues 1992) or global and European integration zones (ESPON 2007a).

economic weights. Conversely, the regionalists study territorial inequalities and describe spatial structure in terms of qualitative and quantitative differences. According to Szabó, it is also permissible to combine the two approaches. Representing one of the trends of spatial structure research approaches, Rechnitzer (2013) also discusses – commencing with the main indicators (e.g. GDP per capita) – the identification of territorial inequalities and the delineation of development types; and then are subsequently refined in view of further information. The other trend is a combined (multivariate and/or simulation) assessment method based on the various layers (economy, society, settlement network, geographic, environmental, etc.) of the territorial units.

Turning to our objectives, this paper essentially follows the regionalist approach, but we wish to interpret and describe the spatial structure layers and then to create a compound spatial image for Central and Eastern Europe. In our opinion, this topic has not been considered to date using this type of mathematical-statistical approach. It should be noted that our study is not intended to serve developmental purposes. Instead, it is targeted towards initial exploration.

Issues of research methodology

Our spatial structure analysis was carried out in six steps. Accordingly, the study describes our research logics, main considerations, and work methodology (e.g. territorial level and database).

1. Our first step was to perform the *operationalisation of spatial structure layers* (i.e. the studied phenomena)[5] and to explore the phenomena attached to the individual layers. We defined the layers in view of the challenges and transformation phenomena at global and European levels and near-consistently with the major studies concerning spatial structure (Gorzelak 1997, Leibenath et al. 2007, SIC! 2007, Rechnitzer–Smahó 2011, TA 2011, ESPON 2014, Simai 2014, Szabó–Farkas 2014, etc.).
   - The layers of *economy and society* remain displayed as central categories. The former layer is studied in terms of its static, dynamic, and structural features. The latter layer has been redefined: the phenomena of demographic transition (EC 2014, ESPON 2014, Simai 2014) and territorial social cohesion (EC 2008, ESPON 2014) have become the subjects of the society layer.
   - As the process of globalisation has reinforced the economic role of territorial concentrations (EC 1999, Lengyel 2003, TA 2011, Lux 2012),

[5] The layer structure is mentioned by Rechnitzer–Smahó (2011), but there are no detailed guidelines in literature sources for the complex mathematical/statistical approach to this issue. In our opinion, the notion of layers is best approached through the theory regional capital and competitiveness (Stimson et al. 2011, Lengyel 2012).

concentration is defined as a separate layer centred on the density of population, labour force, and economic output.

- The layer of *settlement pattern* has been included in the study to highlight the growing level of urbanisation (TA 2011, ESPON 2014). Although the layer of concentration presumably supplies some information on the development poles, we need to also gain insight into their expansion and agglomeration. This layer is examined in terms of the use of space (ESPON 2006).
- The *network layer* is accepted as described by Rechnitzer–Smahó (2011) and examined for the aspects of infrastructure and settlement.
- The importance of knowledge – as the 'only meaningful resource' (Drucker quotes Smahó 2011)[6] – influenced us to introduce the *innovation layer,* which plays an increasingly important role in regional growth, development, and competitiveness (Smahó 2011, OECD 2013).
- Due to the socio-economic nature of our analysis, we decided not to include the geographic, environmental and institutional layers (e.g. public policies and regulatory system) mentioned by Rechnitzer–Smahó (2011) (see Figure 1).

2. *We loaded the spatial structure layers* with a sufficient volume of relevant data. We determined the relevance and suitability of the data based on numerous literature sources and research reports dealing with this topic; we then created a database.
3. We used R type factor analysis to *identify correlations of the loaded information by layer* (Sajtos–Mitev 2007). In particular, we used main component analysis and attempted to create an independent principle component (of adequate statistical parameters[7]) for each layer. This method provides an opportunity for weighting and differentiating the importance of variables (Kovács–Lukovics 2011).
4. *Mapping the main correlations of the spatial structure layers*. For technical and statistical reasons, it is desirable to examine the relationship between layers. Accordingly, we have performed correlation analysis (Pearson–Spearman) and Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy index calculation, as well as bivariate global and local autocorrelation analyses.[8] The correlation and spatial autocorrelation analyses identify any coherence/incoherence between layers and indicate how and where the layers strengthen or weaken each other. The results of the KMO index calculation demonstrate the aggregate redundancy of the spatial structure layers.

[6] Knowledge is approached along the lines of knowledge economy, the centre of which is knowledge creation, and this is what innovation means in our opinion.

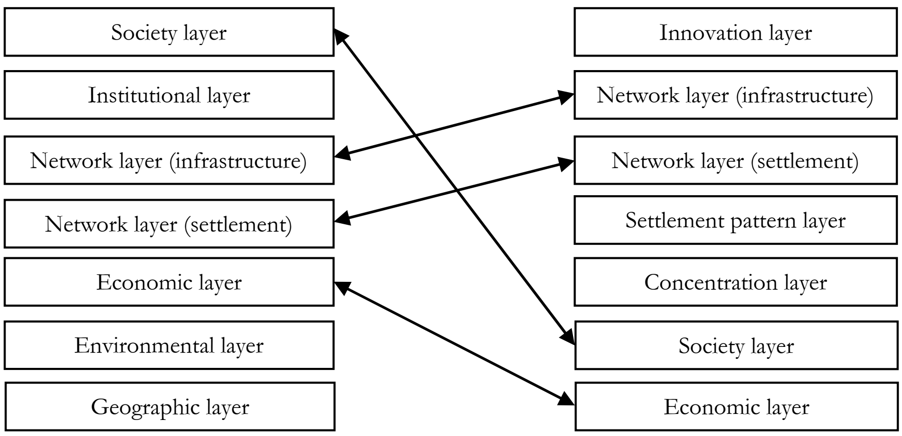
[7] The communalities must be above 0.25, the eigenvalues must exceed one, the proportion of retained variance must be higher than 60 percent, and the KMO value of the indicator structure must be at least in the acceptable category. (See Sajtos–Mitev 2007 for details.)

[8] It belongs to the tool set of explanatory spatial data analysis (Anselin 2005, Tóth 2013).

5. Through *assignment into homogeneous groups and mapping*, it is possible to identify subregions with similar characteristics and to subject them to spatial analysis. In view of its numerous advantages (applicability, interpretation, etc.), two-step cluster analysis was used. The resulting clusters were mapped. The homogeneous groups were interpreted according to three types: cities/urban areas, agglomerations, and rural/peripheral areas.
6. As the subregions involved in the analysis had been created in different manners (size and population), we applied *amendments and corrections*. This was done by mapping the settlement network features and thus supplementing the network layer.

Figure 1

Spatial structure layers for Rechnitzer–Smahó (2011) and the new model



SPSS for Windows 20.0, GeoDa 16.6, and ArcGIS 10.2 software products were used for the implementation of our research tasks.

Territorial delimitation

At macro-level, the following countries provide the spatial framework for our study: the Visegrád Four, Slovenia, Romania, Bulgaria, (the former) East Germany, and Austria. We considered it important to also involve the former East German region for two reasons: first, the spatial structure figures of Central and Eastern Europe include the region (even if not as an integral part); second, it is still considered a region in transition (Paqué 2009, Horváth 2013). Absent sufficient data, we had to ignore Croatia and other countries of the Balkans. NUTS3 subregions were selected to act as a spatial framework at meso-level. The advantages of using this level include the possibility of more detailed ‘construction’, great similarity to the actual spatial structure, little (or at least lower) loss of aggregation information, and a high number of components; furthermore it can be viewed as the level of regional decentralisation in most of the countries involved (Tóth 2003). The numerous disadvantages include the limited database (although there are promising initiatives, e.g. ESPON 2005, 2012a, 2012b), GDP reliability concerns (Dusek–Kiss 2008), and high levels of deviation for the populations.[9] The issue of modifiable territorial units represents a natural disadvantage, while the area delimitation (Dusek 2004) produces strong implications for the study. Within the area under review, for example, (the former) East Germany has 26 cities qualifying as NUTS3 units, while the Czech Republic and Hungary have only one such city each.

Database

At the time of creating our database, efforts were made to load each layer with relevant data of adequate quantity and quality. As a first step, we reviewed the literature sources and research reports dealing with this topic and region (ESPON 2006, Dijkstra 2009, ESPON 2007a, 2007b, 2010, EC 2010, Dijkstra–Poelman 2011, ESPON 2012a, 2012b, 2014). The reports are coupled with online databases; the European Observation Network for Territorial Development and Cohesion (ESPON) and the sources of Eurostat offered a solid basis for loading each layer with data. We have downloaded or created a total of 47 specific indicators. The observation period included the final years of the first decade of the 2000s (2006–2010). Unfortunately, some indicators (e.g. accessibility and use of space) were available only for a single year, and certain regions of the NUTS system underwent border changes, which prevented us from making any assessments post-2010. The selection of variables for the spatial structure layers was carried out through main component analysis, the results of which are shown in Table 1 below. The principal components are figured on boxplot maps (Figure 1).

Results

Economic layer. The sole main component indicates clear correlations. Higher economic output (gross domestic product, GDP) is positively correlated with services, business, industrial output, and tourism capacities, while agricultural employment and economic growth are negatively correlated with the former indicators. The contradiction in the polarity of the correlations between the static and dynamic variables of the economy shows the process of convergence in the region. The boxplot map indicates marked and general territorial differences, but there is no outstanding value in the component value of the economy layer. There is a clear east-west split between the continuous regions of high and low development levels.

[9] The relative deviation of population is 90% in the region under review.

Almost the entire area of Austria is shown in the (most developed) upper quartile, accompanied by each of the East German cities and their agglomerations. Warsaw, Prague, Budapest, and Ljubljana are also in this group. The economically peripheral areas cover almost the entire area of Romania and Bulgaria, and only a few regions with one or two cities and tourism districts (e.g. Timisoara, Cluj Napoca, Varna, and Constanta, as well as Bucharest and Sofia with their agglomerations) are excluded from this region type. Moreover, the (less developed) lower quartile covers most of Poland; excluded are the former Prussian regions, the Silesian core area, and the cities with their hinterlands. Within the new EU member states, only the surroundings of Prague (a former Bohemian area) and Ljubljana display the typical concentration of subregions representing the (above average) third quartile, while in other countries the same is shown only by single cities. None of this type can be found in Hungary, which is a sign of excessive concentration.

Table 1

Indicators of the principal component analysis by layer

Layers	Component
Economy *(KMO: 647; total var: 65.70%; eigenvalue: 5.25)*	
Gross domestic product per capita (PPS), 2009	.915
Gross value added per capita (euro), 2009	.947
annual work unit in agriculture, 2008	–.809
industry gross value added per capita (euro), 2009	.725
service sector employment share, 2008	.864
financial services and real estate market employment share, 2008	.850
commercial accommodation/1000 persons, 2008	.601
cumulated economic growth (%), 2006-2010	–.716
Society *(KMO: 693; total var: 59.35%; eigenvalue: 2.97)*	
population, 2010 (logarithmic)	.748
population change (‰), 2006–2010	.827
net migration (‰), 2006–2010	.731
unemployment rate as a share of active population, 2008	–.657
ageing index, 2009	–.871
Concentration *(KMO: 851; total var: 78.28%; eigenvalue: 3.91)*	
economic density (GDP/km^2), 2009	.977
employment density (employed persons/km^2), 2009	.980
population density (person/km^2), 2009	.968
territorial productivity (GDP/built-up area), 2008	.883
Network (infrastructure) *(KMO: 647; total var: 81.68; eigenvalue: 2.45)*	
accessibility by rail (% of EU27 average), 2006	.957
accessibility by air (% of EU27 average), 2006	.791
accessibility by road (% of EU27 average), 2006	.954

(Table continues on next page.)

(Continued.)

Layers	Component
Settlement pattern *(KMO: 802; total var: 72.52%; eigenvalue: 3.63)*	
share of non-continuous settlement pattern, 2006	.968
share of urban tissue, 2006	.967
share of artificial surfaces, 2006	.960
settlement density (share of built-up and agricultural areas per capita), 2006	–.695
population potential (share of population within 50 km radius), 2008	.591
Innovation[a)] *(KMO: 710; total var: 89.25%; eigenvalue: 2.68)*	
share of patents filed at EPO[b)] (patents/million persons), 2006–2009	.910
share of high tech patents filed at EPO (patents/million persons), 2006–2009	.952
share of ICT patents filed at EPO (patents/million persons), 2006–2009	.971

a) Regarding the database, we adhere to the trend represented by Porter–Stern (2003), i.e. innovations are identified with patent data. This idea has been widely criticised (e.g. Bajmócy–Szakálné 2009, OECD 2011). However, according to Varga (2009), patents represent fairly reliable measurement tools for innovations.

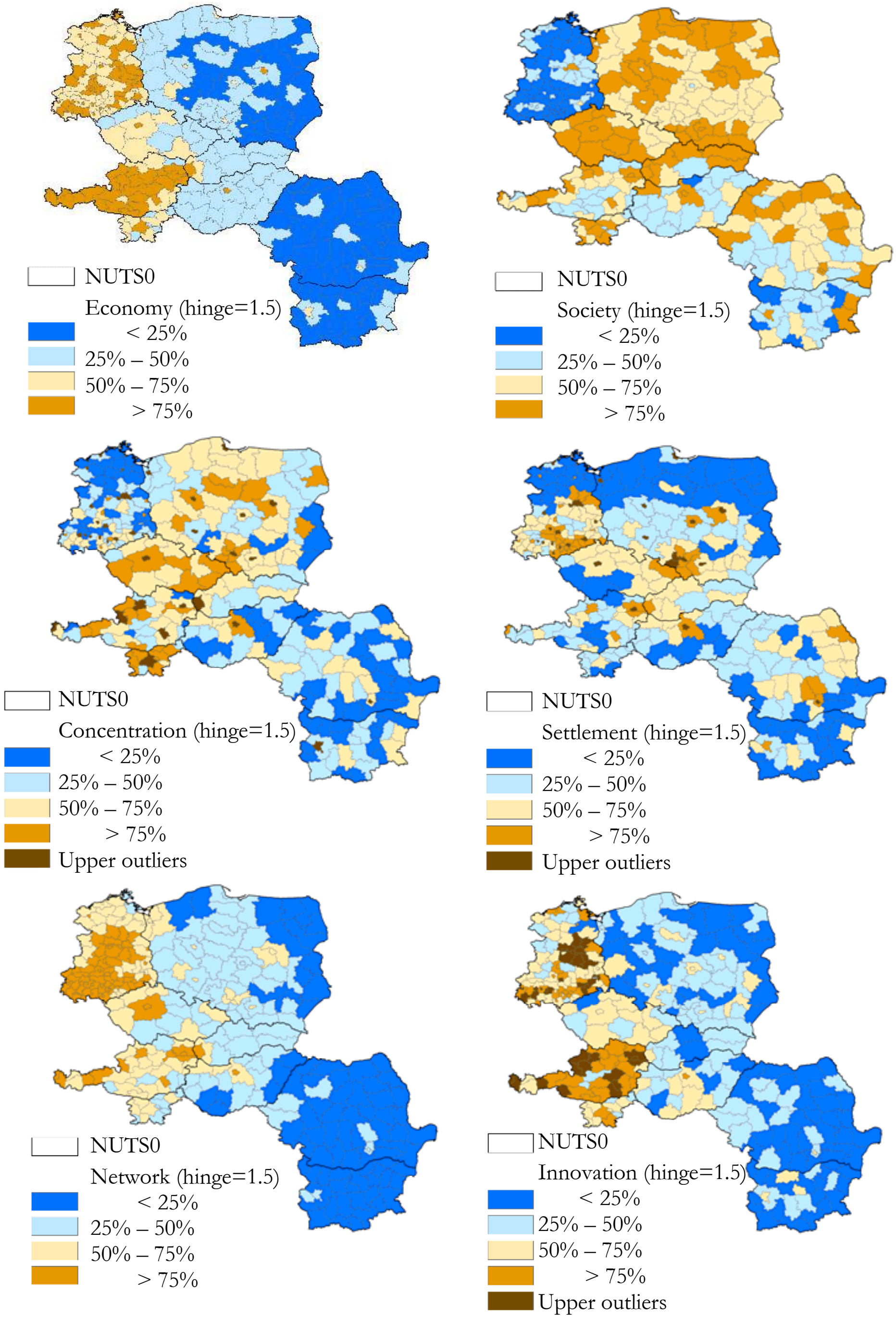
b) European Patent Office.

Source: Eurostat, ESPON online databases, own calculation.

Society layer. According to the main correlations, subregions with a higher ageing index have higher than average unemployment rates. Moreover, areas with a high rate of natural reproduction show high population numbers and high net migration rates. The parameters of the main component analysis can be considered adequate. The lower quartile accommodates mostly East German subregions, a few Bulgarian subregions, and one Hungarian subregion; the high levels of ageing, population decline, and unemployment jeopardise the social cohesion of the region here. The society layer is below the average in almost all East German regions: only three (Berlin, Dresden, and Potsdam) of the 103 NUTS3 regions indicate higher than average values. The ageing index is by far the highest here: the average is 232 percent, while the city of Hoyerswerda provides the extreme value (357 percent). The positive processes of retaining a stable population size indicate a split also at country level: Poland, the Czech Republic, Slovakia, and Slovenia (with very few exceptions) perform continuously above the average. This layer also shows urban-rural differences which are typical mostly in Austria, Hungary, Bulgaria, and (the former) East Germany.

Figure1

The spatial features of the layers in Central and Eastern Europe



Concentration layer. The indicators of socio-economic nodes show positive and significant correlations: economic output, population, labour force, and territorial efficiency rates are concentrated in a main component of desirable characteristics. Due to the special features of territorial delimitation, the cities (e.g. Berlin, Budapest, Vienna, Cracow, Szczecin, etc.) or the subregions with small agglomerations (e.g. Bratislava, Salzburg und Umbegung, Graz, and Osrednjeslovenska[10]) – acting as places that accommodate socio-economic concentrations – enjoy natural advantages. For statistical purposes, most of these cities (37) are outliers: they dominate the Central and Eastern European area. Their concentration is outstanding: the 37 regions cover 1.8% of the area under review, yet 20% of the population and 26% of the employed people are concentrated here, and more than 35% of the GDP is produced. The concentration layer ranking is led by Bucharest, Vienna, Warsaw, Budapest, Berlin, and Prague, followed by the large Polish centres (Cracow, Poznan, Lodz, Wroclaw, and Katowice) and then by the cities of Germany, Austria, Slovenia and Bulgaria. It should also be noted that the territorial delimitation does not always help certain subregions, as some smaller German cities (of 40,000–100,000 inhabitants) are not among the outliers (e.g. Frankfurt, Görlitz, Plauen, Cottbus, Eisenach, etc.). Nevertheless, in the case of these cities we can also see the 'formation' of wider agglomerations, the components of which are found in the fourth (top) quartile. These include, for example, the cross-border region of Upper Silesia, Pest county, and Jihomoravský kraj with Brno[11]. It is also clear that there is no uniform range for certain large centres; this is particularly evident in the case of Berlin. In less polycentric countries, the subregions can be identified only based on output shown in the third quartile. This category (i.e. lower socio-economic gravity points) includes, among others, the Szeged and Győr subregions in Hungary, Temes, Cluj, Constanta, Brasov, and Iasi counties in Romania, and Plovdiv, Burgas, and Varna in Bulgaria. Regarding Hungary, the western counties in the third quartile also indicate the direction of attachment to more developed European areas. The scarcely populated peripheries are located mostly in the northern part of (the former) East Germany, along the Carpathian Mountains, in East Poland, and in the rural areas of Bulgaria and Hungary.

Network layer. The weight of accessibility by road and rail is higher in the main component, while the weight of accessibility by air is less pronounced (given that airports occur 'less frequently' in the area), but it is still rather strong. All three indicators of accessibility are positively correlated and reinforce each other. The boxplot map shows normal distribution for the main component; there are no regions with outstanding values and the figure displays the centre-periphery features of transport geography. The developed continuous core of the network layer is provided by East German subregions. Regions in the fourth quartile – containing Austrian and German

[10] Central Slovenia, i.e. the subregion of Ljubljana and its agglomeration.
[11] South Moravia region.

subregions, as well as the agglomerations of Budapest, Bratislava, and Prague – exceed the EU average for all three indicators. As regards the Czech Republic, Slovakia, and Hungary, subregions of higher value can be seen only along Pan-European Corridor IV (showing the way stations, e.g. Budapest, Wien, Berlin, etc.), which indicates the region's directions of western attachment and the backbone of the potential economic core area. The north-western part and some large cities of Poland represent accessibility nodes; the former benefits from the vicinity of Germany, while the latter enjoy an advantage from the presence of airports in the regional subcentres. This accessibility feature represents a justification for the new banana. In the members of the lower quartile – covering, among others, the Polish eastern wall according to Gorzelak, most subregions of Romania and Bulgaria, and the peripheral areas of Hungary – the rates of accessibility by rail, road, and air are approximately one-quarter, below one-third and slightly above two-fifths of the EU average respectively.

Innovation layer. The indicators making up the layer that expresses innovative ability (and knowledge economy) display relatively strong positive correlations. The spatial analysis indicates the emergence of dynamic agglomeration benefits in the region (Lengyel-Rechnitzer 2004), but with a strict east-west division line. Jena, Vienna, Berlin, Graz, Salzburg, Linz, Wels, Dresden, Greifswald, Ilm kreis, Leipzig, Frankfurt, Potsdam, Erfurt, and their agglomerations have a clear dominance over the Central and Eastern European area. These subregions (36) are outliers; this fact is evident from the concentration of the indicators involved. This area produces 60% of all patents, 70% of high tech patents, and 67% of ICT patents. Sitting in the fourth quartile, Budapest ranks highest in this regard among the Visegrád and Balkan subregions, while Prague, Warsaw, Bucharest, and Sofia are only in the third quartile. The concentration of patents displayed by the below-average groups provides information on the uneven distribution of innovation output. It is below 1 percent in the first quartile and, even if the first and second quartiles are combined, the total is still below 5 percent for all three patent forms.

Settlement pattern. The analysis has revealed clear correlations: the indicators regarding urban use of space and the share of population within a 50 km radius are positively correlated, while the share of built-up and agricultural areas per capita is inversely correlated with the component. The statistical tests used for suitability verification show compliance. The spatial analysis of the main component results in a more marked display of the cities and their emanating impacts (agglomerations), and the rural areas are also delimited. Urban agglomerations are shown by the 32 cities (outliers) and the related upper quartile. The main settlement structure nodes are represented by Berlin, the continuous zone of Dresden, Chemnitz-Zwickau, Leipzig, Halle and Magdeburg, Upper Silesia centred around Katowice and the agglomerations of Warsaw, Lodz, Prague, Vienna, Budapest, and Bucharest. Based on indicators regarding the use of space, the rural areas are also exhibited with their typical features, and it is easy to identify the German-Polish Plain as well as the rural areas of the Czech Republic, Hungary, Romania, Bulgaria, and Austria.

Main correlations of the spatial structure layers

According to Rechnitzer (2013), the various layers are placed on top of each other in space. Their impact and strength may vary at the individual spatial points, with the layers reinforcing or destroying each other. Layer correlation is first examined with the Pearson and Spearman correlation coefficients[12] (Table 2). The correlation of individual layers generates mostly significant results, although a diverse picture emerges according to their strength. Based on the Pearson correlation coefficient, the strongest reinforcing correlation exists between the network and economy layers and between the concentration and settlement structure layers. The interpretation of these (synergistic) relations can be fine-tuned by the rank-order correlation coefficient, as it gives further information on the relationship between the network and innovation layers and between the innovation and economy layers. Synergistic relations of medium strength exist between the innovation and settlement structure layers, society and concentration layers, settlement structure and economy layers, concentration and economy layers, and innovation and concentration layers. It is interesting to see the weak inconsistency and antagonistic impact between the society and economy layers, indicating a serious spatial split of the two most important phenomena in Central and Eastern Europe. According to our calculations, there is no significant interaction between the society and settlement structure layers.

Table 2

Main correlations between individual layers based on the Pearson and Spearman rank-order correlation

	Economy	Society	Concentration	Infrastructure	Innovation	Settlement pattern
Economy	1.000	–.263**	.358**	.873**	.558**	.462**
Society	–.259**	1.000	.240**	–.310**	–.023	.049
Concentration	.422**	.449**	1.000	.262**	.222**	.835**
Infrastructure	.876**	–.285**	.349**	1.000	.523**	.442**
Innovation	.834**	–.182**	.392**	.812**	1.000	.315**
Settl. struct.	.454**	.049	.618**	.523**	.466**	1.000

The Pearson correlation coefficients and the Spearman rank-order correlation coefficients are shown above and below the main diagonal, respectively. ** stands for the 1% significance level.

Since the ultimate aim of our analysis is to create homogeneous groups, the aggregate redundancy of individual layers was also examined. According to Sajtos–Mitev (2007), if the correlation between individual variables is too strong (above 0.9), their joint application leads to redundancy or distortion. Although no correlation of such strength was found, we had no information on the group of

[12] The use of the latter (rank-order correlation coefficient) is important for the treatment of outlier data.

variables. This is why the test/indicator expressing the suitability of the variables involved is used during the main component analysis. The KMO index has proved that the layers involved are suitable for the main component analysis, which means that redundancy exists but it has only a weak or moderate level (Sajtos–Mitev 2007, Füstös–Szalma 2009; Table 3).

In our opinion, the paired and aggregated correlations of the layers created with socio-economic content represent a versatile spatial structure and, therefore, enable us to describe the special features of the spatial structure in Central and Eastern Europe. Before that, though, we describe the spatial relations of the individual layers.

Table 3

Redundancy test of spatial structure layers

Kaiser–Meyer–Olkin Measure of Sampling Adequacy		.625
Bartlett's test of Sphericity	Approx. Chi-Square	1,188.603
	df	15
	Sig.	.000

For this purpose, we have used bivariate global and local autocorrelation analyses. Table 4 contains Moran's I for the bivariate global autocorrelation analyses. The purpose is to identify how one phenomenon influences the spatiality of another and to see the direction and strength of the spatial configuration resulting from their interaction[13] (Anselin 2003). The layers in the first column of Table 4 represent spatially lagged variables 'y', while the layers in other columns always produce the corresponding variable 'x'. The first figure (–0.297) expresses how the society layer influences the spatiality of the economy layer. The figure indicates negative neighbourhood assimilation for the two parameters.

Table 4

Bivariate global autocorrelation analyses of spatial structure layers (Moran's I)

	Society	Concentration	Infrastructure	Innovation	Settlement pattern
Economy	–.297	.064	.750	.424	.157
Society	–	.214	–0.350	–.157	.008
Concentration		–	.087	.053	.037
Infrastructure			–	.435	.297
Innovation				–	.105

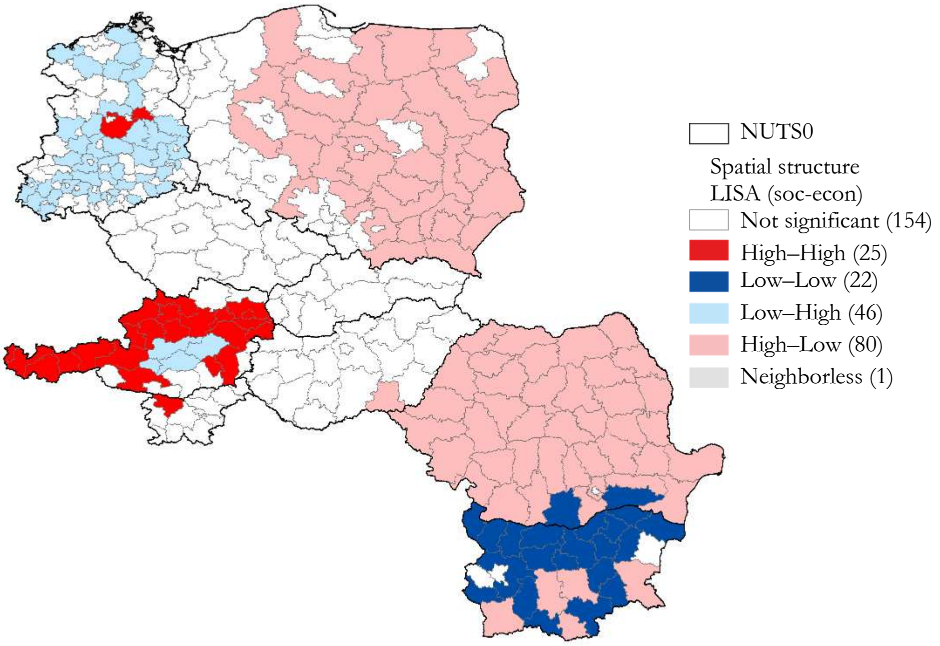
The neighbourhood matrix is based on queen-1 contiguity. Pseudo-p 0.05; number of permutations: 999.

[13] It is answered through Moran's I. If I>–1/N–1 then the autocorrelation is positive; if I<–1/N–1 then it is negative. If I= –1/N–1 then there is no autocorrelation between the individual spatial units. Its maximum approaches 1, its minimum approaches –1, but it has no precise value as it depends on the neighbourhood matrix and the number of spatial units (Dusek 2004). In the current case –1/N–1 = –0.003.

Furthermore, the network and economy layers exhibit a tight parallel movement and clustering where Moran's I equals 0.750. Negative neighbourhood assimilation was detected in three cases, while the remaining 12 cases show some level of positive autocorrelation.[14] Nevertheless, the tight correlation detected formerly between the settlement structure and concentration layers (Table 2) is lost 'in space'.

Figure 2

Local spatial autocorrelation pattern of society and economy



Accordingly, settlement structure does not generate any substantial spatial impact and only has an emanating impact on the individual socio-economic nodes.[15] It is (also) probable, based on this correlation, that the spatial character of the level of socio-economic development takes the shape of a 'bunch of grapes'.

The following Figures show two correlations of extreme values and describe their local pattern based on Local Moran's I. The local pattern shows the spatial arrangement (high-high, low-low) of high values (hot spot) and low values (cold spot)

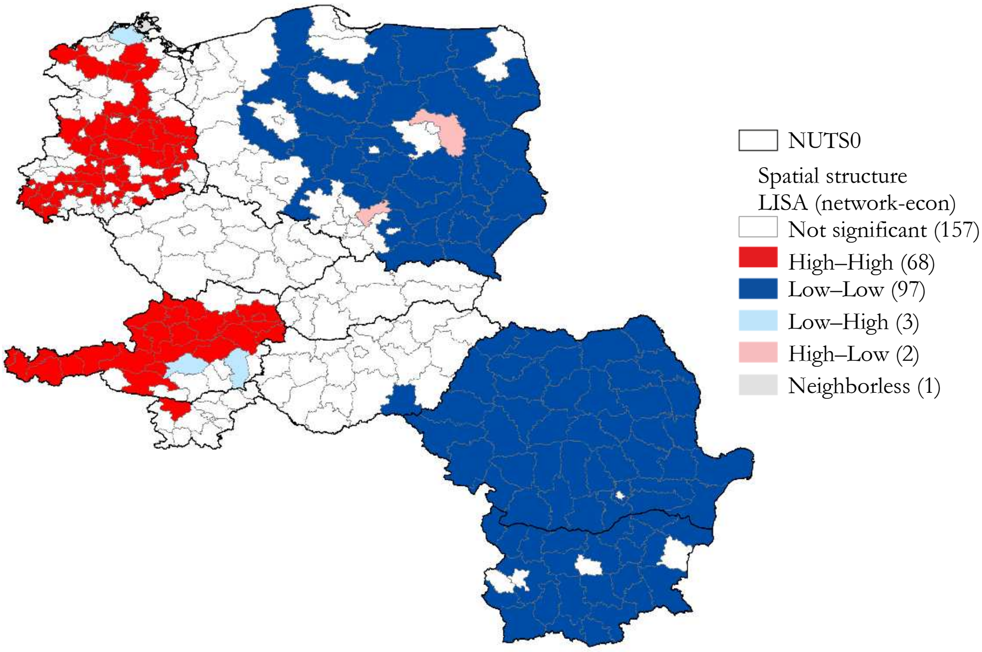
[14] The sign and strength of the correlations are similar to those of the correlation coefficients.

[15] A methodological note should be made here. Both layers display a large number of outstanding values. This status is attributable to the applied indicator structure and the method of delimitation. (The impact of indicator structure is more marked in the case of the concentration layer as the use of density indicators facilitates the emergence of the above feature.) The logarithmisation of the applied indicators could have made it easier to identify spatial emanating impacts (due to the narrowing of the data series), but in this case the outstanding nature and the spatial dominance would have been eliminated for these subregions.

and the locations of the spatial units that significantly differ from each other (low–high, high–low).

Figure 3

Spatial configuration of network and economy layers in Central and Eastern Europe



Although the negativity of neighbourhood assimilation is stronger between the network and society layers (Moran's I= –0.350), we describe the joint spatial configuration of the two central layers (society and economy; Figure 2). This spatial arrangement shows the one-sided status of the two basic parameters in Central and Eastern Europe; the number of outlier subregions (LH, HL) exceeds, even separately, the extent of those in the clean (HH, LL) clusters. Adverse spatial relations (low society–low economy) occur mostly in the Bulgarian region and in two Romanian (cross-border) regions. The significant arrangement of high-high is present in only 26 subregions, and only Austria displays a continuous cluster. Apart from the HH clusters of Berlin and Potsdam in (the former) East Germany, almost the entire country area is a spatial outlier, and the adverse society layers are coupled with a fairly strong economy layer. The high society–low economy outlier cluster is fairly extensive: apart from the central and eastern subregions of Poland, it includes Romania and some subregions of Bulgaria. An example of spatially synergistic layers is shown in Figure 3. The east–west division of the network and economy layers is clearly visible, leading to significant hot spot and cold spot clusters. The majority of

East German and Austrian subregions is continuous HH, while LL groups exhibit a strong level of eastern determination. The number of outliers is small: only five regions 'disturb' the space of uniform clusters.

Results of cluster analysis

A cluster analysis was performed to typify the individual NUTS3 regions and to delimit the spatial units of various development stages that can be separated from each other.

At the start of the analysis, it is useful to recall that 'the term of spatial structure should be used to denote designs that demonstrate the socio-economic features of geographic space in a selective, generalised, and simplified manner' (Szabó–Farkas 2014). However, in our case, the large number of elements, the applied variables, and the issue of modifiable territorial units enabled and, moreover, forced us to display the versatile spatial structure. We have opted for the two-step cluster method because it: (i) eliminates the disadvantages of the K-means analysis suitable for handling a large number of elements (Lukovics–Kovács 2011), (ii) makes a proposal for the ideal number of clusters, and (iii) enables us to interpret groups of special characters (Sajtos–Mitev 2007). After several attempts, 21 was chosen as the number of clusters. This number was justified by the result of the Silhouette coefficient (0.4 means acceptable category) used for the statistical interpretation of consistency.

Table 5

General features of city and urban clusters

Urban clusters	Economy	Society	Concent-ration	Infra-structure	Innovation	Settl. pattern
Pentagon cornerstones	1.67	1.27	5.15	1.43	0.75	3.98
Balkan focal point	0.22	1.21	9.71	–0.43	–0.28	4.98
Polish large centres	0.37	0.60	2.34	0.17	–0.31	2.73
Silesian metropolis	–0.18	0.80	0.54	–0.05	–0.46	1.09
'City of science'	1.95	0.25	1.31	1.78	9.29	1.22
German stars (1)	1.57	0.40	0.83	1.30	4.35	1.33
German stars (2)	1.49	–0.99	0.98	0.81	–0.10	2.25
German stars (3)	1.45	–0.17	1.28	1.96	1.36	2.29
Ageing subcentres with declining population	1.24	–1.50	0.30	1.14	0.42	1.05
Austrian regional centres	1.98	0.96	0.36	1.30	1.84	0.14

To avoid redundancy, the spatial structure of Central and Eastern Europe will be described in three parts. First, we describe the main focal points, cities and urban areas; then their spatial expansion and relevant groups (agglomerations and wider hinterlands); finally, the scarcely populated rural-peripheral clusters. Due to the differing delimitation (often by nation) of spatial units and the absence of a settlement network layer, the results need to be adjusted. Therefore, spatial typification was compared to the population-based categorisation of functional urban regions[16] (Figure 4). In view of this (and our previous knowledge), it is stated in advance that the relevant metropolis regions can be detected and delimited with a good approximation. Additional spatial structure types (e.g. agglomerations, hinterlands, and scarcely populated rural areas) can also be identified. However, the specific nature of the delimitation represents a major obstacle for large functional urban areas with more than 250,000 inhabitants.

The groups of cities and urban areas shown as major socio-economic nodes result in a versatile structure; this is reinforced by the fact that these groups account for almost half of all clusters (Table 5). The first cluster, named *Pentagon cornerstones,* includes cities located at the top of the settlement hierarchy: Berlin, Vienna, Prague, Budapest, and Warsaw. The most important socio-economic gravity points are ranked first in almost every layer: economy, concentration, and settlement structure are outstanding, while network and society provide one of the best results in urban areas. The only factor that lags behind is innovation: it shows the east-west division within the group as Budapest, Prague, and Warsaw produce only one-sixth or one-seventh of the patent indicators shown for Vienna and Berlin. Bucharest is the sole member of the cluster named *Balkan focal point*. Its socio-economic concentration, just like its settlement structure layer, is the highest in the region under review. Its economic dimension is significantly below the average, but this is true only for the static indicators. In fact, it has outstanding economic dynamics, the highest among the studied capital cities. The population retention layer is similarly positive in the capital city of Romania, although lags in the fields of infrastructure and innovation make Bucharest a one-sided urban pole. The next two clusters show national nature. The *Polish large centres* such as Lodz, Cracow, Katowice, Poznan, Wroclaw, and the Tri-City (Gdansk-Sopot-Gdynia) emerge as substantial socio-economic gravity points in the Central and Eastern European space under review. Despite their large populations – indicated also by the outstanding values of the concentration and settlement

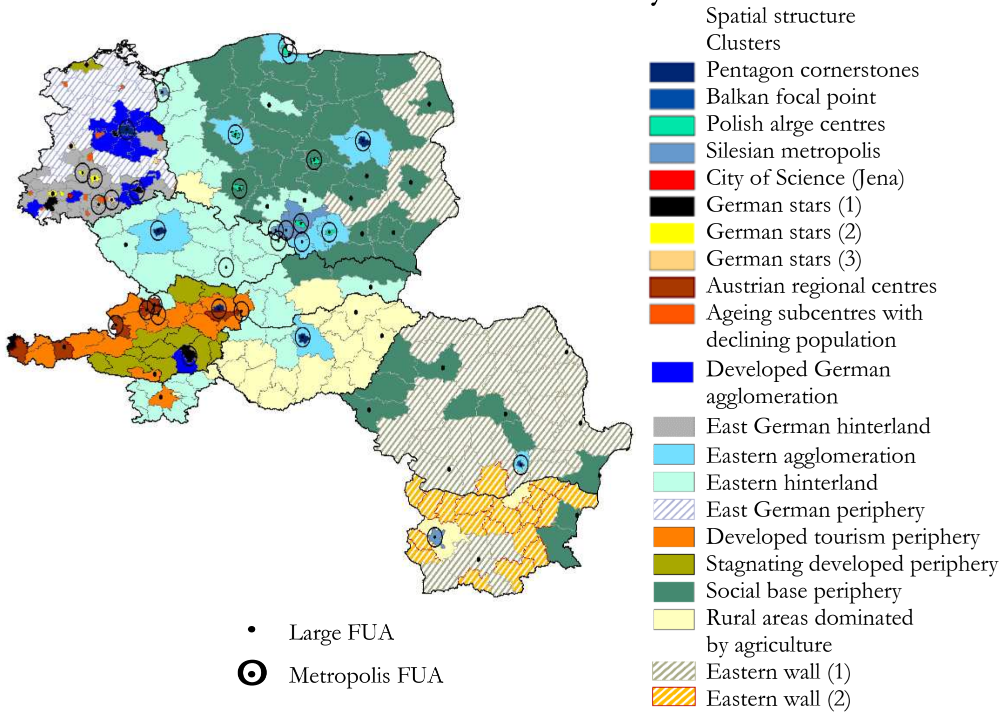
[16] The urban function study of ESPON (2007) was used for this issue. In that study, the large functional urban areas (FUAs) are regions with 250,000–500,000 inhabitants and the metropolis areas are regions with more than 500,000 inhabitants. Besides population numbers, the national and international decision-making centres, transport infrastructure, knowledge, culture, tourism, and industrial output play a role in the determination of FUAs (ESPON 2005, 2007).

structure layers – they perform poorly in terms of innovation and infrastructure, in comparison with other metropolis regions, and thus diminish their existing advantages. The *Silesian metropolis* covers most of the macroregion termed the 'black hole' by Gorzelak (1997). This cluster embodies the multi-centre agglomeration of Katowice, except for Moravia (Moravskoslezský kraj) in the Czech Republic. The Sofia region also joins the agglomeration, which is facilitated by similar settlement structure factors and the delimitation effort. Population retention is above the average in both clusters.

The next six clusters are located on the western side of the region under review, i.e. in (the former) East Germany and Austria. The cluster named *City of science* has only one member. The city of Jena represents the highest innovation potential in the region, coupled with a fairly strong economic position. Its role of socio-economic gravity point weakens in terms of population retention; ageing is a particular challenge for the city. The German stars cover German regions and the subregions of Graz and Bregenz. Their rank is based on economic output. The group of *German stars (1)* covers large centres and metropolises (Dresden and Graz) but also includes smaller regional urban areas of innovation and tourism (e.g. Potsdam, Greifswald, Ilm-Kreis, and Bregenz). Of the three clusters, this one has the strongest innovation layer, supported also by its excellent network and economy layers. The centre of *German stars (2)* is the metropolis area of Chemnitz-Zwickau and the regional service centres of Magdeburg, Rostock, and Cottbus. Their strong economic potential is coupled with poor innovation, and this status is further weakened by the society layer. This cluster is burdened with one of the highest rates of ageing, emigration, and unemployment. Concentrated in space, the cluster named *German stars (3)* is located in the south-western part of (the former) East Germany. Its central region is the Lepzig-Halle metropolis accompanied by Weimar and Erfurt. Its spatial structure layers are above the average in most cases. In particular, the network layer is outstanding (due to its great accessibility by rail and road). However, the society layer is not so impressive. The common feature of the cluster named *Ageing subcentres with declining population* (Frankfurt, Schwerin, Görltiz, Gera, etc.) is the low population level (40,000–130,000 inhabitants). The population retention layer is substantially below the average, compromising the better economy and infrastructure layers.

Figure 4

Spatial structure of Central and Eastern Europe shown on the basis of socio-economic layers



The *Austrian regional centres* represent the tertiary nodes of Austria (e.g. cross-border functional uban area of Salzburg, metropolis region of Linz-Wels, Innsbruck, etc.) or belong to such nodes (e.g. the southern agglomeration of Vienna). It is characterised with the most balanced layer structures; lagging in the case of concentration and settlement structure layers is attributable only to the delimitation effort.

Table 6

Average output of layers in the attraction zone regions

Emanating clusters	Economy	Society	Concent-ration	Infra-structure	Inno-vation	Settl. pattern
Developed German agglomerations	0.69	–0.42	–0.29	1.02	1.36	0.12
East German hinterland	0.60	–1.35	–0.31	1.13	–0.01	0.11
Eastern agglomeration	–0.58	1.72	–0.09	0.02	–0.40	0.18
Eastern hinterland	–0.04	0.73	–0.09	0.02	–0.34	–0.32

The attraction zones are categorised along two distance dimensions: the ones closer to cities are called agglomerations and the larger ones located further away from cities are named hinterlands (Table 6). These attraction zones are divided in space as well. The differences come from the interaction between the layers. The east-west differences should be interpreted in terms of the economy, society, infrastructure, and innovation layers. The *developed East German agglomerations* refer to the attraction zones of Berlin, Dresden, Jena, Erfurt, and Graz. The economy, network, and innovation layers of the regions reinforce each other, but the society layer represents a strong deteriorating factor. However, the *Eastern agglomerations* excel in the field of population retention, while their other layers fail to reach the average of the region under review. The Eastern agglomerations represent the emanating impacts of such regional nodes and the Tri-City, Warsaw, Prague, Budapest, Bucharest, Cracow, Katowice, and Poznan. The *East German hinterland* and the *Eastern hinterland* cover an extensive zone of loose settlement structure beyond the agglomerating regions. Concentrated in the southern part of (the former) East Germany, the East German hinterland provides a background for agglomerations and metropolis FUAs. Moreover, the Eastern regions with an expanded attraction zone function as connection axes towards the West: Poland has a belt area along the German border, while the entire area of the Czech Republic, the western layers of Slovakia and Hungary, and the Slovenian layers of good network properties help the formation of these spaces. This spatial character facilitates the acceptance of the new banana structure.

The *East German periphery* is one of the most backward clusters in terms of the population layer; it is above the average economy and network layers are unable to improve the poor state of ageing, emigration, and unemployment. The categories of *developed tourism periphery* and *stagnating developed periphery* are present mainly in Austria. Among the rural areas, the innovation layer is outstandingly reinforced – for the developed tourism peripherycluster type – by the economy, society, and network layers. This category is characterised by a high capacity for tourism. The subregions of Bratislava and Ljubljana are also part of the region; the awkward position is attributable partly to the delimitation effort.[17] Although the level of concentration differs from that of other Austrian regions, the innovation, infrastructure, and society layers direct them into the same cluster. The units of *stagnating developed periphery* are found in Austria; their economic, network, and innovation potential exceeds that of similar cluster groups located in the east. The clusters named *social base periphery* and *rural areas dominated by agriculture* are similar, but the former has a vigorous population retention layer and the latter has a satisfactory economy layer. The remaining layers are significantly below the average. The peripheral regions are concentrated into two clusters named '*eastern wall (1)' and 'eastern wall (2)'*. These groups suffer from

[17] Both capital cities were considered with their respective attraction zones. Their respective population figures are not outstanding as these subregions have some 500,000 inhabitants.

multidimensional backlogs in terms of the economy, infrastructure, and innovation layers, which are the worst among the studied regions. The relatively more developed first group – encompassing Polish eastern subregions as well as Romanian and Bulgarian subregions – has a much stronger society layer, exceeding even that of rural areas dominated by agriculture (which comprise mostly Hungarian regions). The second category accommodates the least developed Romanian and Bulgarian regions, but the society layer does not exceed the average of the *East German periphery* (Table 7).

Table 7

Layer characteristics of rural and peripheral clusters

Emanating clusters	Economy	Society	Concent-ration	Infra-structure	Inno-vation	Settl. pattern
East German periphery	0.60	–1.45	–0.49	0.58	–0.25	–0.67
Developed tourism periphery	1.28	0.80	0.01	0.76	0.50	–0.20
Stagnating developed periphery	0.69	0.00	–0.31	0.13	0.32	–0.56
Social base periphery	–0.83	0.83	–0.21	–0.79	–0.47	–0.47
Rural areas dominated by agriculture	–0.47	–0.18	–0.33	–0.68	–0.42	–0.49
Eastern wall (1)	–1.40	0.44	–0.38	–1.38	–0.50	–0.43
Eastern wall (2)	–1.26	–0.84	–0.45	–1.38	–0.50	–0.69

Several large FUAs are found in the area covered by clusters named *social base periphery* and rural areas dominated by agriculture: on the eastern side of Poland, in the relatively more developed subregions of Romania, in the seaside regions of Bulgaria, and in Eastern Hungary. It is also evident that these smaller poles of regional level are unable to properly highlight their regional base from the rural space or to ascend to a higher category from the deep peripheries (e.g. see the cases of Bialystok, Lublin, Kielce, Brasov, Cluj Napoca, Constanta, and Varna). However, Iasi, Craiova, Galati, and Plovdiv are unable to make such upward progress due to their low socio-economic weight in the periphery of Central and Eastern Europe and to their (current) inability to improve their state of backwardness.

Summary

Our study aimed to demonstrate the spatial structure of Central and Eastern Europe. For this purpose, we employed and operationalised the spatial structure and then described the territorial characteristics of the region with the use of multivariate and spatial methods.

According to the results obtained, the main socio-economic processes are deemed suitable for modelling by layer and the model is deemed suitable for use in spatial structure research work. The layers represent rather fragmented areas characterised by traditional differences (east-west, urban-rural) and other (nationwide) inequalities. The layers have versatile correlations and both synergistic and antagonistic mechanisms. In particular, the two most important layers (economy and society) do not show coherent parallel movements, which indicates serious problems in terms of future demographic processes. By employing the multivariate methodology, the relevant layers lead to a versatile spatial structure. As a result, it is difficult to perform the usual and straightforward categorisation using generalised figures. Therefore, we describe the main elements in three parts: cities/urban areas generating development, attraction zone regions, and rural/peripheral clusters. At the same time, our results also highlight the main transformation processes (demographics, innovation, and urbanisation) affecting the region. According to our analyses, developed areas that are either banana-shaped or shaped like a bunch of grapes (polycentric) can be found in the region. In the former case, the *new banana* shape seems to have a more solid base, and the mathematical-statistical methods have also identified a string of the western subregions of the Visegrád countries. However, the eastern wall covers a much larger area than in the former figures.

Since our study aimed to typify intermediate regions, i.e. areas considered peripheral from a European perspective (except for Austria), the study results should be interpreted within that framework. Although our study was intended to serve the purpose of identification and analysis, it may be used as a point of reference for the development aspects of European (cross-border, transnational, and inter-regional) territorial cooperation initiatives affecting the macroregions.

REFERENCES

ANSELIN, L. (2003): *An Introduction to Spatial Autocorrelation Analysis with GeoDa* Spatial Analysis Laboratory Department of Agricultural and Consumer Economics, University of Illinois, Urbana-Champaign.

ANSELIN, L. (2005): *Exploring Spatial Data with GeoDaTM: A Workbook* Center for Spatially Integrated Social Science, Spatial Analysis Laboratory Department of Geography University of Illinois, Urbana-Champaign.

BAJMÓCY, Z. – SZAKÁLNÉ KANÓ, I. (2009): Hazai kistérségek innovációs képességének elemzése *Tér és Társadalom* 23 (2): 45–68.

BRUNET, R. (1989): *Les villes europeénnes: Rapport pour la DATAR* Reclus, Montpellier.

CSÉFALVAY, Z. (1999): *Helyünk a nap alatt… Magyarország és Budapest a globalizáció korában* Kairosz Kiadó/Növekedéskutató, Győr.

EC (1999): *European Spatial Development Perspective. Towards Balanced and Sustainable Development of the Territory of the European Union* Office for Official Publications of the European Communities, Luxembourg.

DIJKSTRA, L. (2009): Metropolitan regions in the EU *Regional Focus* nr. 01/2009.

DOMMERGUES, P. (1992): The Strategies for International and Interregional Cooperation *Ekistics* 59:352/353.

DUSEK, T. (2004): *A területi elemzések alapjai* Regionális Tudományi Tanulmányok 10., ELTE TTK Regionális Földrajzi Tanszék, Budapest.

DUSEK, T. – KISS, J. P. (2008): A regionális GDP értelmezésének és használatának problémái *Területi Statisztika* 48 (3): 264–280.

EC (2008): *Green Paper on Territorial Cohesion. Turning territorial diversity into strength* Communication from the Commission to the Council, the European Parliament, the Committee of the Regions and the European Economic and Social Committee, Brussel.

EC (2010): *Rural Development in the European Union* Statistical and Economic Information Report 2010. Directorate-General for Agriculture and Rural Development, Brussel.

EC (2011): *Territorial Agenda of the European Union 2020. Towards an Inclusive, Smart, and Sustainable Europe of Diverse Regions* http://www.terport.hu/webfm_send/2291 (Downloaded: 12.10.2012).

DIJKSTRA, L. – POELMAN, H. (2011): Regional typologies: a compilation *Regional Focus* nr. 01/2011.

EC (2014): *Population ageing in Europe* Facts, implications and policies Directorate-General for Research and Innovation, Brussel.

EGRI, Z. – LITAUSZKY, B. (2012): *Térszerkezeti sajátosságok Közép-Kelet-Európában* http://www.mrtt.hu/vandorgyulesek/2012/2/egri.ppt (Downloaded: 20.11.2015).

ESPON (2005): *Potentials for polycentric development in Europe* ESPON 1.1.1. Project. ESPON Coordination Unit, Luxembourg.

ESPON (2006): Urban-rural relations in Europe. ESPON 1.1.2. Final Report. ESPON Coordination Unit, Luxembourg.

ESPON (2007a): *ESPON project 4.1.3 Feasibility study on monitoring territorial development based on ESPON key indicators* ESPON Coordination Unit, Luxembourg.

ESPON (2007b): *Study on Urban Functions* ESPON 1.4.3 Final Report, ESPON Coordinate Unit, Luxembourg.

ESPON (2010): *Metropolitan macroregions in Europe: from economic landscapes to metropolitan networks (Cities and their Hinterlands)* FOCI Future Orientations for Cities Final Scientific Report, ESPON Coordinate Unit, Luxembourg.

ESPON (2012a): *EDORA European Development Opportunities for Rural Areas* Final Report, ESPON Coordination Unit, Luxembourg.

ESPON (2012b): *SGPTD Second Tier Cities and Territorial Development in Europe: Performance, Policies and Prospects* Final Report, ESPON Coordination Unit, Luxembourg.

ESPON (2014): *ET2050 Territorial Scenarios and Visions for Europe* Final Report, ESPON Coordination Unit, Luxembourg.

FÜSTÖS, L. (2009): *A sokváltozós adatelemzés módszerei* In.: Füstös L. – Szalma I. (ed.): Módszertani füzetek 2009/1. MTA Szociológiai Kutatóintézete Társadalomtudományi Elemzések Akadémiai Műhelye (TEAM), Budapest.

GORZELAK, G. (1997): Regional Development and Planning in East Central Europe In: KEUNE, M. (Ed.): *Regional Development and Employment Policy: Lessons from Central and Eastern Europe* pp. 62–76., ILO, Budapest.

GORZELAK, G. (2001): Regional Development in Central Europe and European Integration *Informationen zur Raumentwicklung Heft* (11/12): 743–749.

GORZELAK, G. (2006): *Main Processes of Regional Development in Central and Eastern Europe after 1990. Regional Diversity and Local Development in Central and Eastern Europe* Conference paper. http://www.oecd.org/dataoecd/58/41/37778478.pdf (Downloaded: 20.11. 2015).

HALL, P. (1992): *Urban and Regional planning* Routledge, London.

HORVÁTH, GY. (2013): A német Mezzogiorno? A keletnémet regionális fejlődés az újraegyesítés után *Területi Statisztika* 53: (5) 492–514.

KINCSES, Á. – NAGY, Z. – TÓTH, G. (2013a): Európa térszerkezete különböző matematikai modellek tükrében, I. rész *Területi Statisztika* 53 (2): 148–156.

KINCSES, Á. - NAGY, Z. - TÓTH, G. (2013b): Európa térszerkezete különböző matematikai modellek tükrében, II. rész *Területi Statisztika* 53 (3): 237–252.

KUNZMANN, K. R. – WEGENER, M. (1991): The pattern of Urbanization in Western Europe *Ekistics* 58: 350–351.

LEIBENATH, M. – HAHN, A. – KNIPPSCHILD, R. (2007): Der „Mitteleuropäische Kristall“ – zwischen „Blauer Banane“ und „osteuropäischem Pentagon“. Perspektiven der neuen zwischenstaatlichen deutsch-tschechischen Arbeitsgruppe für Raumentwicklung *Angewandte Geographie* 31 (1): 36–40.

LENGYEL, I. – RECHNITZER, J. (2004): *Regionális gazdaságtan* Dialóg Campus Kiadó, Budapest-Pécs.

LENGYEL, I. (2012): Regionális növekedés, fejlődés, területi tőke és versenyképesség In.: BAJMÓCY, Z. – LENGYEL, I. – MÁLOVICS, GY. (ed.): *Regionális innovációs képesség, versenyképesség és fenntarthatóság* pp. 151–174., JATEPress, Szeged.

LENGYEL, I. (2003): *Verseny és területi fejlődés: térségek versenyképessége Magyarországon* JATEPress, Szeged.

LUKOVICS, M. – KOVÁCS, P. (2011): A magyar kistérségek versenyképessége *Területi Statisztika* 51 (1): 52–71.

LUX, G. (2012): A gazdaság szerepe a városi térségek fejlesztésében: A globális kihívásoktól a fejlesztéspolitikáig In.: SOMLYÓDYNÉ PFEIL, E. (ed.): *Az agglomerációk intézményesítésének sajátos kérdései: Három magyar nagyvárosi térség az átalakuló térben* pp. 67–89., Publikon Kiadó, Pécs.

NEMES NAGY, J. – TAGAI, G. (2009): Területi egyenlőtlenségek, térszerkezeti determinációk *Területi Statisztika* 49 (2): 152–169.

OECD (2011): *Invention and Transfer of Environmental Technologies* OECD Studies on Environmental Innovation, OECD Publishing, Washington.

OECD (2013): *Regions and Innovation: Collaborating across Borders* OECD Reviews of Regional Innovation, OECD Publishing, Washington.

PAQUÉ, K-H. (2009): *The Transformation Policy in East Germany – A Partial Success Story* http://www.kas.de/upload/Publikationen/Panorama/2009/1/paque.pdf (Downloaded: 15.11.2014).

PORTER, M. E. – STERN, S. (2001): *National Innovative Capacity* Oxford University Press, New York.

RECHNITZER, J. – GROSZ, A. – HARDI, T. – KUNDI, V. – SURÁNYI, J. – SZÖRÉNYINÉ KUKORELLI, I. (2008): *A magyarországi Felső-Duna szakasz fejlesztési kérdései* MTA RKK NYUTI, Győr.

RECHNITZER, J. – SMAHÓ, M. (2011): *Területi politika* Akadémiai Kiadó, Budapest.

RECHNITZER, J. (2013): Adalékok Kelet-Közép-Európa térszerkezetének felrajzolására *Geopolitika a XXI. században* 3 (4): 35–52.

SAJTOS, L. - MITEV, A. (2007): *SPSS kutatási és adatelemzési kézikönyv* Alinea Kiadó, Budapest.

SIC! (2006): *Sustrain implement corridor. Long factbook.*
http://195.230.172.167/cms_sic/upload/pdf/061010_SIC_LongFactbook.pdf (Downloaded: 12.10.2012).

SIMAI, M. (2014): A térszerkezet és a geoökonómia *Tér és Társadalom* 28 (1): 25–39.

SMAHÓ, M. (2011): *A tudás és a regionális fejlődés összefüggései* Doktori értekezés. Széchenyi István Egyetem Multidiszciplináris Társadalomtudományi Doktori Iskola, Győr.

SZABÓ, P. – FARKAS, M. (2014): Kelet-Közép-Európa térszerkezeti képe *Tér és Társadalom* 28 (2): 67–86.

SZABÓ, P. (2009): Európa térszerkezet különböző szemléletek tükrében *Földrajzi Közlemények* 133 (2): 121–134.

STIMSON, R. – STOUGH, R. R. – NIJKAMP, P. (2011): *Endogenous regional development* Edward Elgar, Cheltenham.

TÓTH, G. (2013): *Bevezetés a területi elemzések módszertanába* Miskolci Egyetem, Miskolc.

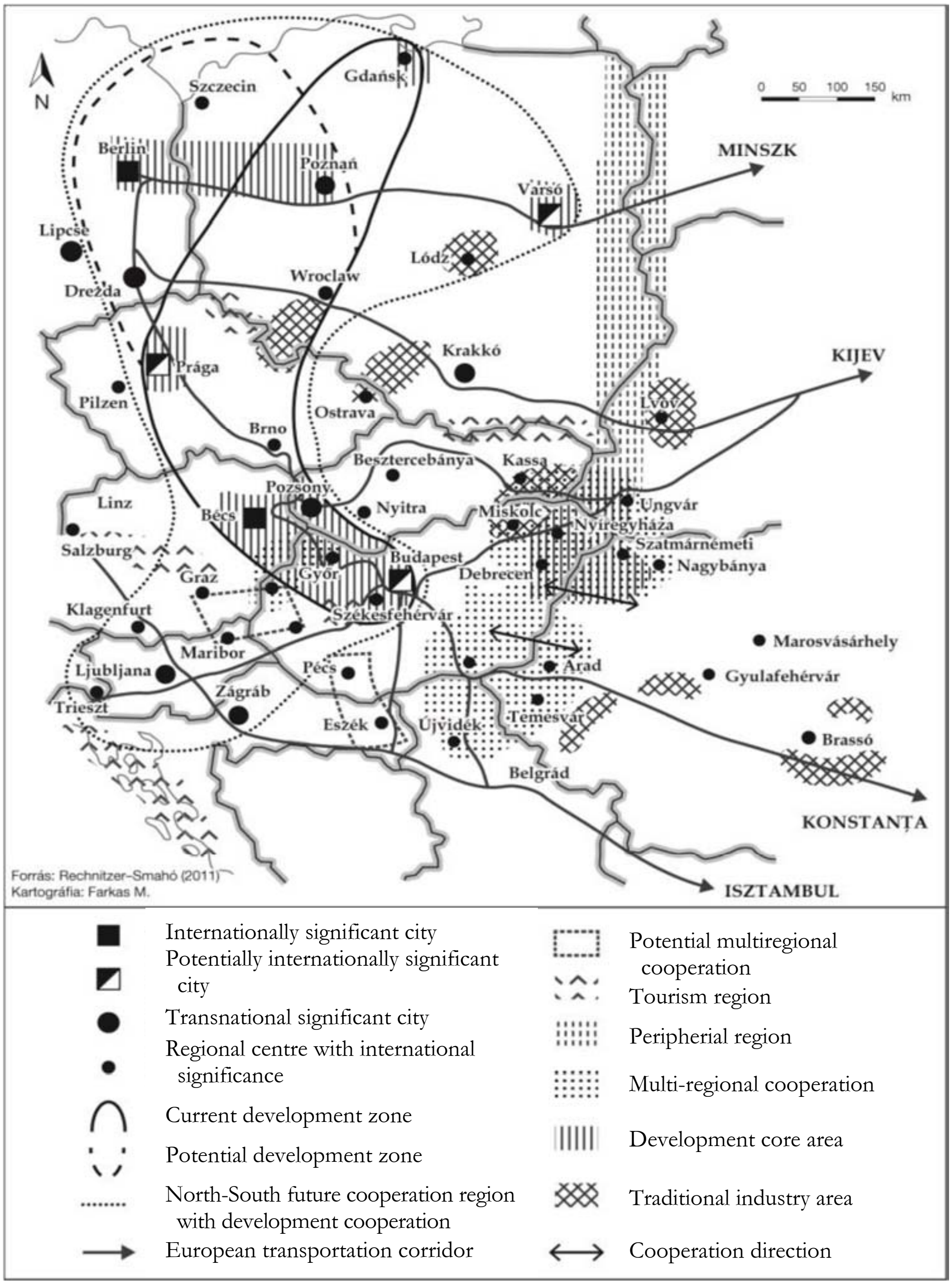
TÓTH, SZ. (2003): A régiók Európája *Korunk* 14 (1): 97–106.

VAN DER MEER, L. (1998): The Red Octopus In: BLAAS, W. (ed.) *A new perspective for European spatial development policies* pp. 9–26., Avebury, Aldershot.

VARGA, A. (2009): *Térszerkezet és gazdasági növekedés* Akadémiai Kiadó, Budapest.

ANNEX

Spatial model of Central and Eastern Europe in the 1990s

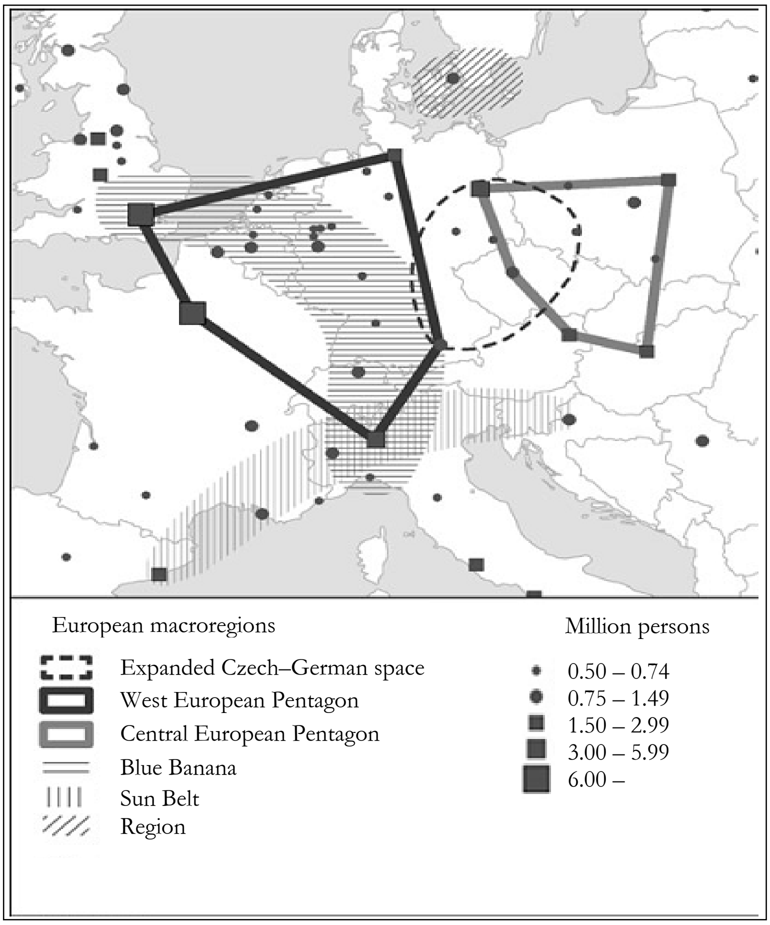


Source: Szabó–Farkas (2014) based on Rechnitzer–Smahó (2011).

Old and New banana in Europe

Source: SIC! (2006).

The European Macroregions



Source: Leibenath et al. (2007).

Local Labour System After the Turn of the Millennium in Hungary

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The current research puts the issue of functional urban regions (or districts) into the focus delimited by the commuting network of employees. The local labour system (LLS) provided a specific dimension of this complex approach however it is one of the most adequate possibilities to delineate these areas of commuting. The delimitation process consisted of two steps with the separation of employment centres and with the assignment of settlements to these cores. The alteration of the LLS pattern was also analysed as the investigation was carried out by the census data from 2001 and 2011. The results provided a comprehensive overview about the process of territorial concentration and the instability of peripheral areas. Significant regional disparities of commuting came to light as the consequence of the body of settlement network. The territorial division of the country provided by LLS pattern is fitting to the new and integrated European approach of cities and their hinterlands but it is not alternative against other administrative or statistical divisions of Hungary. However this territorial point of view is in closer relation to the issues of analysing the local labour market processes or the developments targeting the increase in employment.

Keywords:
employment,
functional urban area,
commuting,
LLS,
settlement network

Introduction

In our approach, the Local Labour System (LLS) is a dimension of the delimitation of functional urban regions, which are recently receiving attention increased. The concept of functional urban regions can be traced back to the fundamental consideration that the operation and development of different territorial units can only be successful with the integrated management of cities and their hinterlands (EU 2011).

In Hungary, regionalisation integrates functional aspects (for example educational or medical services) and is implemented on various regional levels, mainly with the objective of developing administrative units (Barancsuk–Gyapay–Szalkai 2013). In the period between the two world wars, based on the uniformity of traffic connections and agricultural production, a landscape classification was prepared in the framework of the landscape administrative theory combining physical and human geography (Hajdú 2001). The 'product' of the period after the Second World War is 'economic region research', which attempted to delimitate units held together by 'organic economic relations' on the basis of production relations and territorial division of labour. At the same time, only a few representatives of these investigations (Gyula Krajkó in Southern Great Plain and József Tóth in Southern Transdanubia) deal with the level of the micro-districts that correspond suburban relations (Beluszky–Sikos 1982). The third approach is based on the central places theory. In this approach, the ideas of county towns establishing administrative units connected by 'real common interests and solidarity' corresponding to the catchment areas of towns and considering market towns and their scattered farmsteads as a pattern are popular (Hajdú 2001).

The other aspects formulated in connection with functional cohesion and establishment of administrative units (proportionality in territorial terms and in population number, full coverage of the country's territory, assigning each settlement to one centre) are in conflict with each other. This conflict can be associated with the different nature of the spatial organizational mechanism of regionalism and regionalisation (Süli-Zakar 2010). The nodal or functional regions of regionalism are characterised by elastic borders changing in time, which partly overlap and leave some uncovered areas (as opposed to the rigid and clear spatial frames of the administrative regions characteristic of regionalisation). Furthermore, due to the heterogeneity and differentiation of the settlement network, functional units of very different size may develop (Barancsuk–Gyapay–Szalkai 2013).

The aim of this study is the delimitation of districts based on the attraction of the labour market, which is one of the most important spatial organizational features of functional urban regions in Hungary after the turn of the millennium. However, as opposed to the characteristics of functional spatial structuring and acknowledging that the internal cohesion of spatial units delimited this way is based on relationships of varying intensity, we cover the country as a whole without duplications. On the other hand, we wanted to keep the temporal elasticity of nodal regions in mind. Therefore, we prepared the delimitation for two different dates. The investigation is based on the 2001 and 2011 census data on employment and commuting,[1] which is supported by a number of considerations:

- Spatial mobility connected to employment is one of the strongest spatial structure-forming factors and an important aspect of delimitation of the catchment areas of settlements: the most regular and considerable personal relationship between employment centres and their surrounding settlements is the work commute (Radvánszki–Sütő (2007) and Bujdosó (2009)). Furthermore, the daily mobility for employment purposes and crossing borders of settlements has strengthened in recent decades: 30% and 34% of employees commuted to work in Hungary in 2001 and 2011, respectively.
- Censuses collect data on employment and daily commuting for work purposes with a unified methodological background that is also harmonized internationally. This enables the easy quantification of the intensity of inter-municipal relations.

However, before describing our empirical investigations in detail, we give a short review of the international and domestic regional delimitations on the basis of labour commuting. Our aim is not only presenting the importance of the applied indicator in international practice, but, by outlining the domestic preliminaries, to inform the starting points and methodological bases of our own study.

Approaches of territorial division based on labour commuting

The concept of functional urban regions dates back to the 1950s in the United States (Keserű 2013). Despite its long history, the concept is not clearly defined (OECD (2002) and Antikainen (2005)). On one hand, this lack of definition is due to the variety of statistical databases; on the other hand, the lack of definition is also due to the different settlement structure of countries (Keserű 2013). In the course of

[1] The most important source of employment and commuting data covering the whole country on settlement scale is the census. Our study is based on census data, but it is worth drawing the attention to some of their limits. The methodology of measuring the number of employed has changed since the 1990 census, so today, in line with international recommendations, employed are those persons aged 15 years and over who, during the week preceding the reference date of the census worked at least one hour for pay or profit or had a job from which they were only temporarily absent. Among others, people in work for public benefit and public work are classified as employed as well (for further details of methodology see. http://www.ksh.hu/nepszamlalas/docs/modszertan.pdf). Employment or commuting to work data may be biased of course by the grey or black economy, but we had no opportunity to correct these. In case of commuting data, a further problem is the category of those who 'work in different settlements, as in the applied methodology, we could not clearly assign this group to one commuting target settlement. Therefore, we had to disregard these data. The scope of our study was Hungary, so we did not examine employment abroad.

delimitations, the 'quality' of centres (their size, and role in employment and institutional supply) and the specific features of the spatial flows and interactions organising the region must be taken into account. The real spatial organisational character of the city centre and the mutual relation system between the city and its region are essential for the creation of such a region (Klapka–Halás–Tonev 2013). In the course of its delimitation, commuting to work is taken as the basis for assigning the settlement to the centre where most people go to work (without a minimum threshold), but the urban character of the centre is emphasised by taking into account the existence of 15–20,000 employees (Drobne et al. 2010).

In many countries, functional regions form the basis for analysing socio-economic and labour market trends and social inequalities or the frame of delimitating underdeveloped regions in need of support (OECD 2002).[2]

The concept of functional regions is complex as it refers to regions where intense economic interactions, including the use of services, trade or commuting to work are typical (Karlsson–Olsson 2006). Despite this, in the course of the delimitation, most studies were mainly based on commuting for work purposes (Cörvers–Hensen–Bongaerts 2009). Functional regions can be divided into further subgroups according to the direction of the commute (Klapka–Halás–Tonev 2013). In the OECD delimitation, functional regions were separated only in the narrower surroundings of cities with a population greater than 100,000, highlighting the large population density (OECD 2012).

As a part of the ESPON 1.1.1 project launched under the aegis of the European Commission, the concept of functional urban regions, which can be identified by the travel-to-work areas, is described. The essence of the delimitation method is that settlements are assigned to the centre to where the highest proportion of employees are commuting, exceeding a defined threshold within the employed (most often 15–20%) (Antikainen 2005). As a consequence of this filter condition, the concept of functional urban areas is interpreted in a broader sense (Drobne et al. 2010). However, several thresholds may be fixed during the course of delimitation, including the minimum number of workplaces or the proportion of local employees in the area; these could also be changed depending on the population number. It is important to highlight that the thresholds may vary in different countries, and that there are a variety of alternative approaches (Cörvers–Hensen–Bongaerts 2009).

In addition to the term "travel-to-work area," "Local Labour Market Area" is also often used in the scientific literature. The conceptual difference between the two is

[2] Connected to the concept of functional urban regions, it is worth mentioning that a Hungarian study was published in 1978, which delimitated 23 functional urban regions – in addition to Budapest and the today's county seats, Dunaújváros, Nagykanizsa, Sopron, as well as Baja, Kazincbarcika and Ózd were among the cetnres (Lackó–Enyedi–Kőszegfalvi 1978). Delimitations based mainly on commuting relations assigned each settlement to a single centre and kept also the hierarchical scheme of the National Spatial Development Concept of 1971 in mind.

that in the former, weekly movements for work purposes are also included. The latter basically refers to daily commuting and does not necessarily take into account only the flow to a particular centre (Klapka–Halás–Tonev 2013). The common feature of these delimitations is that they cover regions that have intense relations, and depending on regional characteristics, significant areas may fall outside the created zones.

The defined thresholds constrain the adaptation of the international methodology presented. If the centres were designated by 20,000 employed persons, there would be 22 urban centres according to the 2011 data. In case of a lower threshold (15,000 employed persons), the number of centres would be only 32, that is, even Salgótarján would not fit into the narrower circle. According to the criterion of 100,000 inhabitants drawn for functional regions, in Hungary, only the capital, the regional centres, and Nyíregyháza and Kecskemét could be centres. Other approaches had to be rejected as not every settlement was assigned to the employment catchment area of a centre.

As a part of the RePUS (Regional Polycentric Urban System) project, the colleagues of VÁTI (Hungarian Nonprofit Ltd. for Regional Development and Town Planning) delimitate local labour market systems, also known as Local Labour System (LLS), by using the commuting for work data of the 2001 census (Radvánszki–Sütő 2007). As a continuation of the investigation, they combine the created catchment areas with the micro-regional system, which results in the establishment of territorial units called Functional Urban Districts (Sütő 2008). Without striving for completeness, from the domestic scientific literature in recent years, we would like to mention the study of Albert Faluvégi delimitating 'functional regions' on the basis of commuting data (Faluvégi 2008). These two domestic studies analyse the same database using a two-stage model where the centres were assigned first, and then the catchment areas were identified. The two authors of VÁTI took a much smaller critical mass (1,000 persons) as the basis for defining employment centres, but required the connection of at least one settlement attracted in the first place. The second approach only used absolute weights for the calculation: it considered urban employment centres as those with over 5,000 persons, and rural employment centres as those with between 1,200 and 5,000 persons. After delimitating the catchment area, every settlement is assigned to an employment centre in the first study, while in the second one, by fixing the critical degree of catchment, a number of settlements not belonging to any functional region remained in the system.

We prepared our work by modifying the methodology used by authors Radvánszki–Sütő (2007), as we consider its practice of assigning centres embedded in the settlement network more flexible and better adaptable to the heterogeneity of the settlement system. Moreover, the delimitation of catchment areas in this study enables the consideration of the entire territory of the country without duplications. These methodological corrections will be discussed in the relevant parts of our study.

Although the scope of concepts and approaches reviewed here is not complete and cannot always be clearly separated from each other, our 'brief investigation' well expresses the complexity of the problem and confirms the relevance of labour market studies.

The phenomenon of commuting for work purposes and its research in Hungary

In Hungary, by the progress of occupational re-stratification, commuting for work purposes became a mass phenomenon in the 1960s. On the one hand, the labour released from agriculture due to its large-scale reorganization and modernization and the concentrated industrial developments offering alternatives in terms of employment, and, on the other hand the development of public and individual transport provided the background of this process.

By the 1980s, commuting zones evolved, especially in the surroundings of settlements of town rank, which largely depended also on geographical characteristics: the (economic) size, density, and distance of the settlement (Erdősi 1985).

Table 1

Number and proportion of employees commuting from their place of residence

Regions	Number of employees commuting from their place of residence, thousand persons			Proportion of employees commuting from their place of residence, %		
	1990	2001	2011	1990	2001	2011
Central Transdanubia	166.8	180.5	206.8	33.1	40.4	45.4
Western Transdanubia	131.6	147.6	177.6	29.2	35.5	41.5
Central Hungary	267.0	300.1	388.0	19.9	25.9	30.4
Southern Great Plain	104.0	99.1	123.5	17.3	21.0	25.0
Northern Great Plain	146.0	120.7	158.6	23.1	25.9	30.0
Southern Transdanubia	129.2	106.8	116.6	29.6	31.7	34.0
Northern Hungary	201.1	146.5	169.8	36.0	37.4	40.8
Country, total	*1,145.6*	*1,102.0*	*1,340.8*	*25.3*	*29.9*	*34.0*

Following the regime change, the number of commuters decreased nationwide – the rate of decline was 3.8% between 1990 and 2001 – but its exact trend within the decade is not known. The number of commuting employees was 1,145,581 in 1990, which fell to 1,102,005 by 2001 (while their proportion within all people employed increased from 25.3% to 29.9%) (Table 1).

However, the change had distinctive regional differences: the number of employed people and commuters decreased mainly in the underdeveloped regions (at the same time, their proportion increased moderately in all regions). The drop in the number of commuters was larger in the less developed regions, which was due to the considerable regression of industry and mining employing a large number of commuters. Besides, the sharp rise of travel costs also reduced the chances of commuting (Szabó 1998). The change negatively affected the low-skilled social groups and the Roma (Kertesi (2000) and Pásztor–Pénzes (2012)). All these factors had serious regional-settlement structural consequences as well (Forray–Híves 2009): in case of small settlements farther away from the employment centres that have a low-skilled workforce, labour market problems accumulated (Balcsók 2000).

In 2011, 1,340,831 commuters were recorded during the census, which constitutes 34.0% of the people employed (however, more than one tenth of commuters – 153,410 persons – commuted to varying settlements; so it was not possible to clearly identify the directions of their mobility). It is not incidental that in the underdeveloped areas, the low base value of the number of employed may also result in the relative high proportion of commuting. The detailed analysis of the trend of changes between 2001 and 2011 would exhaust the scope of this study. Moreover, the census data used are not very suitable to investigate the considerable decline of employment from 2008 to 2009 due to the economic crisis (Kiss 2011) and its effects on commuting. However, our analysis based on the comparison of the conditions on two dates (2001, 2011) has some dynamic elements.

Figure 1

Change in the intensity of commuting between 2001 and 2011

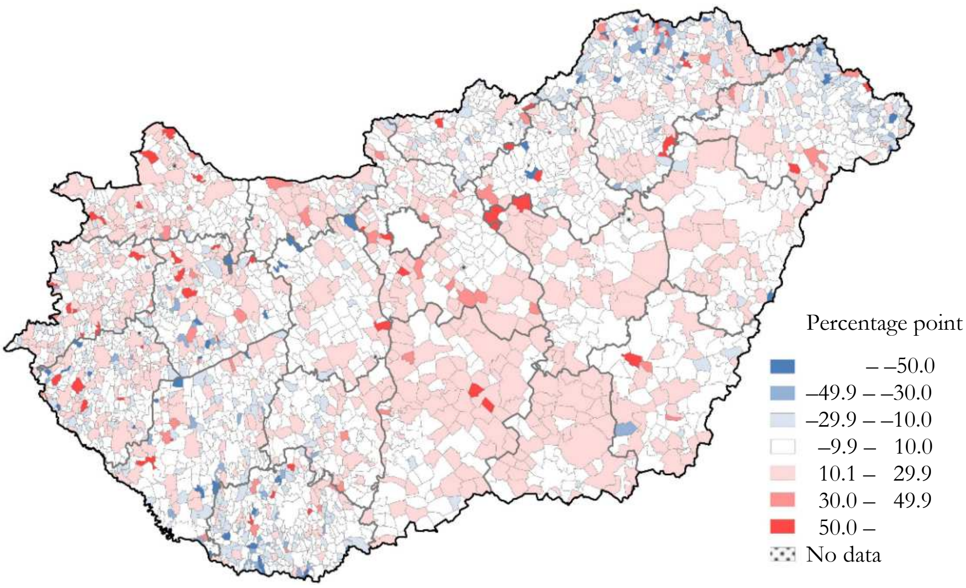
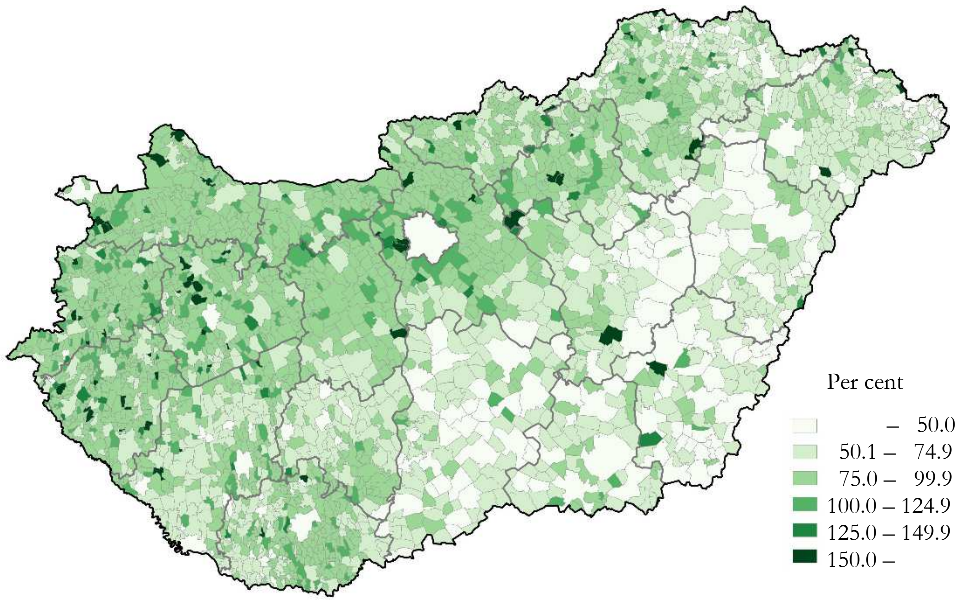


Figure 2

Intensity of commuting in 2011



In our investigation, the frequency of movements for the purpose of work crossing settlement borders is essential: in regions that can be characterized with more intense relations, more pronounced local labour systems are delimitated. We summarize the settlement-level trends in the intensity of commuting in the last decade on two maps: in case of each settlement, the sum of the number of employees commuting from and to was compared to the number of resident employees and expressed as a percentage (although the method is not suitable for examining the labour force account and for accurately presenting the proportion of employees commuting from and to the settlement, it expresses the intensity of inter-municipal relations comprehensively, as it shows cross-commuting as well). The first figure shows the direction of changes between 2001 and 2011 (Figure 1). The importance of labour force movement crossing settlement borders is generally increasing, but its degree is outstanding in some distinguished settlements (for example, Budaörs, Dunakiliti, Dunavarsány, Jászárokszállás, Jászfényszaru, Mosonszolnok, Rácalmás, Sopronkövesd, and Tiszaújváros), because of the sharp increase in the number of people commuting to the settlement. In the case of these settlements, with the exception of only Budaörs, the workforce attracting effect of some significant industrial investments is in the background. The range of the strongly declining settlements is remarkable as well: one type is represented by previously significant, typically mining-related economic actors (for example, Balinka, Fenyőfő, Mány, Pusztavám, and Visonta). Their other basic type is connected to the north-eastern and south-western small village peripheries of the country and reveals the demographic degradation and socio-economic exclusion of these settlements (Kovács 2010).

The second figure shows the conditions in 2011, and outlines the pattern of differences in the labour force movement crossing settlement borders by large regions plastic. On the one hand, the differences that result from the settlement structure between the Great Plain, where local employment is stronger, and the Transdanubian and Northern Hungarian regions, which have a more fragmented structure with more intense relations, are clearly shown. On the other hand, by comparing the small village regions of Southern Transdanubia and Western Transdanubia, the differences which can be traced back to the difference in economic background are striking as well. Here, the intensity of commuting is a factor that indicates economic prosperity: the appearance of villages characterized by more intense relations shows some coincidence with the spatial structure of re-industrialization (Figure 2). Therefore, it is not surprising that, due to its indirect socio-economic effects, the phenomenon of commuting is also an important element of typifying settlements on a regional scale (Beluszky–Sikos 2007). The main lesson of the figure is that it is not possible to delimitate functional urban regions with internal relations of similar intensity that cover the whole territory of the country on the basis of commuting.

The role of labour commuting (defined as a production relationship closely connected to the specific production activity) in forming catchment areas has been questioned by several researchers (for example, Mendöl (1963) and Beluszky (1967)). However, due to the very narrowly available databases describing inter-municipal relations, labour commuting is considered in most catchment area studies (Timár 1983) and regional delimitations, or the need for it arises (Szalkai 2012). It is worth mentioning that the examination of the flows, especially road traffic, plays a more prominent role in the study of inter-municipal relations (for example, Szalkai (2010) and Tóth (2013a-b)), but the database built from surveying commuting for work during the census, which can be identified on the level of the settlement, offers broader opportunities for analysis as it also covers specific inter-municipal relations. Of course, functional catchment areas can be interpreted in a complex way by integrating a number of factors (for example, Beluszky (1967), Dövényi (1977), Bujdosó (2009), and Bodor–Pénzes (2012)). Therefore, the results of this study cannot be considered as an alternative system to complex catchment area studies or any other horizontal regional delimitation integrating several aspects. Despite this, we can refer to analyses which took commuting for work purposes as a basis for the dynamic examination of catchment areas (Erdősi (1985) and Nagy (1988)) or for establishing regional categories (Radvánszki–Sütő (2007) and Pénzes (2013)).
The investigation of employment centres also takes into account the characteristics of commuting in many cases for a given group of settlements (Balcsók–Koncz (2004), Molnár–Pénzes (2005), and Faluvégi (2008)).

Since the scope of commuting is narrowed considerably due to the costs of travel, the study usually applies at the level of labour districts, most likely in the direction of the local employment centre (Kertesi–Köllő (1998) and Pénzes (2013)). Contracted travel services ensured by larger employers may broaden the scope of commuting. At the same time, it is worth mentioning that this kind of delimitation cannot separately handle those who are commuting farther away and often, and not necessarily on a daily basis. In addition, employees commuting from the centres (mostly employees with more qualifications and larger scope) are largely outside the focus of the investigation.

Employment centres and commuting districts

We built our study by modifying the methods in the scientific literature according to our own criteria (Radvánszki–Sütő 2007). We carry out the delimitation that had been completed by 2001 again. We used a two-stage model to determine the commuting catchment areas.

First, the range of the centres was selected:

– We have taken all settlements with more than 1,000 persons employed locally[3] (328 settlements in 2001 and 348 in 2011) into account. The threshold used the same as that used in the above mentioned literature.
– We left only those settlements among the centres that attracted at least one settlement from where the most commuters went to work in the given centre (205 settlements in 2001 and 197 in 2011). This selection method was also used based on the sources read previously.
– Next, we removed those settlements from the range of centres from where more than 10% of employees commuted to another centre (our earlier review of scientific literature includes similar thresholds). Although the threshold is arbitrary, we found it to be suitable to filter the range of employment centres (if 10% of a settlement's employed people commute to a single place, it means an external attachment which is strong enough to question that the settlement is an independent centre). In order to reduce the anomalies resulting from the application of the method, we have made an exception in two cases. On the one hand, in case of some settlements mutually attracting each other, centre-pairs have been designated (Keszthely and Hévíz (2001), Keszthely and Hévíz (2011), Balatonboglár and Balatonlelle (2001), Balatonboglár and Balatonlelle (2011), and Siklós and Harkány (2001)). On the other hand, in the surroundings of larger towns, the settlements from where the proportion of people commuting was less than 20%, the number of people employed locally was more than 5,000 (also called urban centres- Faluvegi (2008)), and there was a daily labour force account were considered independent centres, despite gravitating towards larger centres. In the surroundings of Budapest, Vác met

[3] In the study, 'people employed locally' are those who live and work in the settlement and those who commute to the settlement to work, that is, the number of people actually employed in the settlement or settlement group in question.

the criteria both in 2001 and 2011, and Százhalombatta in 2001. In 2011, Bonyhád, Hatvan, Kazincbarcika, and Körmend could also be separated from the hinterland of the nearby large towns. Accordingly, we designated 141 centres or centre-pairs in 2001 and 123 in 2011.

- Although the methodology required that the delimitation of centres should be able to manage the spatial heterogeneity of the country's settlements (employment centres of different sizes, labour movement of different intensity), catchment areas within catchment areas cannot be displayed with the method applied. Therefore, corrections described in the third point were necessary to manage very extreme cases. We think that the examination of the remaining secondary catchment areas, especially in the capital region, is justified, but their detailed presentation is not possible due to the limited size of the study. The method applied could not really handle the self-employing settlements either, as it is also shown by a few examples in the study.

When creating catchment areas around centres:

- On the one hand, irrespective of the intensity of attraction, we determined (and assigned to the selected centre) the settlements where the most important destination of commuting of employees was the central settlement in question.
- We merged centres strongly linked to another centre (that is, from where more than 10% of employees commuted to the centre in question) and brought their entire catchment area determined with a similar method.
- Finally, further settlements were assigned (indirectly) to the designated centres according to the affiliation of their most important centre of attraction.
- The spatial continuity of catchment areas was formed in this way, because of which some settlements were re-assigned to the secondary or tertiary centre of attraction (however, this was not applied in case of the catchment area of Miskolc).

The number of the established, employment-based urban regions decreased between 2001 and 2011: the decrease in the number of centres and the fact that several more important actors got in the shadow of a nearby larger town show the increasing importance of commuting and the development of broader units instead of more fragmented structures. Some centres drop out of the system due to the following reasons: first, there may be a decrease in the number of people employed there under 1,000; second, the settlements forming the catchment area turn to other centres; third, it could be the result of the strengthening commuting links to the nearby larger town (over 10%), or, it may come from the combination of these factors. According to our investigation, a total of 31 centres dropped out of the system due to the abovementioned reasons, which can be mostly explained by the increasing importance of commuting to a nearby (larger) centre. Among them, there are such towns of considerable size, such as Cegléd, Hajdúszoboszló, or Törökszentmiklós (Table 2). There are also settlements that became centres by 2011:

in most cases, the number of people employed locally increased above 1,000 there. However, in the Great Plain, several centres entered the system by creating new catchment areas. The case of Hatvan is interesting: despite the fact that more than 10% of employees commuted from there, it was separated from the Budapest urban region in 2011 because the number of people employed there locally increased so that the daily labour force account of the town became positive (Table 2).

Table 2

Labour market catchment centres entering and dropping out of the system according to delimitations in 2001 and 2011

Main reason for the change	Entering the system	Dropping out of the system
Number of persons employed locally increased to more than / decreased to less than 1,000	Abádszalók, Abaújszántó, Kál, Nyírmada, Szany, Szendrő;	Beled, Beremend, Bugac, Bükkábrány, Nagyoroszi, Sásd;
Acquiring attracted settlement / losing attracted settlements	Battonya, Harta, Kecel, Kunszentmiklós;	Balkány, Bercel, Jászfényszaru, Mezőhegyes, Mezőtúr, Nagyigmánd, Putnok, Százhalombatta, Vésztő;
Commuting from the settlement decreased under /increased above 10 %	Kisbér, Sellye;	Bábolna, Balatonkenese, Bük, Cegléd, Edelény, Hajdúszoboszló, Kaba, Lábatlan, Martfű, Siklós-Harkány, Simontornya, Szécsény, Tiszalök, Tompa, Törökszentmiklós, Zalaszentgrót;
Positive labour force account	Hatvan;	–

The attribute most closely linked to the centres is the volume of local employment. Between 2001 and 2011, the change in the absolute weight of employment centres shows a typical regional pattern (Table 3). Budapest and settlements around the capital that are not independent centres (Budaörs, Szigetszentmiklós, Dunakeszi, Vecsés, and Gyál), the largest county seats in the Great Plain (Debrecen, Szeged, Nyíregyháza, and Kecskemét), and some re-forming centres along the industrial axis (Kozma 1998) (Tatabánya, Komárom, and Zalaegerszeg on the West and Hatvan and Tiszaújváros on the East) appeared among the biggest winners. At the same time, the growth in the number of people employed locally results not only from the change in the economic performance, but also the impact of public employment which was already considerable at the time of the 2011 census. The group of the biggest losers of the decade is also heterogeneous. Traditional heavy industry settlements (Salgótarján, Dunaújváros, as well as Balatonfűzfő, Pusztavám, and Visonta which are not included among centres), centres exposed to the crisis in the light industry (Baja and Körmend), some representatives of the re-industrialization in the 1990s that were less dynamic after the turn of the millennium (Székesfehérvár, Sárvár, and Szombathely), as well as employers with logistical function (Záhony and Taszár which is not a centre) appeared in this range (Table 3).

Table 3

Settlements showing the largest absolute change in the number of people employed locally between 2001and 2011

Largest growth	Largest decline
Budapest (+60,833)	Salgótarján (–3,493)
Debrecen (+9,927)	Dunaújváros (–2,907)
Szeged (+7,939)	Székesfehérvár (–2,817)
Nyíregyháza (+7,549)	Sárvár (–1,708)
Kecskemét (+7,193)	*Balatonfűzfő (–1,515)*
Budaörs (+7,066)	Nagykanizsa (–1,383)
Szigetszentmiklós (+5,208)	Szombathely (–1,277)
Tiszaújváros (+5,163)	**Szécsény (–1,214)**
Dunakeszi (+3,912)	Baja (–1,182)
Hatvan (+3,729)	*Visonta (–1,138)*
Tatabánya (+3,668)	*Pusztavám (–1,129)*
Vecsés (+3,376)	*Taszár (–1,090)*
Gyál (+3,360)	Záhony (–1,081)
Zalaegerszeg (+3,332)	Körmend (–1,040)
Komárom (+3,094)	

Note: Was not a centre at either date – italics. **Became a centre / ceased to be a centre – bold.**

The decrease in the number of local labour systems also resulted in an increase in average sizes of the units, which is reflected in the number of settlements and in the number of employees as well (Table 4). After Budapest, units integrating the largest number (more than 100) of settlements were Pécs, Miskolc, Zalaegerszeg, and Győr, both in 2001 and 2011. Except for Győr, it can be stated about all of the three rural regions that the relative importance of the centres is coupled with a fragmented settlement structure and with the lack/weakness of alternative centres. The latter can be seen well in the considerable growth in the catchment area of all the three towns: Miskolc 'swallowed up' the district of Edelény, Pécs, Siklós–Harkány, Zalaegerszeg, and Zalaszentgrót between the two dates. In respect of the volume of employment, a different picture is outlined that arises from the differences in settlement geography. The district of Budapest was followed by Debrecen, Székesfehérvár, and Győr, and by the districts of other regional centres (Miskolc, Pécs, and Szeged). In all of the listed regions, employment was over 90 thousand persons in 2001, and over 100 thousand in 2011 (half of the county's area). At the same time, their order changed due to their different dynamics that result from the actual increase in their employment and the horizontal extension of their catchment areas. Debrecen strengthened its second place by integrating Hajdúszoboszló and Kaba, Miskolc moved forward to the third place, and Győr overtook Székesfehérvár by 2011.

Table 4

Some major characteristics of Local Labour Systems

Characteristics	2001	2011
Pieces	141	123
Average number of settlements	**22**	**26**
Maximum number of settlements	209	213
Minimum number of settlements	2	2
Average number of people employed locally	**24,841**	**30,126**
Maximum number of people employed locally	1,115,396	1,252,180
Minimum number of people employed locally	1,113	1,241
Average intensity (people commuting from and to the settlement together as a percentage of all employees)	**55**	**65**
Maximum intensity (people commuting from and to the settlement together as a percentage of all employees)	120	109
Minimum intensity (people commuting from and to the settlement together as a percentage of all employees)	19	30
Weight of the centre (average, %)	**72**	**69**
Weight of the centre (maximum, %)	98	99
Weight of the centre (minimum, %)	38	34

Smaller units that represent a fragmented structure were characteristic in regions having marked small centres farther away from larger centres, as well as in the inner and outer peripheries of the Great Plain, which are more closed in respect of labour movement between settlements and have fewer centres with more significant scope (were mostly located in the territory between the inner and outer town ring). While, for example, the territory of Pest county was basically shared by two regions, the centre of Budapest and the centre of Vác, and in Fejér county three centres (Székesfehérvár, Dunaújváros, and Mór) dominated the area, the territory of Bács-Kiskun county was divided among fourteen units in 2011 (Figures 3–4). The general increase in the importance of commuting and the trend between the two censuses points towards the disappearance of micro-regions at national level: in 2001 84 districts with less than 10 thousand people and 45 districts with less than 5 thousand people were delimitated, while in 2011, these figures were only 63 and 37, respectively. In particular, the proportion of employees in local labour systems with more than 100 thousand people and in those with 10-20 thousand people showed an increasing trend, mostly at the expense of lower categories (Table 5).

Table 5

Distribution of settlements and people employed locally by the magnitude of the Local Labour Systems

LLS-categories by the number of people employed locally	Number of Local Labour Systems in the categories		Share in the number of people employed locally, %	
	2001	2011	2001	2011
1,000,000 –	1	1	31.8	33.8
100,000 – 999,999	3	6	9.6	18.3
50,000 – 99,999	9	8	18.8	14.3
20,000 – 49,999	18	16	17.0	13.8
10,000 – 19,999	26	29	10.9	11.5
1,000 – 9,999	84	63	11,9	8,2
Total	*141*	*123*	*100.0*	*100.0*

Figure 3

Local Labour Systems in 2001

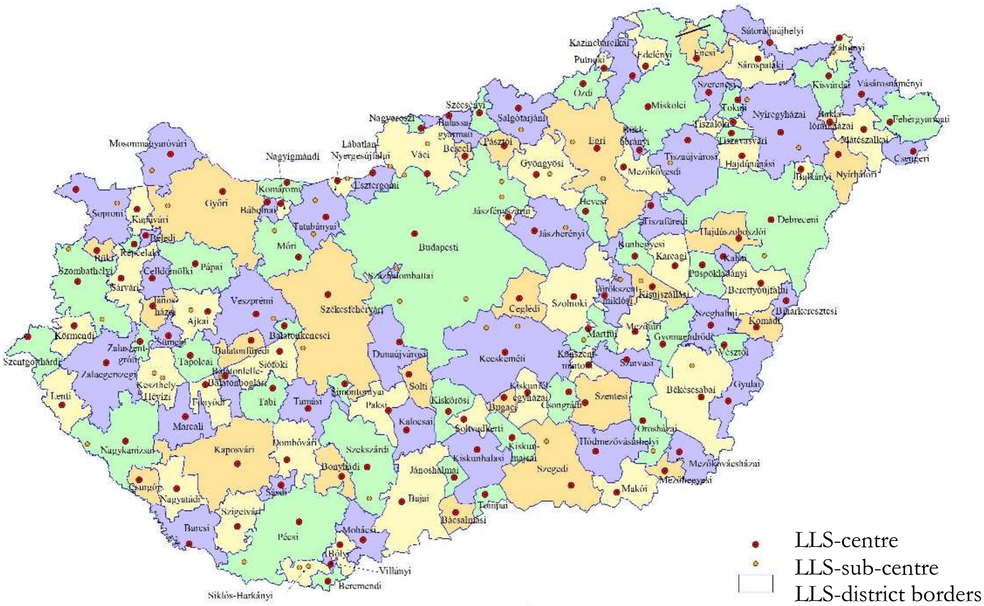
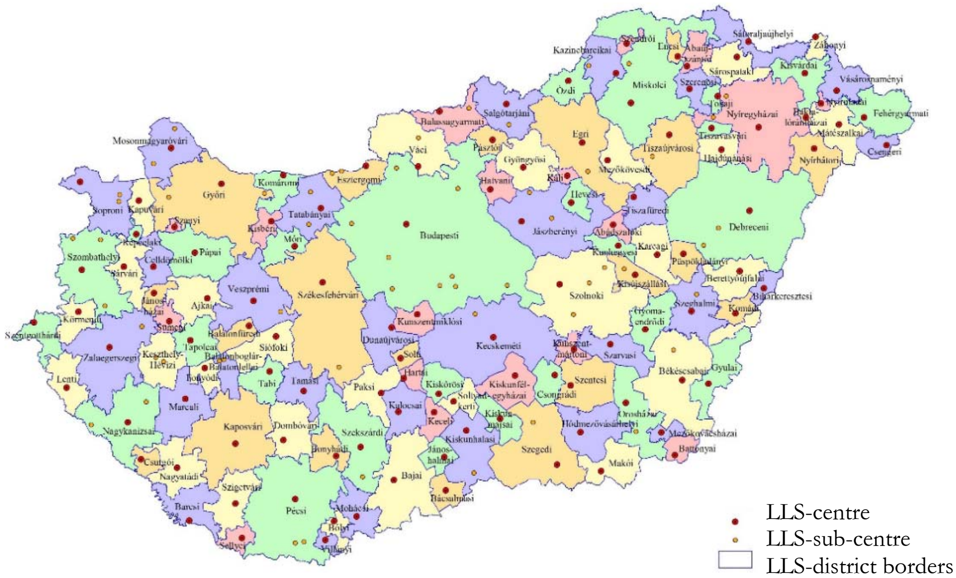


Figure 4

Local Labour Systems in 2011



The strengthening commuting can be demonstrated by the increasing intensity of labour movement as well (Table 4). At the same time, there are huge differences among regions delimitated: while in the regions of Záhony, Jánosháza, and Mór, the total number of those commuting from and to as a percentage of all employees approached or exceeded 100% on both dates, the indicator was less than 45% in 38 regions (37 in the Great Plain) in 2001 and in 13 regions (in the Great Plain) in 2011. The former phenomenon can be associated with the relatively small size of marked employment centres and the fragmented settlement structure of their environment (that is, the considerable separation of place of residence and place of work), while the latter one reflects the more closed labour market and self-employing nature of settlements in the Great Plain. The increase of local labour systems by absorbing smaller districts resulted in many cases of the decline of the centre's weight and the development of units having more sub-centres. In addition to regions around the two centre-pairs (Balatonboglár–Balatonlelle and Keszthely–Hévíz), such units developed around several larger employers as well: the weight of Tatabánya in its own district – in respect of people employed locally – was only 55% in both years, which reflects the significant role of Tata and Oroszlány as sub-centres. By integrating the sub-systems of Martfű, Mezőtúr, and Törökszentmiklós, the region of Szolnok also increased significantly by 2011. Along with this, the weight of the county seat fell under 55%. The differences in the cohesive centripetal forces in the two regions are demonstrated by the different data of commuting intensity: the value of the examined indicator was 75% in the region of Tatabánya and 60% in the region of Szolnok (in the latter case, Mezőtúr was assigned to Szolnok as its most important centre of attraction not due to the intensity of attraction, but the absence of a centre of attraction in Szolnok).

Out of the more significant centres, the weights of Gyöngyös, Esztergom, and Mór (due to the effect of Visonta, Dorog, and Kisbér/Pusztavám) were relatively smaller in their own regions in 2001, and similar centres were Esztergom (due to Dorog, Nyergesújfalu, and Lábatlan) and Jászberény (because of the significance of the sub-centres in the Jászság) in 2011. The latter is also interesting because by 2011, the local labour system of Jászberény, preceding Sopron, Dunaújváros and Nagykanizsa, became the largest non-county seat employing unit. In addition to the districts of Tatabánya and Szolnok, several other county seats integrated settlements employing more than 5,000 people as well (Székesfehérvár–Várpalota, Pécs–Komló, and Békéscsaba–Békés in both years and Debrecen–Hajdúböszörmény–Hajdúszoboszló in 2011). Between 2001 and 2011, after Budaörs, Gödöllő, Érd, Dunakeszi, Szigetszentmiklós, Szentendre, Vecsés, Dunaharaszti, Törökbálint, Gyál, Dabas, Veresegyház, Fót and Biatorbágy, Budapest integrated Cegléd and Százhalombatta but lost Hatvan, which shows one of the largest increases in employment.

Conclusions

Our aim was to delimitate local labour systems, which is a dimension of functional urban areas, built on the commuting data of the 2001 and 2011 census on the basis of a methodology from the existing literature. In the course of the delimitation, we determine the units flexibly and cover the entire territory of the country without duplication. Our goal was to detect the changes between the two dates as well.

At both of the examined dates, local labour systems of very different sizes developed from micro-regions to units integrating almost the entire area of the county. In addition to the absolute size and the dynamics of the centres, the specific features of the settlement network, such as the lack of dominant centres in the periphery, also greatly influenced their formation.

The number of local labour systems decreased and their average size increased between the two dates, which is associated with less micro-regions mainly due to the increasing intensity of inter-municipal relations.

The peripheral features appear in the system in two ways: on the one hand, in the far-extending effects of some centres of attraction in space and, on the other hand, in the strongly local catchment areas of small centres, which are farther away from larger centres (linked only a little to them) and are not able to integrate larger areas.

The qualitative transformation of local labour systems is indicated by the increasing intensity of labour movement typical in numerous places on the one hand,

and on the other hand, by the trend of growing number of sub-centres by the involvement of larger employers in many cases.

In our opinion, the delimitation of local labour systems is an important aspect of regional investigations. Of course, it cannot be considered as an alternative for the system of districts or micro-regions, as it is based only on employment relations and reflects their dynamically changing image. However, this is precisely the reason why it is worth taking the results of the delimitation into account in the analysis of labour market trends and in the efforts of expanding employment and their territorial scope. This limitation also offers an opportunity to carry out comparative examinations of more countries (beginning with the neighbouring countries of Hungary) on the basis of an equal territorial division, which would contribute to the more adequate exploration of Central European regional processes.

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REFERENCES

ANTIKAINEN, J. (2005): The Concept of Functional Urban Area. Findings of the EPSON project 1.1.1. *Informationen zur Raumentwicklung* (7): 447–452.

BALCSÓK, I. (2000): Hátrányos helyzetű társadalmi rétegek az Északkelet-Alföld határ menti térségeinek munkaerőpiacán *Tér és Társadalom* 14 (2-3): 285–294.

BALCSÓK, I. – KONCZ, G. (2004): *A Hajdú-Bihar megyei városok foglalkoztatási helyzetének alakulása a rendszerváltástól napjainkig.* In: A versenyképesség regionális, vállalati és intézményi dimenziói. Győr. Fiatal regionalisták IV. országos konferenciájának CD kiadványa

BARANCSUK, Á. – GYAPAY, B. – SZALKAI, G. (2013): Az alsó középszintű térfelosztás elméleti és gyakorlati lehetőségei *Területi Statisztika* 53 (2): 107–129.

BELUSZKY, P. (1967): *A magyarországi városok vonzáskörzetei* Kandidátusi Értekezés Tézisei. Debrecen. KLTE.

BELUSZKY, P. – SIKOS T., T. (szerk.) (1982): *Területi kutatások 5.* MTA Földrajztudományi Kutatóintézet, Budapest.

BELUSZKY, P. – SIKOS T., T. (2007): *Változó falvaink* MTA Stratégiai Tanulmányok Sorozat, Budapest.

BIHARI, ZS. – KOVÁCS, K. (2006): Lejtők és csúszdák, avagy a foglalkoztatási esélyek térbeli egyenlőtlensége az ezredfordulón *Tér és Társadalom* 20 (4): 49–66.

BODOR, N. – PÉNZES, J. (2012): Eger komplex vonzáskörzetének dinamikai vizsgálata *Tér és Társadalom* 26 (3): 30–47.

BUJDOSÓ, Z. (2009): *A megyehatár hatása a városok vonzáskörzetére Hajdú-Bihar megye példáján* Studia Geographica 24. Debreceni Egyetemi Kiadó, Debrecen.

CÖRVERS, F. – HENSEN, M. – BONGAERTS, D. (2009): Delimitation and Coherence of Functional and Administrative Regions *Regional Studies* 43 (1): 19–31.

DÖVÉNYI, Z. (1977): A vonzáskörzetek történeti kialakulásának és változásának vizsgálati lehetőségeiről *Alföldi Tanulmányok* 1: 132–142.

DROBNE, S. – KONJAR, M. – LISEC, A. – PICHLER MILANOVIĆ, N. – ZAVODNIK LAMOVŠEK, A. (2010): Functional Regions Defined by Urban Centres of (Inter)National Importance – The Case of Slovenia. In: Schrenk, M. – Popovich, V. V. – Zeile, P. (eds.): *Cities for Everyone. Liveable, Healthy, Prosperous. Promising Vision or Unrealistic Fantasy?* Real Corp 2010 15th International Conference on Urban Planning, Regional Planning and Information Society. pp. 295–304., CORP – Competence Center of Urban and Regional Planning, Wien.

ERDŐSI, F. (1985): Az ingázás területi-vonzáskörzeti szerkezete Magyarországon *Demográfia* 28 (4): 489–498.

EU (2011): *Cities of Tomorrow. Challenges, Visions, Ways Forward.* European Union Regional Policy, Brussels.

FALUVÉGI, A. (2008): A foglalkoztatás területi-települési szerkezete Magyarországon *Statisztikai Szemle* 86 (12): 1077–1102.

FORRAY R., K. – HÍVES, T. (2009): Az iskolázottság, a foglalkoztatottság és az ingázás területi összefüggései *Szociológiai Szemle* 19 (2): 42–59.

HAJDÚ, Z. (2001): *Magyarország közigazgatási földrajza* Dialóg Campus Kiadó, Budapest–Pécs.

KARLSSON, C. – OLSSON, M. (2006): The Identification of Functional Regions: Theory, Methods, and Applications *The Annals of Regional Science* 40 (1): 1–18.

KERTESI, G. (2000): Ingázás a falusi Magyarországon – egy megoldatlan probléma *Közgazdasági Szemle* 47 (10):775–798.

KERTESI, G. – KÖLLŐ, J. (1998): Regionális munkanélküliség és bérek az átmenet éveiben. A bérszerkezet átalakulása Magyarországon II. rész *Közgazdasági Szemle* 45 (7–8): 621–652.

KESERŰ, I. (2013): *Post-suburban transformation in the functional urban region of Budapest in the context of changing commuting patterns.* PhD doktori disszertáció, SZTE TTIK, Szeged.

KISS, É. (2011): A válság területi konzekvenciái az iparban *Területi Statisztika* 51 (2): 161–180.

KLAPKA, P. – HALÁS, M. – TONEV, P. (2013): *Functional Regions: Concept and Types* In: 16th International Colloquim on Regional Science, Conference Proceedings (Valtice 19–21.6.2013). pp. 94–101., Masarykova Univerzita, Brno.

KOVÁCS, K. (2010): Területi-társadalmi egyenlőtlenségek a rendszerváltozás utáni Magyarországon. In: Fábián, A. (szerk.): *Párbeszéd és együttműködés. Területfejlesztési Szabadegyetem 2006–2010.* pp. 15–32., Nyugat-Magyarországi Egyetem Kiadó, Sopron.

KOZMA, G. (1998): A gazdasági élet szereplőinek térbeli preferenciái *Falu Város Régió* 5 (9): 7–14.

LACKÓ, L. – ENYEDI, GY. – KŐSZEGFALVI, GY. (1978): *Functional Urban Regions in Hungary* Studia Geographica 24. International Institute for Applied Systems Analysis, Laxenburg.

MENDÖL, T. (1963): *Általános településföldrajz* Akadémiai Kiadó, Budapest.

MOLNÁR, E. – PÉNZES, J. (2005): Kis- és középvárosi foglalkoztatási centrumok az Észak-alföldi Régióban In: Czimre Klára (szerk.): *Kisközségtől az Eurorégióig.* Prof. Dr. Süli-

Zakar István tiszteletére szerzett tanulmányok gyűjteménye pp. 159–175., Didakt Kft. , Debrecen.

NAGY, R. (1988): Szolnok város vonzásviszonyai (1949-1980) *Alföldi Tanulmányok* 12: 219–236.

OECD (2002): *Redefining Territories. The Functional Regions* Organization for Economic Co-operation and Development, Paris.

OECD (2012): *Defining "Urban". A New Way to Measure Metropolitan Areas* Organization for Economic Co-operation and Development, Paris.

PÁSZTOR, I. Z. – PÉNZES, J. (2012): Foglalkoztatási krízis és jövedelmi periférizálódás Északkelet-Magyarországon a roma népesség arányainak tükrében *Területi Statisztika* 52 (4): 353–371.

PÉNZES, J. (2013): A foglalkoztatottság, az ingázás és a jövedelmi szint összefüggései Északkelet- és Északnyugat-Magyarországon *Területi Statisztika* 53 (3): 202–224.

RADVÁNSZKI, Á. – SÜTŐ, A. (2007): Hol a határ? Helyi munkaerőpiaci rendszerek Magyarországon – Egy közép-európai transznacionális projekt újdonságai a hazai településpolitika számára *Falu Város Régió* 14 (3): 45–54.

SÜLI-ZAKAR, I. (2010): A régió: földrajzi integráció. In: Süli-Zakar, I. (szerk.): *A terület- és településfejlesztés alapjai II.* pp. 145–155., Dialóg-Campus Kiadó, Budapest–Pécs.

SÜTŐ, A. (2008): Város és vidéke rendszerek és típusaik Magyarországon *Falu Város Régió* 15 (3): 51–64.

SZABÓ, P. (1998): A napi ingázás kérdésköre a kilencvenes években Magyarországon *Tér és Társadalom* 12 (4): 69–89.

SZALKAI, G. (2010): Várostérségek lehatárolása a közúti forgalom nagysága alapján a magyar határok mentén *Tér és Társadalom* 24 (4): 161–184.

SZALKAI, G. (2012): A járások kialakításának módszertani megalapozása *Területi Statisztika* 52 (3): 215–229.

TIMÁR, J. (1983): Vonzáskörzet-vizsgálatok Szarvas és Gyoma térségében *Alföldi Tanulmányok* 5: 231–254.

TÓTH, G. (2013/a): *Az elérhetőség és alkalmazása a regionális vizsgálatokban* Központi Statisztikai Hivatal, Budapest.

TÓTH, G. (2013/b): *Bevezetés a területi elemzések módszertanába* Miskolci Egyetem, Miskolc.

DATA SOURCES

http://www.ksh.hu/nepszamlalas/docs/modszertan.pdf

The Role Weight of Key Factors Determining the (Infrastructure and Traffic) Intensity of Aviation for the Countries of the World

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The interdependence between air transport and the economic sector can be examined from two directions. Several theoretical and regional studies were published on the economic impact of aviation, which is the fastest growing but the most environmentally harmful among all of the transport subsections. However, out of the many factors that influence the development level / performance of aviation, only the thematization and examination of the relationship with the GDP per capita was carried out for a narrower group of countries.

Compared to the past, the author methodologically exceeded previous studies in many respects, since the correlation calculations were carried out on168 countries on 8 hypothetical acting factors and other specific indicators instead of one factor. Furthermore (breaking with the earlier practice), the indicator of passenger traffic per inhabitant was produced not from the data of official statistics (such as ICAO and IATA), which is only related to airlines registered in the given country, but from the complete national airport traffic data that was painstakingly generated by the author.

In addition to the global scale, the evaluation of correlation coefficients from a geographical point of view was done according to quantitative categories of hypothetical acting factors and at the same time for every country in the dataset. To illustrate the vast differences among the aviation (infrastructure / traffic) specific indicators, linear scale charts and graphs were made, while the correlation of indicators aggregated by continents was visualized with a logarithmic scaling.

Keywords:
air transportation,
economy,
infrastructure,
interdependence,
correlation,
tourism,
specific indicators,
continents,
countries

Introduction

A recent notable paradox is that the spread of information and communication technologies and devices did not reduce the long-distance mobility and specific travel demand of the people, as was previously assumed (Erdősi 2000, 2010). Though the possibility of teleworking restrained the growth of commuting related travel performances on a global scale, but recreation (as well as training related) mobility and travel attained much larger proportions than the passenger kilometre performance saved this way (Erdősi 2010a).

In contrast to terrestrial and marine transport, the speed and global coverage of aviation makes it significantly more advantageous: airplanes allow the exploration of areas inaccessible by other means (Erdősi 2003a). In our globalizing world, out of all transport subsectors, the performance of air transport rises the most, as it is also the consumer and integrator of most of the I + K production (in navigation just as in cabin services or reservation systems – (Hansman 2005). Airbus predicts that between 2012 and 2032, the number of air passengers on Earth will grow from 2.9 billion to 6.7 billion by an average of 4.7% per annum, and air freight transport will also increase by 4.8% per year (AIRBUS 2013). More recently, aviation surpassed rail transport in terms of passenger kilometre-performance, even in the main territory of the European Union; in some countries aviation almost outperforms rail transport in terms of the number of passengers.

In contrast to the environmental expectations formulated in the European Union's transport policy (KVM 2001), aviation (and road) traffic continues to grow much faster than GDP. In our view, the "homo technicus" will not be able to reduce the use of aircraft (which far exceed other means of transport in respect of emissions per passenger) in the future either.

The contribution of the air transport sector to GDP, even in the most developed countries, is typically only around 1–3%. However, in some countries, like Dubai, owing to its transfer role resulting from its peculiar geographical position and its prestigious (premium level service provider) international airlines, it reaches 26%. In Iceland, the share of the air transport sector in GDP approached 40% in 2000; subsequently, as a result of large-scale industrialization (energy-intensive aluminium metallurgy and the installation of IC industries) and the development of high added value sophisticated services and the quaternary sector, this share dropped to 12.9% in 2011 – that is, to double of the world average (Erdősi 2015, Owram 2015).

Statistics also show that there are substantial regional differences as regards the development and performance of air transport, which seem incomprehensible at first glance-. However, it is not an easy task for the regionalist researcher to develop correct indicators for these differences, to quantify them with acceptable accuracy, and in particular to reveal the reasons for these differences.

Objective

Therefore, in this article, we explore the factors that play a role in the evolution of the intensity of air transport in the individual countries.

It must be made clear that we do not develop a general aviation development index for a given country, because for the calculation of this very complex index number, in addition to the quantitative indices, too many qualitative factors should be considered (for example, the qualitative composition of the aircraft portfolio, the comfort level of airports, the quality of their services, the number and rank of destinations available from the given country, the technical level of air traffic control, the inland availability of the airport, or the dispersion in the income of the population). The problem of assigning weights to a wide variety of qualitative factors cannot be addressed in an exact manner because the choice of weights is a subjective one.

Therefore, in our study, we limit ourselves to determining the airport-supply of air transport and the main specific quantitative indicators of traffic performance in the given countries, and the detection of factors that influence their evolution.

Throughout the world a number of case studies and theoretical works have been published on the interaction between the aviation sector and economic efficiency or performance (for example, ATAG 2012, Morphet–Bottini 2013, Button–Taylor 2000, Ishutkina–Hansman 2009, Erdősi 1998, 1999). These works analyzed the varied (direct, indirect, induced, and catalytic) effects of air transport on a wide spectrum of indicators (ranging from employment to the supply chain). In this paper, we examine another direction of interdependence, namely the extent to which economic and infrastructural factors influence the quantitative indicators of air transport.

The indicators used

We consider the following indicators as the two basic indicators of air transport supply and (quantitative) development:

– airport-density per unit area or population, and

– airport (total) traffic per unit of population

The first indicator refers to the supply of air transport infrastructure and to the possibility of geographical/physical access to air travel. While the first indicator only demonstrates the potential of air mobility, the latter indicator expresses the degree of actual air mobility, or the yearly frequency of travel of the population and the degree of attraction of visitors from abroad by plane.

To determine the overall density of airports (airport/100,000 km^2), we used all airports of a particular country in our calculation (regardless of the length and pavement of runways). This is because even small grassy airports are not without significance, if, in addition to private airplanes, the landing and take-off of aircrafts performing rescue, fire-fighting, forestry/agriculture specialized services, and the aircraft of trainers arriving to hold lectures are considered. To serve scattered settlements that are distant from each other (such as farms, forest depots, power distribution centres, power stations, and satellite tracking stations0), the nearby smaller airports are also come in handy.

In contrast to the specific indicators per area for all airports, to the detection of the possibility of involvement in public air traffic, we only used those airports from the airport portfolio that had solid (concrete or asphalt) pavement and at least a minimum 1,523 meter long runway (hereinafter referred to as "large airports") suitable for the landing and take-off of at least medium-sized (over 100 seats) passenger aircrafts (B 737, A 319, A 320), when we determined the number of airports per 1 million population. This is because, in addition to the 1–10 person (propeller or jet) small airplanes, delegation carrier aircraft serving individual and corporate goals and business flight purposes, mostly turboprop or 35 to 70 person ("regional") aircraft are suitable for serving domestic and short international flights can be considered.

The third indicator is the aviation penetration, that is, the air passengers/ population ratio.

Problems of using traffic statistics data (in particular as regards air transport) and some possible solutions

All transport sub-sectors established sectoral world organizations, in which the countries (with few exceptions) are full members. Therefore they are obliged to provide proper reporting services. Nonetheless, in the international statistical publications of the world organizations, the rubrics of several countries are empty. However, an even greater cause for concern for analysts is that there are unacceptably large differences among data supplied by various organizations (in respect of aviation, the ICAO, the IATA, the EAC, the national statistical offices, the CIA Fact Book, and online statistics) even though they apply to specified concepts and the same year.

On the airport-portfolio of individual countries, the CIA Fact Book gives detailed information by length and cover of runways. However, doubts may arise in relation to their reliability, in particular with regard to the number of unpaved runway airports. It is very likely that in some undeveloped countries with relatively small areas, in addition to the real airports, occasional landing sites were also included in the stock; the strikingly (incredibly) many grassy airports can be attributed to this in such countries not considered to be developed, like Colombia, Bolivia, Papua New Guinea, Paraguay, Sierra Leone, Belize, and El Salvador. (In most countries, however, only those airports appear in the statistics, which meet the criteria set out in the regulations.)

However, in connection with the total airport portfolio, the assessment is doubtful since the lack of adequate data makes it difficult to understand the total air traffic of individual countries. The official (ICAO, Eurocontrol, and IATA) statistical yearbooks merely contain the combined passenger and cargo traffic of airlines registered in the particular country, but not that of foreign airlines. However, the total airport traffic supplemented with the turnover generated by foreign airlines is relevant because it realistically reflects the absolute size of the air mobility, from which a specific intensity indicator per unit of population can be calculated.

Total airport traffic exceeds the traffic of "home" airlines only in a few countries (Ireland, Iceland, Hungary, and Qatar), mainly because their airlines perform cabotage services abroad without passing through domestic airports. It also happens that foreign airlines make use of the tax deductions of a particular country, if the laws make their registration possible.

Due to the above-mentioned anomalies, we were forced to review the total airport traffic with the summation of partial data that can be found on hundreds of airport websites for all examined countries. We can not hide the fact that, in case of some countries, doubts were raised in connection with the authenticity of airport passenger numbers. According to the overall statistical convention, the total number of boarding and disembarking passengers and (transit) passengers who change to another plane constitute the airport passenger traffic. Other approaches only take into account the boarding (departing) passengers.

Among the acting factors that may have some working hypothesis based (positive or negative) relationship with air performances, world statistics on the road network are available from all countries. However, the International Road Transport Union (IRU) is unable to give an identical structure for the data series of member countries containing very different road types. In this respect, most egregious error is that there are no footnotes that provide the definition of road in the context of the data. In certain countries, only the data of the countrywide (national) network or the data of the whole network (together with local roads) appear in the statistics. Likewise, there are doubts concerning the data of the Fact Book because, during its compilation, the editors did not enforce identical criteria. In connection with the 197 thousand kilometres of road network detected in the case of Hungary, it was revealed that it did not refer to the state road network (30.5 thousand kilometres), but to the entire road network, while the length of network in several densely populated and developed countries is rather small to contain local/regional roads too. It is not clear that what the editors consider to be motorways (for example, the national statistics, in accordance with reality, detect only a few hundred kilometres of motorways in Russia; in contrast with this, the IRU detected more than 39,000 kilometres of motorways, in a way that presumably also included the main priority roads into the calculation, which were widened to 2 x 2 lanes in a number of sections.)

The range of countries involved in the evaluation

Morphet–Bottini (2013) only took into account approximately one-third of the countries in the world for the examination of the relationship between the number of air travels per capita (via national airlines) and GDP per capita. He separated the groups of isolated and non-isolated countries from each other and considered small islands and places where other modes of transport had no significance in passenger transport as isolated places. Likewise, he classified city states with a pre-eminent hub function in this category, which due to their unique connectivity form an extremely intense air travel market.

Though our study has a worldwide scope, in order to get a fair assessment and eliminate distortions we did not include the mini-island entities, which are very highly exposed to international tourism into the sample of 168 countries studied in this article (their status is ignored, according to which they can be independent states, overseas provinces, autonomous territories of large states, or commonwealth members). They are predominantly tropical (Caribbean, Pacific, and Indian Ocean based) tourist paradises with small areas and population, where the annual number of tourists arriving by plane (or by cruise ships and yachts) is much larger than the local population. Some of them can be considered tax havens, which also increases their guest traffic. Cyprus, the relatively large island, and Singapore and Hong Kong were excluded from the study since, together with the mini entities, since they not only have outstanding tourism and other kinds of extreme parameters, but towering aviation indicators as well.

However, the island states (New Caledonia, Samoa, Solomon Islands, Jamaica, Trinidad, Brunei), where agricultural, mining, and industrial production activities outperform tourism in terms of value of production were included in the sample of countries assessed. In larger archipelagos, in addition to the regular small and medium-sized aircraft based domestic inter-island air traffic, international air traffic is large and, therefore, the specific airport-density is far above average (for example, in the Philippines).

It is apparent from the extreme values of the indicators of 168 countries displayed in Table 1, that from the indicators of the main factors influencing the density of the air transport infrastructure and the size of the specific passenger traffic, the specific tourist traffic is characterized by the largest (several thousand fold) extremes, while there are several hundred fold differences among the different countries in road vehicle supply and specific GDP and a 120 fold difference in internet penetration. The difference between the extreme values of the specific airport traffic is more than five times larger than the index of the territorial density of the entire airport stock and more than nine times larger than the extremes in the index of the supply with airports that have a solid runway longer than 1,523 meters (In the Fact Book/ICA statistics, the number of runways is included by length categories).

The data used in this study are from between 2010 and 2012 as the same annual data for all countries was not available.

Hypotheses versus calculated results

Following the production of infrastructure and traffic intensity indicators for air transport and the designation of their most relevant influencing factors, we formulate our assumptions based on our previous professional experiences on the effect of the individual acting-factors (like variables) that influence the indicators and confront them with the results of the correlation calculation.

Table 1

Extreme values of indicators for the 168 countries involved in the calculations

Extremity	Population density inhabitants/ km²	GDP (USD) /person	Road vehicles/ 1000 inhabitants	All airports/ 100,000 km²	1523 m < Solid-runway airports/1 M inhabitants	Airport passengers/ inhabitants	Proportion of internet users, %	1000 tourists/ 1M inhabitants
Minimum	2 Mongolia	0.6 Somalia	2 Togo	2.29 Niger	0.09 Rwanda	00:01 Chad	0.8 Eritrea	2.5 Bangladesh
Maximum	1,203.0 Bangladesh	145.9 Qatar	809 USA	527.7 Bahrain	12.13 Iceland	12.11 Iceland	96 Iceland	6,515.1 Bahrain
Difference	601.5-fold	243.2-fold	404.5-fold	230.4-fold	134.4-fold	1,211-fold	120-fold	2,506.1-fold

Source: Author's calculations.

First, we would like to emphasize that we only consider the correlation coefficient as a mathematical theoretical indicator to refer to the stochastic relationship. However, the higher correlation value of the examined factor (variable) does not necessarily mean an actual effect on the analyzed indicator. Thus the reader should not be misled, if hereinafter I write about effect and influence in the text - it is difficult to replace the habitual narrative with another appropriate term. These words are entirely appropriate in case of GDP per capita and the number of tourists (because they actually influence the indicators of the aviation sector), but the other factors only very accidentally influence it - even if their "r" value is remarkable.

(a) According to the transport-geographical logic and the general experience of the author (mainly concerning domestic and European regions), the following conditions are needed to shape the total number of airports per unit area, and consequently, the supply of the regional aviation infrastructure for a wide variety of aviation purposes:

- The greater the area of a country, the more extensive it is, and the greater the distances between the domestic destinations and the peripheral and central regions. Therefore that area where the population needs the closest possible airport for their medium- and long-haul journeys is also larger. In countries with a specifically large area, the provision of state and other administrative services, law enforcement, security, official duties as well as economic activities also require more airports per unit area than in small countries.

Table 2

Correlation coefficients for the 168 countries

Variables	All airports/ 100,000 km^2	Runway of more than 1523 m/1 M inhabitants	Airport passengers/ inhabitants
Area (km^2)	–0.149	0.155	0.040
Population density (people/km^2)	0.040	–0.445	–0.257
GDP/capita (USD)	0.379	0.877**	0.916**
Road/100 km^2	0.332	0.124	0.178
Motorway, m/km^2	0.406	–0.048	0.266
Automobile/1000 inhabitants	0.380	0.862**	0.932**
Railroad, km/100,000 km^2	0.492	0.030	0.320
Internet users, %	0.292	0.826**	0.860**
Foreign tourists/residents	0.255	0.326	0.495
All airports/100,000 km^2	–	0.109	0.204
With a runway longer than 1523 meters/1M inhabitants	0.109	–	0.908**
Airport passengers/inhabitants	0.204	0.908**	–

** A very close correlation.

Source: Edited from calculations by Peter Dombi.

The calculation, however, showed (Table 2) negligible negative values (r = –0.149); that is, the calculation wholly refutes our hypothesis. (Of course, it is an interesting question that how much the weighting with the size of the area would have reduced the anomalies). However, if we disregard the problem of accuracy of the basic data, the result can be attributed to the fact that in a number of large countries, economic and transport activities have low intensities in large areas due to highly unfavourable natural conditions (such as deserts or wastelands) and/or weak economic conditions.

The state is unable to maintain the expected number of airports as public services (for example, in Russia and Kazakhstan, the stock of small airports has decreased significantly since the disintegration of the Soviet Union), while the private sector operates on the basis of ROI (return on investment) and profits.

- Due to the foregoing reasons, there is some degree of inverse relationship with the population density since airports are indispensable in the civilized world to the transport, communication, and supply of inhabitants in sparsely and 'punctiform' populated areas in the absence of other long-distance transport modes (even in the underdeveloped countries, in addition to the public air services, hundreds of "bush pilots" carry out air taxi services).

  From the R = 0.040 value, we can say that our hypothesis was somewhat idealistic, because we previously overestimated the presumed spontaneous and (state influenced) planned supply of airports in sparsely populated areas as compared to the actual situation.
- We expect that the density pf airports would increase with the GDP per capita. This is because, on the demand side, a more affluent population, has a greater average demand for airports in reasonable proximity providing commercial air services (private and business purposes, public use, scheduled / charter); on the other hand, the higher income also should have a beneficial effect on the density of airports that serve general aviation purposes and are intended to provide various special public services on corporate and private airports. The strengthening of financial conditions may stimulate the establishment of additional airports and an increase in supply.

  This conclusion, however, is not supported by the r = 0.379 value.

  According to our hypothesis, the airport-density indicator is less influenced as compared to the previous two indicators by the following factors:
- <u>Density and quality of the terrestrial transport infrastructure network</u>. In many countries, there is no rail transport and there are extensive areas that are not accessible on traditional paved roads suitable for cars. In these areas, only airports provide an opportunity for physical relations.

  Nonetheless, there is a loose correlation with road density r = 0.332, motorways r = 0.406, the vehicle stock r = 0.380, and railways r = 0.492.

- The specific number of foreign tourists also does not affect the density of the airport portfolio. The emerging/developing countries are particularly characterized by the fact that foreign tourists predominantly arrive at some busy airports that serve the most significant resort havens. Undoubtedly, there are also several exclusive resorts providing sophisticated services away from the settlements, to where (to the nearby small grassy airports) the high society guests and villa owners arrive with private aircrafts. Nevertheless, the number of these is dwarfed by the participants of mass tourism, which is in the order of tens of millions.

  In accordance with the assumption, worldwide tourism hardly affects the density of the entire airport portfolio, r = 0.255.
- In principle, the proportion of internet users cannot influence (directly) the density of the entire airport portfolio, because the use of the World Wide Web depends on GDP per capita, the level of education, the information and communication development policy of the given country, and on the interests of service provider companies.

  Nonetheless, the r = 0.292 value implies that the examined indicator is not totally independent from use of the World Wide Web. This may arise because in countries with a denser airport-portfolio other factors play an indirect role in the average and above average frequency of internet use.

b) Presumably the specific supply (for potential passengers) of airports with a solid runway of at least 1523 m (hereinafter referred to as "large" airports) are indispensable to commercial air travel

- This is primarily determined by the level of economic development of the given country (measured in GDP per capita). This assumption proved to be well founded as the related r = 0.847.
- From the hypothetical impact factors, the specific number of foreign tourists was classified in second place. This assumption was not convincingly confirmed by the r = 0.326 value.
- In third place, we assumed a strong correlation between the specific airport traffic (airport passengers/inhabitants) and the large airport supply. The relationship between the two factors is stronger than expected, with r = 0.908.
- The size of the area, which was believed to be the fourth most important factor, can be practically ignored as its coefficient is only r = 0.155.
- Among the other (traffic) factors, the calculation only confirmed the role of vehicle supply (r = 0.862), but not of motorways (r = –0.048), while we do not attach practical importance to the (formally) significant correlation with the internet (r = 0.826).

c) According to our assumption, the following were the most important factors that influence the evolution of specific air traffic that is also known as the number of passengers-penetration (total number of airport passengers per one inhabitant):

- On the supply side
  - The specific value of large airports is suitable for the traffic of scheduled domestic and international commercial air flights, and
  - The number of city pairs linked with scheduled air services (domestic and international relations).
- On the demand side
  - GDP per capita (indirectly the income levels),
  - number of foreign visitors (mostly tourists),
  - the size of the country's territory, and the
  - specific complete airport density was selected.

Among the supply-side factors, we only evaluated the first factor and not the production of the second indicator (partially due to deficiencies in basic data and partially due to the extremely time-consuming nature of data collection).

The specific indicator of airports suitable for regular commercial air transport is considered as the basic measure of the supply of services. However, it can not be neglected that the geographical location and capacity of airports must fit the structure of the settlement network and the geographical distribution of the population. The huge airport capacity utilization of cities and metropolises mostly located near coastlines has better chances than that of medium or small (counting only 50 to 200 thousand passengers per year) airports located in sparsely populated areas, which were established so far from each other that they are also available from the edge of their extensive catchment areas by (potential) passengers still within an acceptable period of time. As regards the geographical distribution of travel demand (and the number of available destinations) and the frequency of service, there are large differences between the airports adjacent to large cities of rich supply, which are heavily concentrated in space, and the smaller rural airports. Insofar as there are many of the latter group (for example, in countries with an area of several million square km) the rationality requires that their destination supply should be sufficiently diversified to reduce the reliance on large airports. However, this requirement prevails in few places, and therefore, passengers are forced to travel to the big cities near coastal areas from the vast, sparsely populated inner areas despite the high cost and time expenses (in good case with domestic feeder flights or only relying on land vehicles) when they do not buy a ticket for a neighbourhood international flight.

The above mentioned hypotheses are verified by our calculations. There is a very strong correlation between the supply with larger airports and air traffic: r = 0.908.

On the demand side, GDP per capita (with its push-pull effects depending on its size) usually affects the flow of traffic strongly. In high-income countries, the traffic generated by those travelling abroad for private (predominantly leisure) purposes is several times higher than the number of people travelling for professional purposes. In certain countries, such as those in Western Europe and the Gulf, the regular movement of migrant workers is significant. In case of a number of countries with poor economic performance measured by GDP per capita, the following may cause relatively large airport traffic:

– employees, university, and college students flowing out regularly and in large numbers (not too far away from the advanced host/employing areas)
– recreation tourists (much less affected by the distance) arriving en masse from the advanced host countries (seasonally depending on the climate or the season).

These result in

– a very close correlation (r = 0.916) between the specific airport passenger traffic and GDP per capita, and
– an insignificant or loose worldwide connection (r = 0.495) between the passenger traffic and the specific tourist traffic.

Basically, the size of the country's territory is relevant for the generation of domestic air traffic. In very large countries, the distances between the departure and destination stations are so big that the demand for airplane travel should have been higher merely based on the consideration of geographical distance as compared to smaller countries that are otherwise similar as regards other indicators. However, in a number of countries with an expressly large area, the average earnings of the population, and therefore its air mobility, is moderate.

The very low value of the coefficient (r = 0.040) refers to this latter essential condition, that is there is no demonstrable relationship between the size of the area and the specific air traffic. This may partly be explained by the fact that the shape of countries also modifies the demand for air transport; for example, several pubic airports operate in Greece, with its dozen islands, in the long stretch of Norway, and in the sickle-shaped Croatia.

According to our assumption, population density in itself cannot substantially modify the specific air traffic, since the level of economic development of the examined country is virtually independent of the population density. This assumption was dramatically confirmed: there is no relationship between specific GDP and population density; the value of r was only 0.140, and therefore, the relationship with air traffic was also very loose (r =0.257).

According to our assumption, the density of the traditional land transport infrastructure network (similar to the coefficient value of 0.204 of airport density) may have a rather weak direct impact on the total air traffic of countries. Their indirect effects, namely, their (feeder and take-away) role in the ground accessibility of airports is not negligible:

– the indicator of the traditional national road density is r = 0.312,
– the indicator of motorways is r = 0.369, which indicates a loose correlation,
– the indicator for vehicle supply (r = 0.731) shows a detectable connection,
– the indicator for the potential rail network had an r = 0.215.

Therefore, we can conclude that the density of motorways and high-speed rail (not included in the study), through their integration of the biggest airports, contribute significantly to air traffic generation; this is due to the fact that they are able to extend the catchment areas of their beneficiary airports to large areas.

A more detailed analysis of some connections according to quantitative categories and geographical distribution and results

Behind the global average data of factors that affect air travel, strong dispersions are displayed according to quantitative categories and geographic presence in more detailed calculations. In this study, we cannot analyse the relationships among all factors. Therefore, we limit ourselves to the analysis of only the most important factors in terms of the topic, and in the interests of transparency and compression we illustrate this with spreadsheets that contain large amounts of information and correlation graph curves.

The data in Table 2 show that there are highly significant (sometimes drastic) differences in the closeness of correlation.

Factors that influence the geographic density of the total airport portfolio are the relatively most balanced (at a low level and only with negative correlation) with a variance between 0.040 and 0.492. They do not display very strong correlation. The column (2) for the indicators on large airports contains, as an extreme case, two negative values and three very strong correlations too. Positive values are dispersed between 0.048 and 0.827 (in a much greater extent as compared to that in the first column).

Against a negative value, the column of passenger penetration contains four very strong correlations. As compared to other indicators, the dispersion of positive values between 0.040 and 0.932 shows the most extreme coefficients.

In Tables 3–5 on individual indicators, in addition to the categories of variables, the number of countries associated with them, and the arithmetic average of the examined (air) indicator, we also include the (arithmetic) average weighted with the population numbers of countries and the extreme values of the (air) indicator and their differences. The last column contains the degree of concentration of values below a certain maximum (as a percentage).

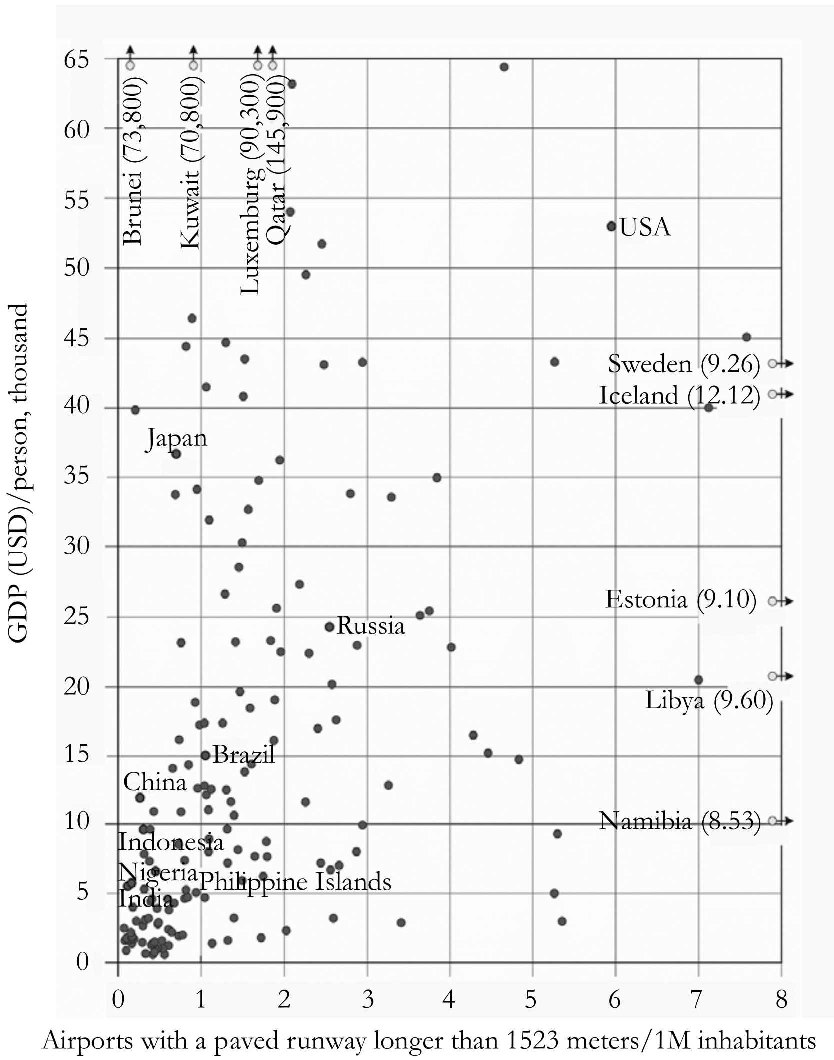
We used detailed linear charts (functions) for the graphical visualization (to illustrate the incredible extremes-like the points concentrated close to the origo and extremely high outlier values). Furthermore, for review of the data, logarithmic graphs that contain the positions of all countries are also included.

Changes in the supply of large airports per million inhabitants as a function of categories of GDP per capita and their geographical dispersion

Table 3 contains 168 countries surveyed classified in 8 categories of GDP per capita. Among the higher categories, the number of countries grows less than the average weighted with the population numbers of countries belonging to the given category due to countries with a large population.

Figure 1

Supply with large airports as a function of GDP per capita



Source: Edited by the author.

Though the differences between extreme values of the supply are highly volatile by the GDP category, but a slightly downward trend is perceptible toward the highest category.

- In the majority of lowermost category countries with an extremely weak economy (maximum 2500 USD GDP/inhabitant) mainly in sub-Saharan Africa and to a lesser extent in Asia, against the specific condition level, the supply of airports is actually insensitive up to the level of 0.60. On a linearly scaled graph the points indicating the values are strongly grouped together besides the ordinate (Figure 1).
- From the loose array of countries with a very weak economy in the category of 2500–5000 USD/inhabitant, the supply indicator of three small tropical countries significantly stands out.
- In the stock of poor condition countries (5,000 to 10,000 USD/inhabitant), the average indicator with a value of 1.36 is slightly above that of the former category (Table 3). The high weighted average can be traced back to 4 highly populous countries (Figure 1).
- The group with an economic strength of 10,000–20,000 USD/inhabitant is made up by emerging and, in worldwide comparison, mid-developed countries with airport indicators ranging from 0.26 to 11.0, with an average of 1.85. In this circle, Europe is represented only by the Balkan countries.
- In the category of 20,000–30,000 USD/inhabitant, which consists of half dozen countries, there are countries that are in a better financial position than the world average and have a strong tourist attraction. Half of these countries are European countries, with Malaysia and Libya strongly sticking out from this crowd (Table 3).
- The difference between the arithmetic and the weighted average in the bloc of dozens of advanced and highly developed countries, that is, in the group with an economic performance of 30,000–40,000 USD/inhabitant can be traced back to Japan, which has a population of 120 million.
- In the group with GDP per capita between 40,000–50,000 USD, Europe is represented by the Netherlands, Sweden, Austria, and Iceland with an average of 2.84.
- In the group of over USD 50,000, Europe is represented by Norway and Luxembourg. Furthermore, there are some rich oil-producing Asian countries. The remarkably high value of the weighted average is attributable to the fact that the United States, with its 320 million people, is also included here.

Table 3

Indicators on supply with (large) airports having a solid runway longer than 1523 meters per 1 million population for each category of GDP per capita

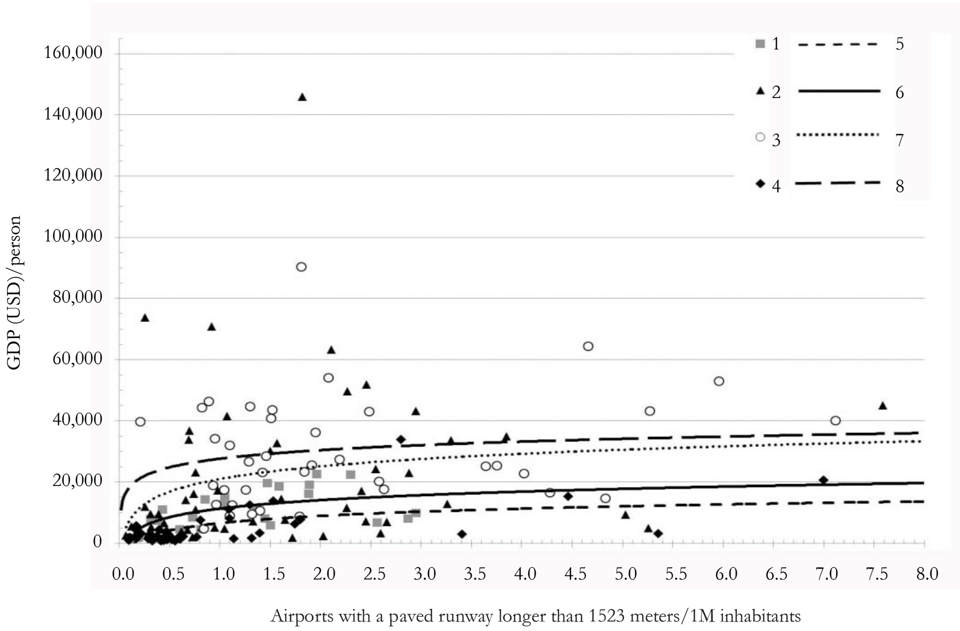
GDP (USD) /person	Number of countries	Airport supply a) arithmetic average b) weighted* arithmetical average	Extremities			Frequency**
			minimum**	maximum**	difference	
2,500 >	34	a) .54 b) 13.05	0.07 Tadzhikistan	2.03 Papua New Guinea	69-fold	Max 0.5 60.6%
2,500 – 5,000	22	a) 1.30 b) 11.16	0.18 Ghana	5.26 Samoa	29-fold	Max 1.0 71.4%
5,000 – 10,000	27	a) 1.36 b) 18.20	0.12 India	5.30 Mongolia	2.29-fold	Max 1.5 63.0%
10,000 – 20,000	33	a) 1.85 b) 24.54	0.26 China	11.00 Dominica	44.2-fold	Max 1.5 60.6%
20,000 – 30,000	18	a) 3.35 b) 14.47	0.76 Malaysia	9.60 Libya	42.3-fold	Max 3.0 66.7%
30,000 – 40,000	12	a) 1.85 b) 23.02	0.21 France	7.12 Finland	33.9-fold	Max 2.0 66.8%
40,000 – 50,000	13	a) 2.84 b) 18.35	0.82 Austria	12.12 Iceland	14.8-fold	Max 3.0 69.2%
50,000 <	9	a) 2.46 b) 92.57	0.26 Brunei	5.96 USA	22.9-fold	Max 3.0 77.8%

* Weighted with population numbers.
** Based on national original supply indicators (without weighting).
Source: calculations and editing of the author (from basic data of the Fact Book and other sources).

Figure 2 illustrates on a logarithmic scale the distribution of the GDP-dependent supply of large airports in some parts of the world.

Figure 2

Distribution of the relationship between major airports and GDP per capita by continent on a logarithmic scale



Legend: designation of individual countries: 1 – Latin American, 2 – Asian/Oceanian, 3 – European and North American, 4 – African. Log trend line of R2 concerning 5 – Latin America, 6 – Asia/Oceania, 7 – Europe and North America, 8 – Africa.

Source: Edited by Aron Kovács.

Developments in specific airport passenger traffic as a function of categories of GDP per capita and their geographical dispersion

In Table 4, the arithmetic average of the indicator for specific airport traffic shows a clear upward trend towards the highest GDP per capita category, in contrast with the weighted average which varies rhapsodically (because of the weight of particularly populous countries determining the third, fourth, and highest categories). The differences between the extreme values of individual categories show a downward trend towards the highest GDP per capita.

– The effect on GDP is least reflected among extremely weak countries included in the lowest category of less than 2500 USD GDP per capita. Insensitivity towards GDP is manifested in special aggregates, most markedly in countries with GDP per capita of around 1400 USD and between USD 1800–1900. In the vast majority of countries with GDP per capita under 1900 USD, the traffic is below the 0.1 value.

Table 4

Indicators on specific airport passenger traffic for each category of GDP per capita

GDP per capita (USD/ inhabitants)	Number of countries	Airport passengers/ inhabitants c) arithmetic average d) weighted* arithmetical average	Extremities**			Frequency**
			minimum	maximum	difference	
2,500 >	34	a) 0.09 b) 13.02	0.01 Chad (+3)	0.69 Solomon Islands	69-fold	Max 0.1 77.0%
2,500 – 5,000	23	a) 0.28 b) 10.86	0.04 Zambia	1.58 Samoa	158- fold	Max 0.2 54.5%
5,000 – 10,000	28	a) 0.46 b) 46.65	0.09 Swaziland	2.65 Belize	29.4-fold	Max 0.5 74.1%
10,000 – 20,000	33	a) 0.88 b) 59.00	0.06 Iraq	2.26 Panama	37.7-fold	Max 1.0 72.7%
20,000 – 30,000	18	a) 1.29 b) 13.83	0.26 Slovakia	3.05 Portugal	11.7-fold	Max 1.2 63.2%
30,000 – 45,000	22	a) 3.90 b) 22.06	0.28 Equatorial-Guinea	6.98 New Zealand	24.5-fold	Max 3.5 66.7%
45,000 <	10	a) 5.10 b) 32.06	1.95 Saudi Arabia	10.60 Qatar	5.4-fold	Max 9.0 62.5%

* Weighted with population numbers. ** National coverage indicators without weighting.
Source: Calculations and editing of the author (basic data deriving from a variety of sources).

– Though the arithmetic average (0.28 or 0.46) of traffic intensity in very poor and weak countries with a GDP per person of between 2,500 and 5,000, and between 5,000 and 10,000 USD is several times higher than that in the lowest category. However, nearly a dozen countries among these (such as Zambia and India) still remain within the traffic category of 0.1. Belize, the Fiji Islands, Jamaica, and Puerto Rico are characterized by the highest traffic values (1.9 to 2.65).

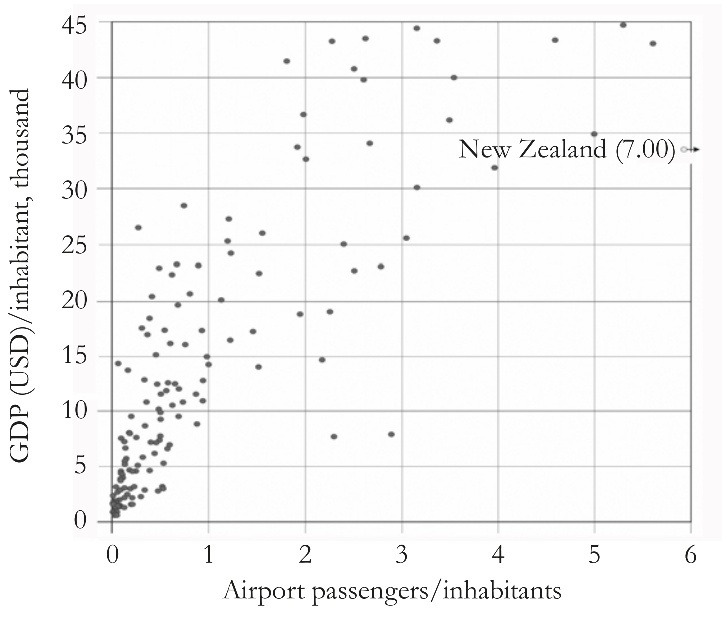
The positive effect of GDP growth on traffic gradually begins to become more and more important (but not in a linear fashion) among countries with a GDP per capita figure of over 10,000.

– Independent countries with the world average medium specific economic performance of 10,000–20,000 USD GDP per person have traffic intensity indicators below the 2.4 value, while their average is 0.88. Within this grouping, the lower sub category is made up by the conglomeration of countries with USD 10,200 to 13,000 GDP per capita, whose traffic intensity is limited to values between 0.3 and 1.0. The members of the upper subcategory with USD 13,000 to 20,000 GDP per capita differ from the former in that their indicators are strongly dispersed (between 0.2 and 2.4). Among the members of the intensity range between 1.0 and 2.26 in Iraq, ongoing conflicts, armed clashes, and a series of attacks reduce traffic. Additionally, few people use air transport in the rather dictatorially governed Algeria, which is faced with problems of internal security (job-takers in Southern Europe, particularly in France, prefer the cheaper sea ferries to their occasional journeys).

– Relatively few countries, which are predominantly not far behind the threshold of the category of developed countries, are in the group of countries with an economic performance of between USD 20,000 and 30,000 GDP per person. Traffic intensity indicators of the independent countries variously evolve between 0.25 (Slovakia) and 3.05 (Portugal), that is, they are highly dispersed. The average of this category is 1.29.
– The (super rich) independent countries with over 45,000 USD GDP per person show very strong extremes not only as regards area, population, and population density, but the base of their economies is also very different: from oil producers in the Persian Gulf area to countries with diversified economic structure, in which, high value-added services predominate.

Figure 3

Relationship between GDP per capita and airport passenger penetration

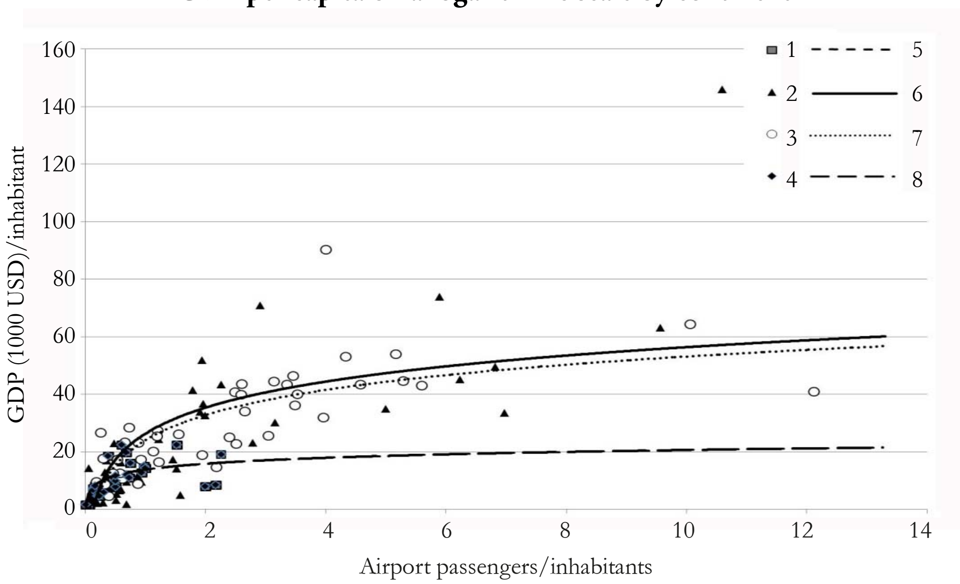


Source: Edited by the author.

Figure 4 illustrates the distribution of the GDP dependent evolution of the airport passenger penetration on a logarithmic scale by continents.

Figure 4

Relationship between airport passenger penetration and GDP per capita on a logarithmic scale by continent



Legend: designation of individual countries: 1 - Latin American, 2 - Asian / Oceanian, 3 - European and North American, 4 - African. Log trend line of R2 concerning 5 - Latin America, 6 - Asia / Oceania, 7 - Europe and North America, 8 - Africa.

Source: Edited by Aron Kovács.

Changes in the intensity of specific airport passenger traffic as a function of specific tourist traffic

Table 5 contains the size of the specific tourist traffic sorted by 6 categories. The number of countries that belong to the individual categories decreases quite regularly and significantly towards the highest value category, while the arithmetic average of the specific airport passenger traffic (a generally strong relationship due to a high correlation coefficient) shows a dynamically growing trend. In contrast with the former, however, the weighted arithmetic average of the turnover shows a strongly decreasing trend regarding the number of countries belonging to the individual categories. There is no any regularity in the development of differences between the extreme values.

a) In four-fifths of the 53 countries that generate an extremely low tourist traffic (less than 50 thousand persons/one million inhabitants), specific airport traffic had a value of less than 0.3, while their arithmetical average was only slightly higher than 0.20. The difference between the arithmetic and the weighted arithmetic mean (Table 5) is by far the biggest in this category, mainly due to China and Brazil.

Table 5

Indicators of specific airport passenger traffic in the categories of specific tourist numbers

Number of tourists, 1,000 persons, per 1 million population	Number of countries	Airport passengers /inhabitants e) arith-metic average f) weighted* arithmetical average	Extremities**			Frequency**
			minimum	maximum	difference	
2.5 – 50.0	53	a) 0.21 b) 136.54	0.01 Haiti (+3)	0.98 Brunei	98-fold	Max 0.3 80.7%
50.0 – 250.0	45	a) 0.60 b) 91.11	0.01 Ruanda	2.59 France	259-fold	Max 0.5 68.2%
250.0 – 500.0	24	a) 1.82 b) 26.92	0.18 Laos	6.24 Australia	34.7-fold	Max 1.5 50.0%
500.0 – 1000.0	26	a) 2.55 b) 8.89	0.03 Ukraine	10.06 Norway	30.5-fold	Max 3.0 71.4%
1000.0 – 2500.0	16	a) 2.22 b) 11.08	0.06 Botswana	10.60 Qatar	176.6-fold	Max 4.0 68.8%
2500.0 <	4	a) 5.16 b) 6.14	1.13 Croatia	9.57 United Arab Emirates	8.5-fold	Max 7.0 62.5%

* Weighted with population numbers. ** Original specific values without weighting.
Source: Author's calculations from basic data found in the websites of the ICAO Statistical Yearbook and airports.

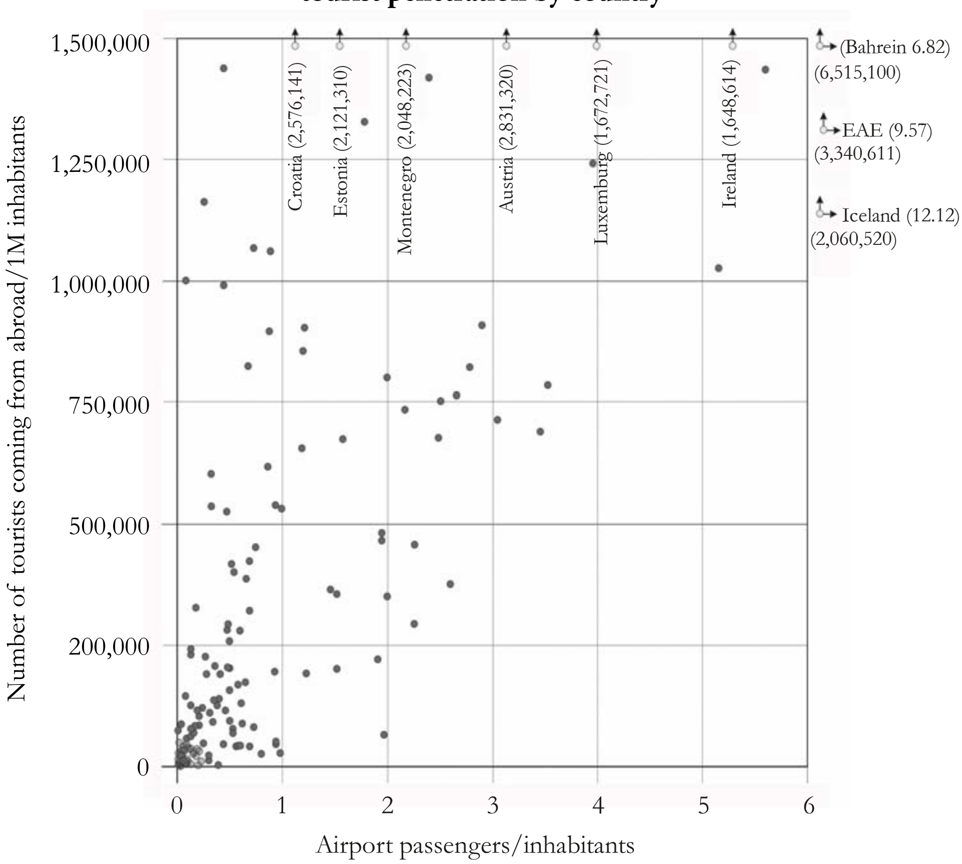
This group also includes, in addition to the most vulnerable countries in sub-Saharan Africa, some Asian poverty-stricken countries (for example, Afghanistan), emerging countries (for example, Brazil), countries that lose large numbers of potential tourists due to internal conflicts (for example, Iraq), and some post-Soviet states.

On figure 5, a multitude of members agglomerate close to the origin (a barely perceptible field between the values of the ordinate (15.0) and the abscissa (0.20)), that is, in this group the very low air traffic can be clearly associated with few tourists.

The role of tourism in generating traffic to airports is already clear in the group flanked by tourist intensity values from 0.55 to 0.60. It is the most pronounced in countries farthest from the origin (for example, in Colombia) producing traffic from 0.68 to 1.00.

Figure 5

Distribution of relations between airport penetration and tourist penetration by country



Source: Edited by the author.

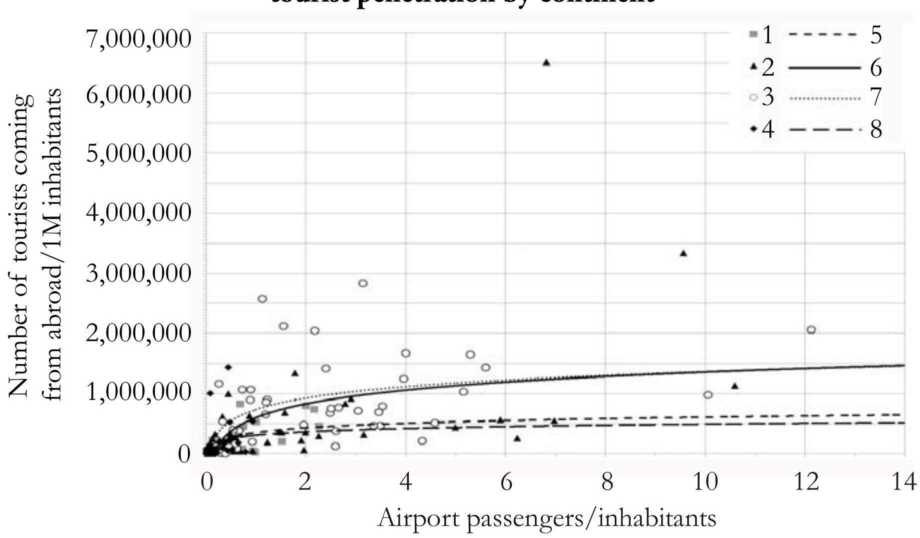
b) Weak tourist traffic (50,000 to 250,000 persons/one million inhabitants) is typical of countries forming slightly more than two-thirds of the portfolio consisting of 45 countries and generating less than 0.5 worth of air traffic. In the very high weighted average, which is hundred and fifty times greater than the arithmetic average, the population of many hundreds of millions in the United States, Japan, and Russia plays a decisive role. Among the national extremities, the minimum value is not greater than the minimum value in the previous group (Table 5). The vast majority of the members of this group are concentrated in the zone between the tourism intensity line of 150 thousand tourists /1 million people and traffic intensity line of 0.7 airports. The overwhelming majority of the Y-axis adjacent members are African, where tourism has only a very modest share in air traffic (because the majority of foreigners arrive on land vehicles from the neighbouring countries).

Ultimately, (as shown in Figure 5) the increase in air traffic due to tourism is the smallest in the tourism intensity subcategory of 2.5 to 50.0 thousand tourists/1 million inhabitants, which is somewhat stronger in the 50–200 thousand subcategory, and most pronounced in the 200–500 thousand subcategory.

d) The positive impact of tourism generated by foreigners on specific air traffic manifests itself most clearly in the stock of independent countries with a high specific tourist traffic (500–2500 thousand/1 million inhabitants) with values concentrated in a long-drawn-range along the ordinate, which mostly remains below 3.6. The quadrangle stretching up to 1.8 of countries representing minimum values in both dimensions closest to the origin within this portfolio is dominated by post-Soviet and other European former socialist countries. A further block of countries emerges between the specific air traffic indicators of 2.2 to 3.6 with a similar remarkably strong thickening, whose composition is very geographically mixed. Luxembourg, Ireland, Denmark, Switzerland, Spain are displayed with values between 3.6 and 5.6. In this category (0.5-2.5 million tourist /1 million inhabitants), the impact of tourism on air traffic was already convincing: tourists exceed the local population 9- to 12-fold and generate the greater or by far the largest part of air traffic. However, the fact is that the international transport of the local population has presumably at least the same proportion in the entire air traffic as the visits of foreigners.

Figure 6

Relationship between airport passenger penetration and tourist penetration by continent



Legend: designation of individual countries: 1 - Latin American, 2 - Asian / Oceanian, 3 - European and North American, 4 - African. Log trend line of R2 concerning 5 - Latin America, 6 - Asia / Oceania, 7 - Europe and North America, 8 - Africa.

Source: Edited by Aron Kovács.

e) The impact of tourism on air traffic culminates with a mean value of 5.16 in the stock of countries with extremely high tourist traffic (2.5 million passengers/1 million inhabitants). Only Croatia, Austria, Bahrain, and the United Arab Emirates belong to this group (Table 5). Figure 6 shows the distribution relationship between airport passenger penetration and tourist penetration on a logarithmic scale for each continent.

Impact strength of the most important four factors influencing the development of air transport for each continent

Based on detailed calculations not displayed here, the number of significant correlations does not depend on the number of countries in the given continent, but on natural, demographic, and economic parameters, the quantitative characteristics of the various infrastructures, and on the complex interdependent structure of all of these.

a) The effect of GDP per capita is most strongly manifested in the following
- – supply with large airports in North and Sub-Saharan Africa,
- – airport passenger penetration in 8 large regions (Australia, East and South-East Asia, South Asia, Middle East, Eastern Europe, South America, Sub-Saharan Africa, Western Europe).

b) The effect of tourist penetration is the strongest in the following areas
- – supply with large airports in Sub-Saharan and North Africa, the Middle East, and in the zone around the Sahara,
- – supply with large airports in the zone around the Sahara and in Sub-Saharan Africa,
- – airport passenger penetration in the zone around the Sahara, the Middle East, and Eastern Europe.

c) The effect of population density very significantly prevails in the following areas
- – airport-density in the Middle East and Central Asia, and
- – airport passenger penetration only in South America.

d) The role of road density has a significant level in the following fields
- – airport-density in the Middle East, Central Asia, North America, and in the zone around the Sahara,
- – in supply with large airports only in the zone around the Sahara,
- – in airport passenger penetration exclusively in South America.

Airport passenger penetration stands out with the supply of large airports in Western Europe and an exceptionally strong GDP dependence in Eastern Europe, while in the Middle East as well as in Central Asia, a strong relation exists with airport and population density. In East and South-East Asia, and in Australia, the relationship between airport density and motorway density stands out, while in North Africa the correlation between airport density and tourist penetration is significant, mainly owing to tourist traffic of tens of millions in Egypt, Tunisia, and Morocco.

Due to the extremely harsh natural conditions in the dry zone around the Sahara, one of the main criteria for airport-construction is road accessibility, which is quite poor in that region. The relationship between large airport-supply and airport density is even closer. The huge region of sub-Saharan Africa, which is more or less rainy, therefore predominantly engaged in plantation farming and has a significant extractive industry, is mainly characterized by the fact that GDP plays a big role in the supply with large airports, while the airport passenger penetration primarily depends on the supply with large airports. (That is, airports with smaller runways play a much smaller role in air traffic than assumed.) In Central America, passenger traffic is primarily generated by foreign tourists. In South America, passenger intensity is almost equally dependent on the population and road density as well as on GDP.

Research findings

Based on the geographical logic and our past experiences (limited to only a few countries), we examined the potential impact of 8 economic/infrastructural and social factors selected to our working hypothesis on the three main characteristics of aviation.
a) Worldwide. Compared with our hypothesis, neither the area as well as the population and road density of the particular country nor the figures of GDP per capita and tourist penetration did not affect the density of the entire airport portfolio (Moreover, the relationship with internet use, which is irrelevant in terms of our topic, was also insignificant).

The calculations confirmed the significant correlations assumed between the indicator of *large airports* per unit of population and GDP as well as passenger penetration, but the relationship with tourist penetration was already weak. On the other hand, (in contrast with our hypothesis), the relationship was especially significant between passenger penetration and the supply with large airports. (Among the other, not very relevant indicators, there was a significant relationship only with car supply and internet use, but not with transport infrastructures.)

In addition to the GDP, airport passenger penetration (number of passengers and of the population) has a highly significant relationship with the supply of large airports (and significantly correlate with the automobile supply), but the impact of tourist penetration is rather weak in this respect.
b) The number of significant correlations of *individual continents* is independent of the number of countries. We did not formulate preliminary hypotheses on the correlation of aviation indicators of continents, but as a result of the calculations, it became clear that in North America tourism (by reason of its significant economic role played in several countries) population density in Central Asia and road density in Australia show a highly significant relationship, while GDP is among the major impact factors both in underdeveloped and developed regions.

REFERENCES

PWC (2014): Connectivity and growth Directions of travel for airport https://www.pwc.com/gx/en/capital-projects-infrastructure/publications/assets/pwc-connectivity-growth.pdf (downloaded: Dec 2015).

BUTTON, K. – TAYLOR, S. (2000): International air transportation and economic development *Journal of Air Transport Management* 6 (4): 209–222.

ATAG (2012): Aviation (Benefits beyond Borders) https://www.oxfordeconomics.com/publication/download/239338 (downloaded: Dec 2015).

ERDŐSI, F. (1998): *A légi közlekedés általános és regionális földrajza, légiközlekedés-politika* Első kötet. MALÉV Rt., Budapest.

ERDŐSI, F. (1999): Légi közlekedés és területi fejlődés *Tér és Társadalom* 13 (4): 45–76.

Erdősi, F. (2000): *A kommunikáció (közlekedés-távközlés) szerepe a terület- és településfejlődésben* Első kötet. VÁTI, Budapest.

ERDŐSI, F. (2003): Műholdas vagy fénykábeles hálózatok *Híradástechnika* 59 (9): 43–50.

ERDŐSI, F. (2003a): A világ légi közlekedésének főbb tendenciái *Közlekedéstudományi Szemle* 53 (2): 54–59.

ERDŐSI, F. (2010): Közlekedésföldrajz In: Tóth J. (szerk.): *Világföldrajz* pp. 513–596., Akadémiai Kiadó, Budapest.

Erdősi, F. (2010a): A távközlés és infokommunikáció földrajza. In: Tóth J. (szerk.): *Világföldrajz* pp. 483–512. Akadémiai Kiadó, Budapest.

ERDŐSI, F. (2015): *A hárompólusú Közel-Kelet közlekedése* Kézirat, MTA KRTK, Pécs.

KÖZLEKEDÉSI ÉS VÍZÜGYI MINISZTÉRIUM (KVM) (2001): *Fehér Könyv. Európai közlekedéspolitika 2010-ig: Itt az idő dönteni* Budapest.

AIRBUS S.A.S. (2013): *Future Journeys 2013–2032. Global Market Forecast* https://www.airbusgroup.com (downloaded: Dec 2015).

HANSMAN, R. J. (2005): The impact of information technologies on air transportation In: *AIAA Aerospace Sciences Conference* pp. 1–12., AIAA January 2005, Reno.

AIRPORT AUTHORITY HONG KONG (AAHK) (2010): *HKIA Master Plan 2030 Technical Report. Chapter 2: Air Traffic Demand Forecast* http://www.threerunwaysystem.com/en/Information/Airport_master_plan_2030.aspx (downloaded: Dec 2015).

OWRAM, K. (2015): How Iceland's airlines have helped Spur a tourism boom *Financial Post* http://business.financialpost.com/news/transportation/how-icelands-airlines-have-helped-spur-a-tourism-boom-lifting-its-battered-economy-back-to-health (downloaded: Dec 2015).

ICAO (2014): *Statistical Yearbook 2013* ICAO, Canada.

ISHUTKINA, M. A. – HANSMAN, R. J. (2009): *Analysis of Interaction between Air Transportation and Economic Activity* Report. No. ICAT 2009-2, March, Cambridge, MA 02139 USA. http://dspace.mit.edu/bitstream/handle/1721.1/44957/Ishutkina_ICAT-2009-2.pdf?sequence=1 (downloaded: Dec 2015).

MORPHET, H. – BOTTINI, C. (2013): *Propensity to fly in emerging economies: Implications for infrastructure investment* https://www.pwc.com/en_GX/gx/capital-projects-infrastructure/pdf/the_new_normal_for_airport_investment_-_06_propensity_to_fly.pdf (downloaded: Dec 2015).

CIA (2015): *The World Factbook* https://www.cia.gov/library/publications/the-world-factbook/index.html

International Migration Diversity in Hungary in the 2011 Population Census Data

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Foreign nationals have had a significantly positive influence on the regional socioeconomic developments of Hungary. Two realignments took place between the last two censuses: at first, the composition of citizenship changed; then, the local redistribution changed partly because of the different structure of citizenship.

Fields of interests and research: Regional science, regional geography, regional and urban development, regional analysing methods, social- and economic geography network-analysis, applied mathematics and the application of physical science models in geography.

Keywords:
international migration,
census,
dual citizenship

Introduction

Migration is an interdisciplinary topic that mainly interests the fields of demography, statistics, geography, law, economic science, history, work science, psychology, and political science. Consequently, its definition and interpretation emphasise numerous forecasted projections. The *Demographic Yearbook* published by the Hungarian Central Statistical Office (HCSO 2008) defines international migration as the permanent abandonment of the original (usual) country of residence with the goal of settling down, residing, or obtaining gainful employment in another country.

Because motivations to migrate are continually evolving, definitions of *settlement* or *performing gainful activity* have expanded to include the ideas of *educational purposes* (Rédei 2007) and *elderly migration* (i.e. the motivation to improve the purchasing power of pensions, increase recreational opportunities, or obtain a relatively more favourable climate) (Illés 2008). The motivation to achieve *family reunion* also is emphasised as a major factor in international migration.

The core assumption of extant interpretations of historical migration is that migration is a singular event in a person's lifetime. In this sense, migration is a relatively rare occurrence, and it can be characterised as a type of extraordinary event.

This migration determines migrants' lives because this unique, unidirectional event is linked to the symbolic moment of crossing a border (Kovács–Melegh 2000).

However, the effects of migration on migrants depend on the socioeconomic contexts at the points of origin and destination where it occurs; moreover, they inevitably bear the characteristic features of their historical contexts. In the present era of globalization, income gaps among countries are increasing at an accelerated rate, and development is uneven (Kofman–Youngs 2003). The widening differences in the quality of life between poor and rich countries are encouraging human migrations. Simultaneously, migrants' financial assets continue to increase, and spatial access is improving. Furthermore, some areas of the world are converging such that the cost of long distance migration relative to household income has become so low that growing numbers of people in peripheral countries are finding it feasible to migrate (Hatton–Williamson 2005). In this context, the advent of omnipresent information and transportation technologies and increased border penetrability has meant easier border crossings. The phenomena of circular migration and transnational migration also have appeared on the international scene. *Cross-border migrations decreasingly determine the intention to finally settle down* (Hatton–Williamson 2005), but rather can be considered *as a station within lifetime*.

The purpose of this study is to challenge historical interpretations of migration behaviours using 2011 population census data and to describe the immigration groups in Hungary. The study describes the geographic locations of Hungarian migrants as well as their demographic, labour market, and educational attainment differences from the Hungarian native population, and it discusses possible causes for their residential choices. Understanding the full complexity of the topic demands a sophisticated analysis that is beyond the scope of this study. Therefore, although not exhaustive, this study focuses on some key aspects of the Hungarian immigration situation.

Content of analysis, main migration groups

For conceptual and practical reasons, the terms *voluntary* and *legal* migration refer to international migration in which migrants change their places of residence (at their volition) from another country and their choices depend on their self-evaluated internal factors, external factors, and attractive and repulsive effects. Most studies on migration consider only foreign citizens or citizens born abroad, although international migration is much broader. To address this weakness and take advantage of the full scope of the population census data, which covers total population of a given area (country) and relates to a predetermined point of time, the paper distinguishes among four migrant groups: *foreign citizens, citizens born abroad*, *dual citizens* (Hungarian plus at least one other national citizenship), and *Hungarian citizens returning home*.

Foreign citizens and citizens born abroad

Citizenship laws throughout the world bind citizenship to the principles of *ius sanguinis* (privity) or *ius soli* (country of birth). In the first case, parental citizenship is decisive to determine citizenship, whereas, in the second case, country of birth is the determining factor. However, variation among national laws means that if a citizen of a country of origin under *ius sanguinis* bears a child in a country that relies on *ius soli*, that child obtains dual citizenship at birth. On the other hand, if a child is born in a country under the principle of *ius sanguinis* and the parents are from a country relying on *ius soli*, neither country would recognize that child as a citizen. Hungary is similar to most European countries in that it confers citizenship under *ius sanguinis*. According to Act LV of 1993 on Hungarian Citizenship (with amendments), only children whose parents are Hungarian citizens are Hungarian citizen at birth. Hungarian citizenship also can be acquired through the process of naturalization (for individuals who are not born as Hungarian citizens) or re-naturalization (for individuals whose previous Hungarian citizenship has ceased).

In 2011, Hungary's foreign citizens were included in the population census if they had been living in the country for at least 12 months at the reference date or if they intended to live in Hungary for at least one year, and if, besides their foreign citizenship, they were not Hungarian citizens. Members of the foreign diplomatic corps and their families, members of foreign armed forces stationed in the country by governmental or National Assembly decisions, and persons in Hungary as tourist visitors, for medical reasons, on business, and so on were not enumerated.[1]

In this study, individuals born outside Hungarian borders and habitually residing inside Hungary are considered foreign-born citizens. This group might include foreign-born foreigners, Hungarians born abroad, those born as Hungarian citizens, foreign-born naturalized Hungarians, and foreign-born repatriated Hungarian citizens.

Dual citizens

Early in the twentieth century, migrants only sporadically travelled home or transferred money home to the country of origin (Rédei 2007). Over time, these became monthly, weekly, or daily practices. The possibilities of maintaining personal contact without spatial mobility changed from being monthly to immediate events (from letters to telegraph to telephone to e-mail, and, recently, to Skype). Thereby, the economic, social, cultural, and political activities of the host and origin countries were increasingly interconnected (Viszt et al. 2001, Portes–DeWind 2004, Walton–

[1] http://www.ksh.hu/nepszamlalas/docs/modszertan.pdf

Roberts 2004, Rédei 2005, Williams–Balaz 2008). Consequently, the characteristics of migration changed.

In the era of globalization, numerous plural phenomena are observed, such as multiple:

– residences,
– citizenships,
– real estate ownerships,
– employments,
– identities,
– loyalties (Waldinger 2008).

In many countries, exclusive national citizenship has been degraded by the elimination of compulsory military service, treaties that end double taxation, and supranational rules of economic integration, even before the recognition of dual citizenship. Transnationalism reached a higher quality level because of the globalization processes of burgeoning travel and communication technologies (Bernek 2002).

An early understanding of migration held that the process of international migration involves at least two independent political states in which a migrant secedes from the releasing state and accedes to the host country. In the concept of transnational migration, dual citizens (in the within analysis these are persons with foreign citizenship plus Hungarian citizenship) are connected to both countries through their work, residences, and other activities, (Waldinger 2008), and they have the language skills and local knowledge of both regions.

Hungarian citizens returning home

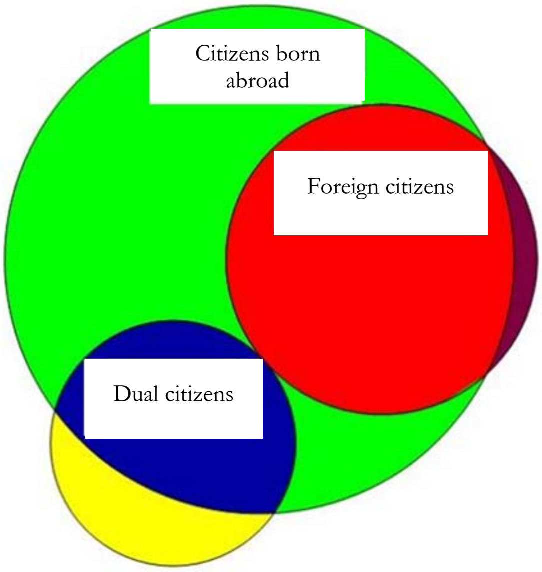
A fundamental approach of historical studies to migration is that migration is a unique event in a person's lifetime and it, therefore, has an extraordinary character. Knowledge of new types of migration (as discussed above) challenges the notion that migration is a unique event, such as losing citizenship of the country of origin and acquiring citizenship of a host country (Bonancich 1972). In this process, cross-border migrations decreasingly mean the intention to finally settle down, but rather they can be found as a station of lifetime.

Migration, from a spatial perspective, could be considered a process because areas of origin and destination are interconnected. According to the spatial scientific approach (Nemes Nagy 2009), migration is separated in area, to which, when a dual time dimension is attached (synchronous–asynchronous), two possibilities arise. First, there will be separate space-synchronous and separate space-asynchronous migration systems. The first separate-space-synchronous migration system will be assigned to the most attractive centres. These core areas practically detect synchronous streams within the borders of their attraction. In global terms, there are three of these centres: Canada and the United States in North America, the European Union in Europe, and

Australia in the Pacific Ocean. To characterize separate space-asynchronous migration systems, a minimum of two attractive centres is necessary, between which the simplest migration system comprises two interconnected processes: migration to somewhere and remigration. When a starting point has no posterior attraction for the migrant, neither does the place of migration meet his expectations, and a third location could advance to the second place of attraction (Illés–Kincses 2009).

Figure 1

Citens born abroad, foreign citizens and dual (Hungarian and other) citizens



Some Hungarian citizens who leave Hungary do not leave their home country forever; Ravenstein (1885) suggests that each significant migration flow creates a reflection, which is its counterflow, at a temporal phase shift, and migrants return after a time lag, by separate-space-asynchronous migration. In this study, Hungarian citizens returning home (returnees) are those Hungarians who had been living at least one year during their lifetimes permanently outside the territory of present-day Hungary, were not born abroad, and had habitually settled in Hungary.

Migrant groups in Hungary

Foreign-born citizens include individuals who have only foreign citizenship and those with dual citizenship (see Figure 1, 3, 4). Independent examination of this group is justified because the Act on Hungarian Citizenship (*ius sanguinis*) categorizes as dual citizens 25,554 of those born abroad. Of those who have only foreign citizenship, 7254 were born in Hungary. Compared to the more than 200,000 persons enumerated in the previous census, the 2011 population census counted fewer foreign citizens. A possible reason for this change is that the earlier count included foreign citizens and dual citizens. At the theoretical time of zero hour on 1 October 2011, Hungary had 143,197 foreign citizens (excluding dual citizens) and 383,236 foreign-born citizens. For both groups, most people migrated from neighbouring countries or from Germany. Europe plays an outstanding part in Hungarian migration, particularly regarding foreign-born migrants. About 90% of the migrants in 2011 originated from Europe.

The significant number from neighbouring countries relates to cross-border linguistic and cultural connections. This fact suggests that the effects of peace treaties formed at the ends of World Wars I and II strongly influence migration processes in the Carpathian Basin (Tóth 2005). Political changes during the 1990s relate to ethnic Hungarians' mass migrations into and out of Hungary. In the first year of the regime change resulting in Romania's anti-minority policy and the incidents in Timisoara, Hungary faced strong migration pressures, which were repeated during the Yugoslav wars. Forced migration transformed into voluntary migration for business or educational purposes.

Interestingly, the number of people born in Romania and living in Hungary is greater than the population of Szeged. Hungary is a primary destination for Europeans, and relatively short distance international migrations are typical. However, the number of Asian and African American migrants is significant *because foreigners living in Hungary comprise 161 different nationalities born in 195 different countries (including associated countries and external territories).*

Dual citizens and Hungarian citizens returning to Hungary are automatically considered Hungarian citizens by most sources. The reason for this is lack of data, and the only reliable source of information is the population census. According to the census, 88,906 persons of Hungarian citizenship had an additional citizenship in 2011. The distribution of this group resembles the distribution of foreign citizens, in which European origins are clearly observed. This phenomenon indicates that an area-independent interconnectivity of economic, social, cultural, and political factors between sending and host states is limited. Regarding the origins of the dual citizens, Asians and Africans are underrepresented and Australia and the Americas are over-represented compared to the distribution of foreign nationals' origins. In Hungary, the numbers of American–, Canadian–, or Australian–Hungarian citizens are higher than those of the American, Canadian, or Australian foreign citizens, respectively, suggesting that most of the migrants from those places have Hungarian roots.

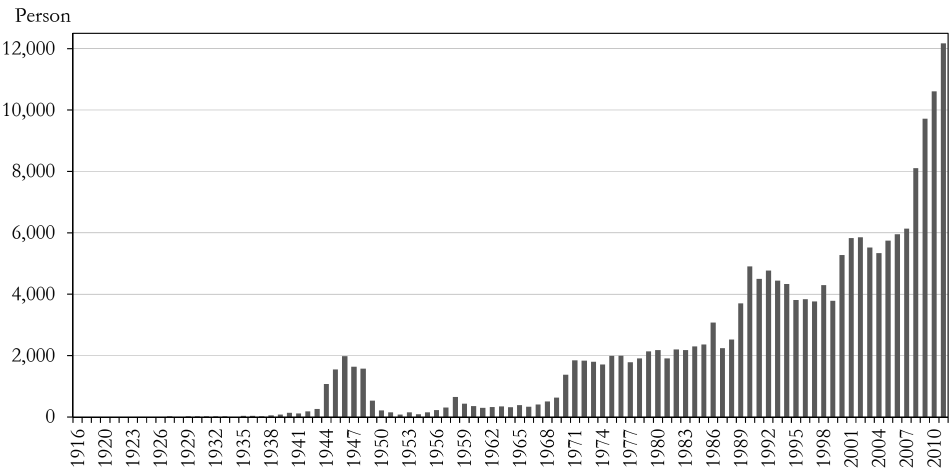
There is no exact information on the number and composition of people emigrating from Hungary. Most studies that address emigration rely on representative samples for surveys or on foreign administrative databases. In both cases, the number of Hungarian emigrants is probably overestimated. In the samples, mode effects and high sampling errors due to small sample size limit generalization, and, in the second case, duplication and cumulative errors could yield unrealistic results. Regarding the number of Hungarian citizens living abroad, few accurate estimations exist (Gödri

2010, Kapitány–Rohr-2013). These studies estimate the number of Hungarians living abroad not in the millions, but in the hundreds of thousands. Without precise knowledge on emigration, it is important to emphasise the census results, according to which *a significant portion of the emigrants does not necessarily cause a demographic loss for Hungary* because 190,204 persons were registered in Hungary who had been living abroad for at least a year but had returned home and settled in Hungary (see fig. 1.).

Hungarians returning home are not just a demographic surplus for Hungary because language skills and foreign experience suggest an important advantage in the labour market (Rédei 2007). This is where new types of migration might be captured, i.e., the separate space-asynchronous migration systems in which Hungary is defined by migrants as an attractive remigration centre. An examination of Hungarian citizens returning to Hungary does not indicate precisely where and when these Hungarians emigrated nor does it inform us of the main foreign centres at that time. However, the data do show the countries to and from which these Hungarians migrated.

Figure 2

Hungarian citizens returning home by year of return



Until the end of World War II, returnees were mostly from neighbouring countries because of the homeland role. Between 1945 and 1980, because of the establishment of socialist state apparatuses, the largest numbers of returnees to Hungary were from Russia, Iran, Mongolia, Egypt, Germany (GDR), and Austria. From 1981 until the regime change, returnees arrived mostly from Germany, Russia, Algeria, Austria, Iraq, and Libya. After 1990, because of the regime change, the countries from which Hungarians were returning changed. The US and Canada joined Austria and Germany (mostly emigrants from 1956), followed by the UK in 2004 (emigrants returning after 1990 is the most probable case). Accession to the EU and the labour market expansion are assumed to have caused the growth in the number of migrants; with a time lag, the number of returnees also is significantly increasing, which process was influenced by the economic crisis and associated decline in employment in Western Europe (see Table 1).

Table 1

Migrants living in Hungary by group and by country of former residence, 2011

Country of citizenship/birth of migrant/country of former residence before returning to Hungary	Dual citizens (Hungarian and other)	Foreign citizens	Born abroad	Hungarian citizens who lived abroad one year or less before returning to Hungary
Romania	39,270	38,574	176,550	4,478
Germany	6,412	16,987	22,605	51,911
Slovakia	1,679	8,246	33,155	2,835
Austria	1,467	3,936	6,160	11,376
United Kingdom	1,627	2,602	3,597	20,949
France	1,298	2,201	3,233	5,214
Netherlands	762	2,058	2,438	3,712
EU-28	*59,644*	*85,414*	*266,701*	*123,181*
Ukraine	2,383	11,820	35,354	3,133
Serbia	9,394	7,752	29,144	1,529
Europe (other)	3,434	7,536	13,608	23,153
Europe total	*74,855*	*112,522*	*344,807*	*150,996*
China	952	8,852	8,767	603
Vietnam	783	2,358	2,668	181
Iran	146	1,523	1,713	232
Asia (other)	2,240	9,571	12,358	8,944
Asia total	*4,121*	*22,304*	*25,506*	*9,960*
United States	4,978	3,022	4,684	15,970
Canada	2,149	484	1,198	4,433
Americas (other)	741	1,237	2,416	1,621
Americas total	*7,868*	*4,743*	*8,298*	*22,024*
Nigeria	128	1,015	1,101	507
Egypt	168	472	632	778
Africa (other)	679	1,366	2,256	3,920
Africa total	*975*	*2,853*	*3,989*	*5,205*
Other and unknown	*1,087*	*775*	*636*	*2,019*
Total	*88,906*	*143,197*	*383,236*	*190,204*
Hungary	*88,906*	–		*190,204*

Figure 3

Foreign born persons living in Hungary by country of birth, 2011

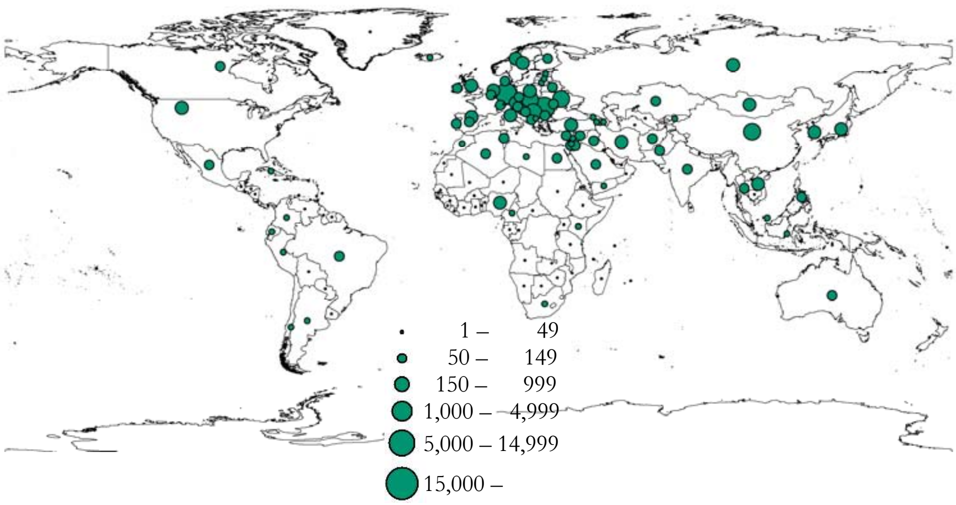
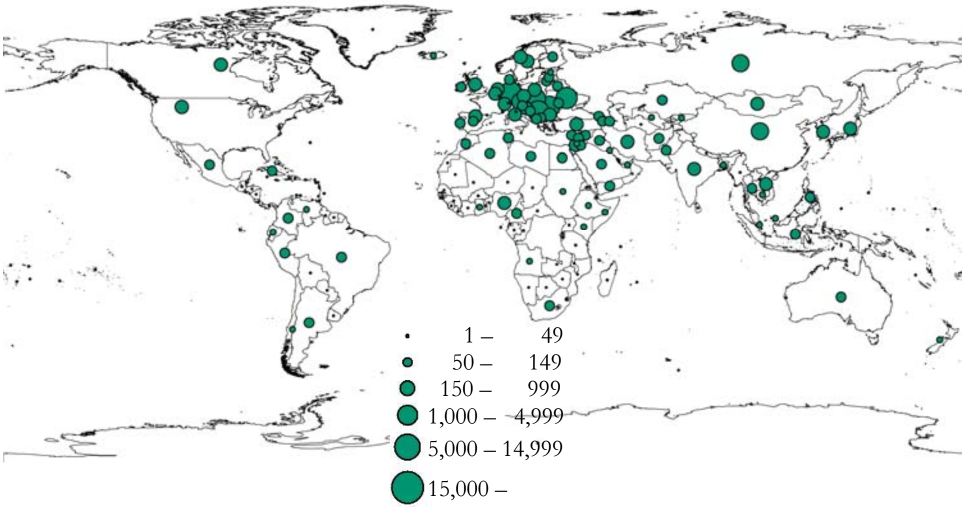


Figure 4

Hungarian citizens returning home by country of foreign residence, 2011



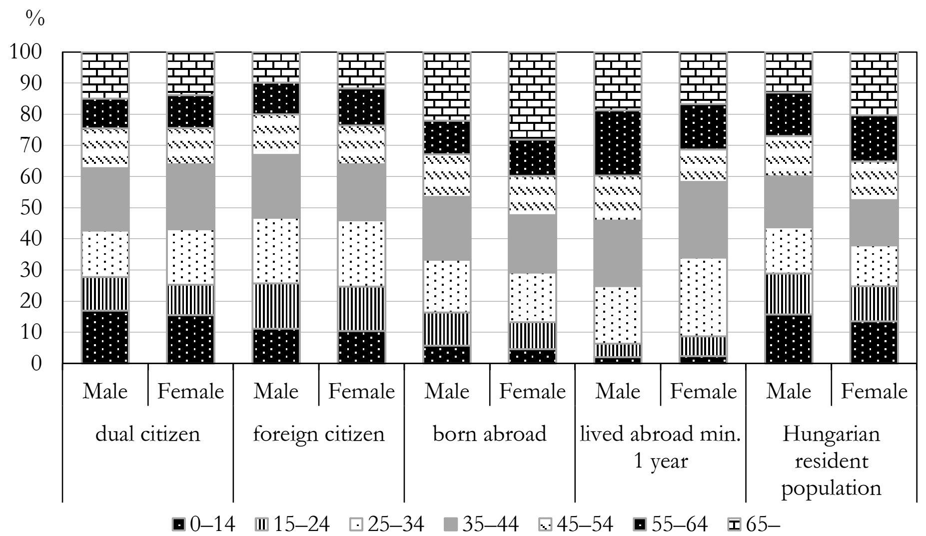
Demographic and labour market characteristics of migrant groups

Most previous studies highlight that migrants are relatively young (Gödri 2012) compared to the resident population in Hungary, and migration has, therefore, rejuvenated Hungary. The average ages of male and female foreign nationals living in

Hungary are 38.0 and 39.6 years, respectively; in the overall population, males and females are 39.3 and 43.5 years, respectively. For dual citizens, the difference is slightly less pronounced (average age is 39.2 years), whereas citizens born abroad are 47.4 years on average, and Hungarian citizens returning home are 47.6 years on average. The two latter groups are older than the average resident population. More than one-quarter of Hungarian citizens born abroad is older than 65 years of age. The majority of working-age adults who migrated to Hungary in large numbers in the 1990s belongs to this age group. For Hungarian returnees, the average age is relatively old because few of them are under the age of 24, suggesting that most of the migrants leave Hungary for employment (see Figure 5).

Figure 5

Migrants by age groups, 2011



Population census data confirm the results of previous studies regarding migrants' characteristics. Migrants are, on average, better educated and more economically active than the Hungarian population (non-migrant resident population), providing a human and economic surplus for Hungary (Kincses 2012). Nearly one-third of the foreign and foreign-born populations over age 24, more than 40% of persons with dual citizenship, and almost one-half of Hungarian returnees have higher educational attainment than non-migrant Hungarian nationals (see Figure 6).

Migrant groups' relatively higher educational attainments and higher proportions of working-age people relate to their relatively higher employment rates compared to the Hungarian resident population. The unemployment rate is lowest for foreign citizens and highest for Hungarian returnees, which is similar to the rate of the resident population. In Hungary, only about 0.4% of inactive earners live on their assets (see Table 2). The same rate for Hungarian returnees is 1.3%; it is 1.8% for those born abroad, 3.1% for dual citizens, and 3.3% for foreigners. Within the dependents of the resident population aged 25–64 years, 10% are full-time students, whereas, for the surveyed migrant groups, the rate is between 14% and 23%.

Figure 6

Migrant groups (aged over 25 years) by educational attainment, 2011

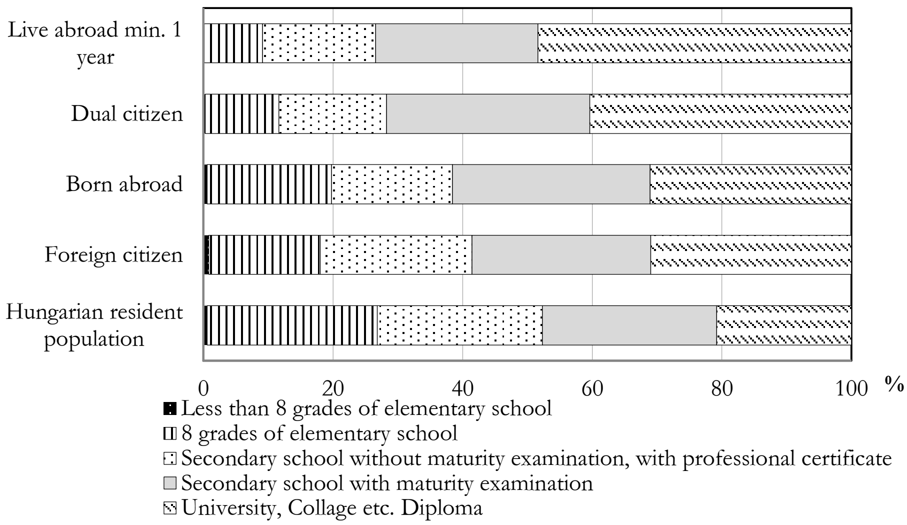


Table 2

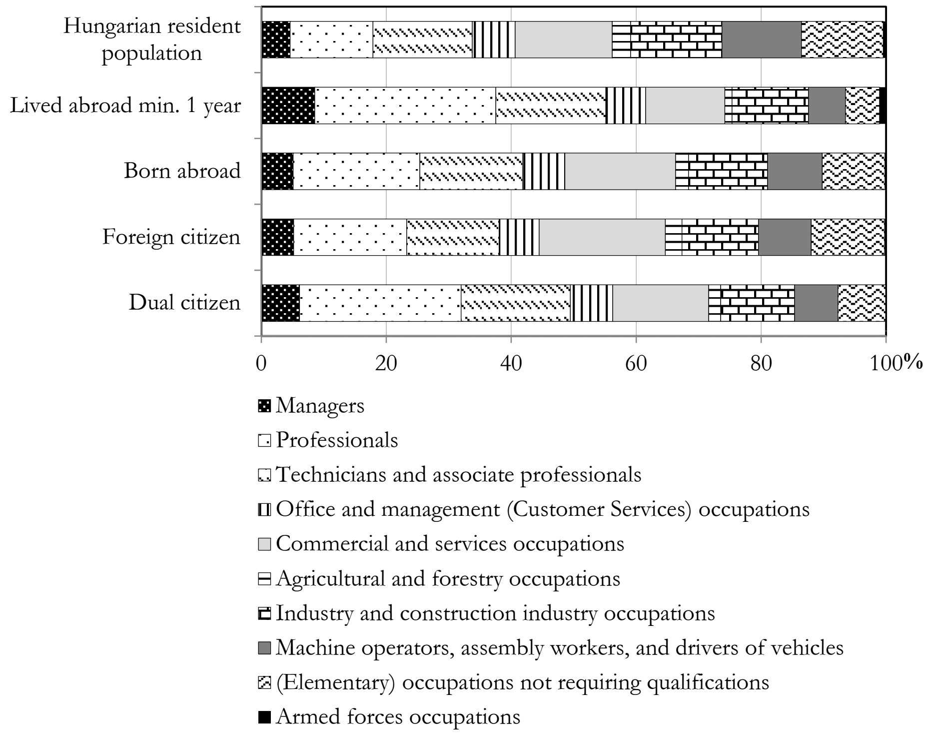
Distribution of migrants aged 25–64 years and of resident population by economic activity

Economic activity	Dual citizens	Foreign citizens	Born abroad	Hungarian citizens who lived abroad one year or less before returning to Hungary	Hungarian resident population
Employed	72.6	70.2	72.2	68.4	64.4
Unemployed	7.4	4.6	6.6	9.0	8.7
Economically active population total	*80.0*	*74.8*	*78.8*	*77.4*	*73.1*
Inactive earner	14.3	15.7	15.7	17.4	23.1
Dependent	5.7	9.5	5.5	5.2	3.8
Economically inactive population total	*20.0*	*25.2*	*21.2*	*22.6*	*26.9*
Grand total	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*

A comparison of current and most recent occupations shows that all of the migrant groups are proportionally dominant over the resident population in the more *prestigious business, senior governmental,* legislative, and *professional occupations requiring third level educational attainment.* The reverse situation is observed for *elementary occupations, plant and machine operators, assemblers, vehicle drivers, agricultural workers, and forestry occupations,* which represent lower value added (see Figure 7).

Figure 7

Distribution of migrants aged 25–64 years in resident population by main occupational groups, 2011



Spatial overview

Because the spatial distributions of migrant groups differ from that of the Hungarian resident population, the influences of migrants on the country might be less than they are in the specific areas where migrants tend to cluster. Social groups with relatively high prestige and better skills in higher paid occupations tend to concentrate in areas with relatively strong economic indicators and more favourable social images, thereby reinforcing the significant differences in spatial social structure typical of Hungary, in which there is segregation and concentration of socioeconomic groups by prestige (Németh 2011). Three Hungarian regions are of particular interest from the migration perspective, which are generally and persistently typical of Hungary's migrant groups: central Hungary, border districts, and the Lake Balaton region.

Budapest and Pest County (Central Hungary) attract foreigners from far away, and the residents of this area are mostly non-European migrants. There are many employed persons, the average age is relatively young, and educational attainment is relatively high. In this area, the residents are mostly highly qualified, economically active foreign citizens. During the past ten years, Budapest has become a global migration target area.

In Hungary, most foreign citizens migrate from neighbouring countries, and the location of target areas plays a decisive part in the regional distribution of migrants. *Border district areas* play an important part in addition to the economic centres with respect to the selection of a place to live. These settlements are not particularly diverse in the composition of citizenship types, and the population mostly comprises people migrating from across the border.

The *Lake Balaton* region is mainly attractive to German, Austrian, Dutch, Swiss pensioners, and elders seeking new locations to improve their pensions' purchasing power, increase recreation, and enhance natural value. In addition, foreigners tend to find it easier to integrate into village than city life. The number of elderly migrants significantly increased between the two censuses (see Figure 8–12).

Figure 8

Distribution of migrant and resident population by the present legal status of residence, 2011

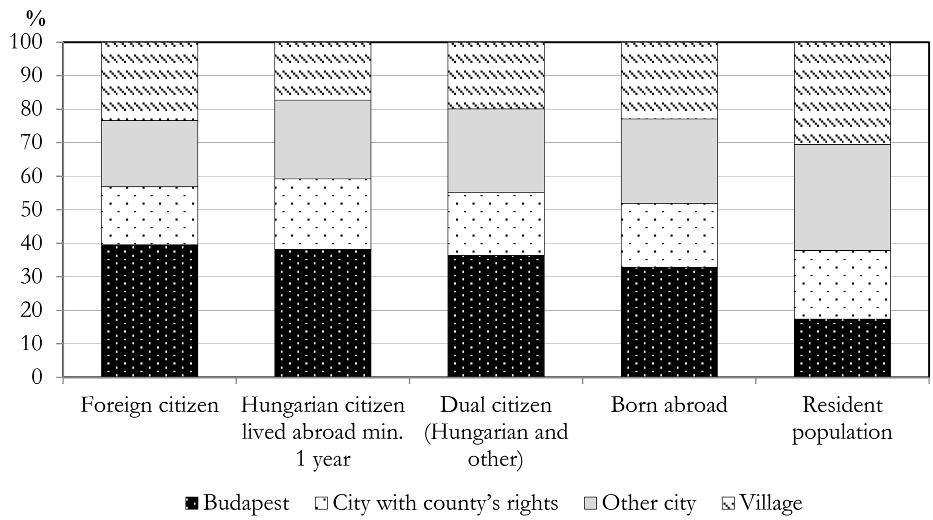


Figure 9

Proportion of foreigners per 100 population, 2011

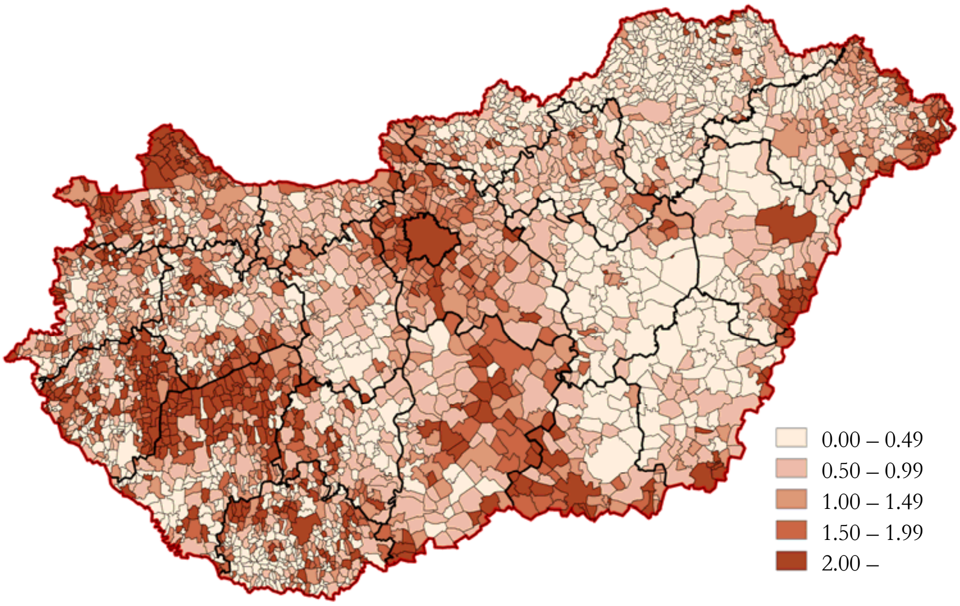


Figure 10

Proportion of dual citizens per 100 population, 2011

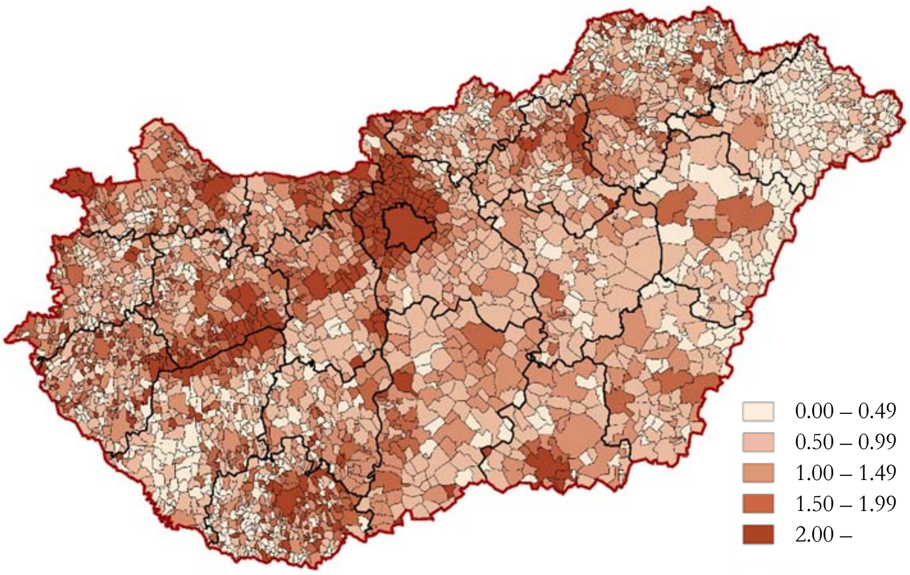


Figure 11

Proportion of citizens born abroad per 100 population, 2011

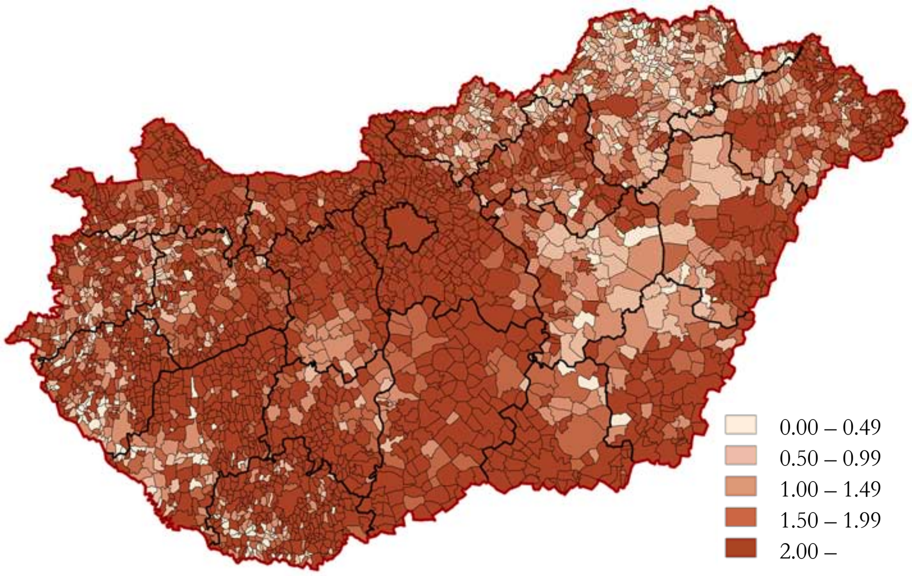
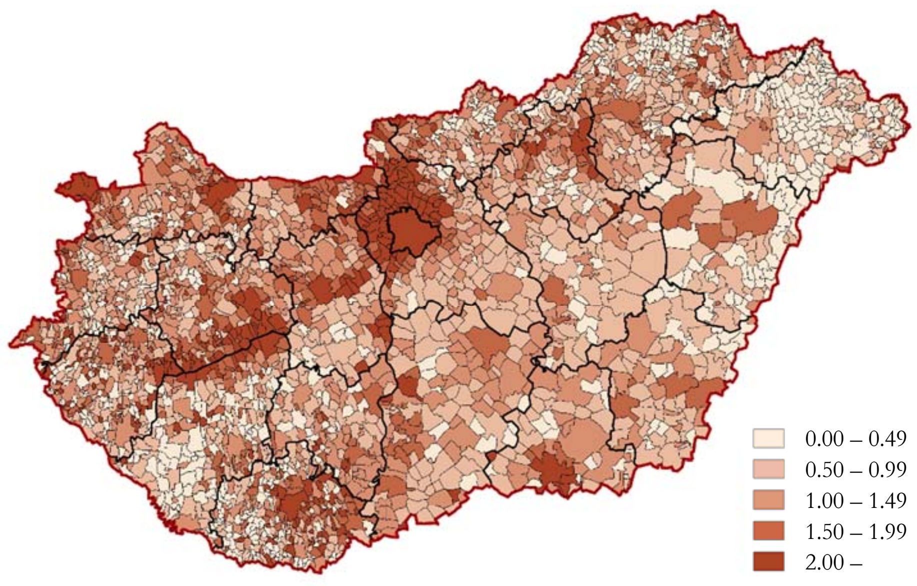


Figure 12

Proportion of Hungarian returnees per 100 population, 2011



It is typical of the spatial distribution of Hungarian returnees that about 30.7% of them returned to the locations of their previous Hungarian residences. Hungarian returnees clearly demonstrate migrant attitudes when choosing a place to live. Underlying this phenomenon is an important factor: The Hungarian non-migrant population is less flexible in choosing a place of residence than the migrant population because it is more place-bound by family and cultural ties, and local patriotism can impede the frequency, distance, and direction of relocations. In the case of returnees, however, the image of local settlement stock can be an important explanatory factor.

Summary

In Hungary, the number and proportion of migrants in the population are continually increasing. There are two fundamental reasons. On the one hand, the size of the resident Hungarian population is decreasing, which increases the migrants' proportional representation. On the other hand, the number of foreign-origin migrants is increasing. Foreign citizens began entering Hungary in significant numbers after the regime change. In the initial period, migrants were mostly ethnic groups of Hungarian nationality. Following accession to the European Union, globalisation influenced Hungarian migration networks such that the number of Hungary's migration sources expanded, and technological changes attracted foreign citizens from farther away. Foreigners living in Hungary comprise about 161 different citizenships born in 195 different countries (including associated countries and external territories).

Currently, the homeland role of the Carpathian Basin, the minority policies of neighbouring countries, transnationalism, multiple identities and multiple citizenships, new types of migration, and circular migration are simultaneously present and active in Hungary. Consequently, international migration cannot be understood as one-dimensional. In this study, Hungary's migrant population was categorised into four large groups (dual citizens, foreign citizens, foreign-born citizens, and Hungarian citizen returnees). It also is important to note Hungary's position as a central area of remigration. In 2011, 190,204 persons in Hungary had lived abroad for at least one year, but had returned to Hungary and settled there.

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REFERENCES

BERNEK, Á. (2002): *A globális világ politikai földrajza* Nemzeti Tankönyvkiadó, Budapest.

BONACICH, E. (1972): A Theory of Ethnic Antagonism: The Split Labor Market. *American Sociological Reveiw* 37 (5): 547–559.

GÖDRI, I. (2010): A vándorlási veszteség Magyarországon az elmúlt évtizedben – avagy hányan is vagyunk valójában? *Korfa* 10 (3): 3.

GÖDRI, I. (2012): Nemzetközi vándorlás In.: KSH NKI (2012*): Demográfiai portré – jelentés a magyar népesség helyzetéről* pp. 137–154, Budapest.

HATTON, T. J. – WILLIAMSON, J. G. (2005): *Global Migration and the World Economy: Two Centuries of Policy and Performance* Mass.: MIT Press, Cambridge.

ILLÉS, S. (2008): Indirect estimation on the types of internatoinal elderly migration in Hungary *Romanian Review on political Geography* 8 (1): 55–63.

ILLÉS, S. – KINCSES, Á. (2009): Cirkuláció és migráció Magyarország nemzetközi vándormozgalmában *Statisztikai Szemle* 87 (7–8. szám): 729–747.

KAPITÁNY, B. – ROHR, A. (2013): A Magyarországon állandó lakcímmel rendelkező 18–49 éves magyar állampolgárok mintegy 7,4 százaléka tartózkodik jelenleg tartósan külföldön *Korfa* 13 (3): 3.

KINCSES, Á. (2012): *A Kárpát-medence ezredforduló utáni migrációs hálózatának vizsgálata* KSH, Budapest.

KOFMAN, E. – YOUNGS, G. (2003): *Globalization: Theory and Practice* Continuum, New York.

KOVÁCS, É. – MELEGH, A. (2000): „Lehetett volna rosszabb is, mehettünk volna Amerikába is”: Vándorlástörténetek Erdély, Magyarország és Ausztria háromszögében. In: Sik Endre–Tóth Judit (szerk.): *Diskurzusok a vándorlásról* pp. 93–152. Az MTA Politikai Tudományok Intézete Nemzetközi Migráció Kutatócsoport évkönyve, Budapest.

L. RÉDEI, M. (2009): *A tanulmányi célú mozgás* REG-INFO KFT. Budapest.

NEMES NAGY, J. (2009): *Terek, helyek, régiók* Akadémiai Kiadó. Budapest.

NÉMETH, ZS. (2011): *Az urbanizáció és a térbeli társadalomszerkezet változása Magyarországon 1990 és 2001 között* NKI, Budapest.

PORTES, A. – DEWIND, J. (2004): A Cross-Atlantic Dialogue: The Progress of Research and Theory in the Study of International Migration *International Migration Review* 38 (4): 828–851.

RAVENSTEIN, E. G. (1885): The Laws of Migration *Journal of the Royal Statistical Society* 48 (2): 167–235.

RÉDEI, M. (2005): A nemzetközi vándorlás folyamatának irányítása *Statisztikai Szemle* 83 (7): 662–680.

RÉDEI, M. (2007): *Mozgásban a világ, a nemzetközi migráció földrajza* Eötvös Kiadó, Budapest.

TÓTH, P. P. (2005): A szomszédos országokból bevándorlók lakóhelyi és kulturális jellemzői *Korfa* 5 (2-3): 3–7.

VISZT, E. – PLANK, ZS. – BORSI, B. (2001): Mobility of Human Resources in Hungary: An Analysis and Proposal for Regular Collection of Statistics *Hungarian Statistical Review* 79 (6): 79–91.

WALDINGER, R. (2008): Between “here” and “there”: Immigrant cross-border activities and loyalties *International Migration Review* 42 (1): 3–29.

WALTON-ROBERTS, M. (2004): Transnational Migration Theory in Population Geography: Gendered Practices in NetworksLinking Canada and India *Population, Space and Place* 10 (3): 361–373.

WILLIAMS, A. M. – BALAZ, V. (2008): *International Migration and Knowledge* Routledge. London.

Divergence in the Socioeconomic Development Paths of Hungary and Slovakia

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This study aims to provide a comparative analysis of socioeconomic development in Slovakia and Hungary. For this purpose, we use the State of the Future Index (SOFI) to measure and forecast the socioeconomic well-being of both the countries from 1995 to 2015. The SOFI methodology has many characteristics that are in line with the 2009 Stiglitz–Sen–Fitoussi report. We find that during 1995–1999, Slovakia had a higher overall SOFI total, signifying a higher level of well-being; subsequently, however, Hungary pulled ahead between 1999 and 2005, after which Slovakia overtook Hungary yet again. Our predictions suggest that Slovakia will continue to pull ahead in the 2015–2025 period. The areas where Hungary has scope for considerable improvement are life expectancy, GDP per capita, renewable energy resources and CO_2 emission and government debt. In some areas, both countries perform poorly: level of corruption and demographic trend. However, Hungary seems to have an advantage in R&D expenditure, unemployment level and voter turnout.

Keywords:
development path,
Hungary,
State of the Future Index,
Slovakia

Introduction

The development paths taken by the Central and Eastern European countries during and after the transition period have been subject to substantial research. In this regard, a comparison of Slovakia and Hungary seems justifiable in many ways: the two countries share a common history and similar cultural background, although there are notable differences as well; for example, Slovakia had to create a new institutional system after the dissolution of Czechoslovakia. Moreover, the countries are seemingly on two very different development paths.

If we look at the PPP GDP per capita of both the countries, in 1995, Hungary was leading by around 14%; however, by 2015, Slovakia overtook Hungary, and gained an advantage close to 13%. During this period, the PPP GDP per capita of Hungary rose by a yearly average of 4.3%, while that of Slovakia was 5.7% (IMF-WEO). Nevertheless, the development of a country cannot simply be described with per capita GDP data. The human development index (HDI), a composite index maintained by the UN Development Programme, combines variables measuring educational achievements, life expectancy and per capita income. A comparison of HDI between Hungary and Slovakia unfolds a slightly different picture: in 1990, Hungary's HDI was 0.701, while Slovakia's was 0.747; by 2000, the two countries achieved close to even scores (0.774 and 0.776); in 2013, however, Slovakia had an advantage again (0.818 vs. 0.830). While Hungary's per capita GDP developed at a slower pace, the country's HDI grew faster between 1990 and 2013 (UNDP).

Using an even larger number of indicators (16 in total), Sikulová and Frank (2013) conducted a study among 10 Central and Eastern European countries that joined the EU between 2004 and 2007. All countries were ranked according to the indicator values, and the final score of every country was based on these rankings. Sikulová and Frank organised the various indicators into three groups ('trinity'): welfare/equality; innovation/growth/competitiveness; and macroeconomic stability. They found that Hungary outperformed Slovakia in the welfare/equality dimension (thanks to its lower unemployment level and higher expenditure on social protection as a percentage of GDP). Slovakia, on the other hand, performed better in both macroeconomic stability (especially in public and private indebtedness and price stability) and innovation/growth/competitiveness (the largest difference can be detected in the case of GDP growth rate) (Sikulová–Frank 2013, pp. 8–9). According to the cluster analysis prepared by the authors, Hungary and Slovakia fall into two different clusters, with Hungary focusing on welfare and Slovakia on growth stability (Sikulová–Frank 2013, pp. 11).

In this study, we use the State of the Future Index (SOFI) to assess the socioeconomic development paths of Hungary and Slovakia between 1995 and 2015. Furthermore, since the index was designed with the purpose of measuring future progress, we also derive a possible development path for 2015–2025.

Measuring socioeconomic development

Since the Stiglitz–Sen–Fitoussi report was published in 2009, renewed efforts were made to accurately measure different aspects of well-being. The report itself, amongst others, provided the following notable suggestions:

- shift emphasis from measuring economic production to measuring people's well-being;
- emphasise on the sustainability of the level of well-being, which also implies that stocks of capital (natural, physical, human and social) that are passed on to future generations will have to be accurately measured as well;

- rather than purely measuring the value of production, focus on capturing quality change (which is especially important in case of services, e.g. healthcare);
- find a better way of measuring government output, and especially capture productivity change;
- focus more on household consumption and income, but consider it jointly with wealth, because spending current wealth on consumption goods increases current well-being at the expense of future well-being;
- more prominence should be given to the distribution of income and wealth;
- attempts should be made to measure non-market activities and leisure;
- finally, well-being should be approached from a multi-dimensional perspective, namely, at least the following eight aspects need to be focused on:
  - material living standards (income, consumption and wealth);
  - health;
  - education;
  - personal activities including work;
  - political voice and governance;
  - social connections and relationships;
  - environment (present and future conditions);
  - insecurity, of an economic as well as a physical nature (Stiglitz–Sen–Fitoussi 2009).

Attempts to measure socioeconomic development can be dated back to the 1950s and 1960s (Gáspár 2013). Gáspár (2013) presents a comprehensive summary on the measurement methods and indices developed over the decades. He distinguishes between two main measures of socioeconomic development/performance: objective and subjective.

The objective measures use statistical data. Here are some examples of such measurement methods:

- adjusting the GDP with additional costs: net economic welfare (1972), index of sustainable economic welfare (1989), genuine progress indicator (1995);
- composite indices: physical quality of life index (1979), HDI (1990), life product index (1992), basic and advanced quality of life index (1995);
- models based on multivariate statistical analysis;
- other measures: weighted index of social progress, happy planet index, ease of doing business index, globalisation index and so on. (Gáspár 2013, pp. 78–79).

The subjective measures apply a qualitative approach to assess well-being, concentrating on the feelings and subjective well-being of people. This second type of measures include:

- cognitive measurements: Cantril's ladder or satisfaction with life scale;
- measuring emotions: happiness measurement, positive-negative feelings, U-index, Gallup world poll, European social survey and so on. (Gáspár 2013, pp. 82–85).

The State of the Future Index

The State of the Future Index (SOFI) was developed by Theodore J. Gordon and Jerome C. Glenn within The Millennium Project (Glenn–Florescu 2015). Using the current methodology, the SOFI was first published in 2001 (Glenn–Gordon 2001). Back then, only the global value was calculated. Thereafter, a number of regional- and country-level SOFIs have appeared. The current study is based on a SOFI calculation conducted in 2014–15 within a project funded by the International Visegrad Fund (Bartha–Tóthné 2015, Klinec 2015).

The SOFI is a composite index; its standard version combines the effects of 26 socioeconomic indicators. All of the indicators are objective measures if we use Gáspár's classification presented above, although some of them were created by polling experts (e.g. the corruption perception index or the level of freedom). One of the greatest advantages of SOFI is that most aspects highlighted by the Stiglitz–Sen–Fitoussi report are reflected by at least one of its indicators:

- emphasis on sustainability and stocks of capital: forest lands or R&D expenditures;
- capturing quality: life expectancy or corruption perception;
- income distribution: poverty headcount or literacy rate;
- the eight dimensions
  - material living standards: per capita GDP;
  - health: infant mortality, number of physicians or life expectancy;
  - education: literacy rate or secondary school enrolment;
  - personal activities including work: not included, although the number of internet users may be moderately related to it;
  - political voice and governance: people voting in elections or freedom level;
  - social connections and relationships: not included, although the number of seats held by women in the national parliament may be moderately related to it;
  - environment: CO_2 emission or energy efficiency;
  - insecurity: number of homicides, unemployment level or number of terrorist incidents.

It is worth mentioning that some of the indicators are do not accurately reflect the given focus area. The SOFI could definitely be improved by selecting indicators that better measure its global challenges. In this manner, it would be even more in line with the principles of the Stiglitz–Sen–Fitoussi report.

The other great advantage of the SOFI is that it was designed to enhance future orientation. The future orientation of SOFI is caused by two factors. First, the individual indicators were selected because they are believed to be accurate measures of the global challenges which, according to The Millennium Project, will play a very important role in the future of our societies. Second, part of the SOFI methodology involves the creation of future indices, typically calculated 10 years ahead.

While the Washington DC-based Millennium Project focuses on the global SOFI, its regional and country level nodes calculate regional and national SOFIs. There are two types of national SOFIs: National Focus and National Comparison SOFI. Some or all of the indicators used to calculate the National Focus SOFI are different from the ones used in the standard, global index. The main aim of the National Focus SOFI is to include indicators that are most relevant for the current and future development of a single given country. It can even happen that the very same indicator is interpreted differently in the National Focus and global SOFI; for example, while population growth increases the value of the standard index, in an overpopulated country, it can be set to decrease it.

The National Comparison SOFI includes the same indicators as the global one. Since it is calculated with identical contents, its primary advantage is that it is comparable to any standard SOFI. However, the disadvantage is that it may include indicators that are not relevant for a given region or country (e.g. the prevalence of HIV can be an important global indicator and is extremely important for Africa, but much less so for the Central and Eastern European region).

For our analysis, we have used the National Comparison SOFI. For a more comprehensive analysis, a specific Central and Eastern European SOFI may be developed in the future. The National Comparison SOFI is calculated in eight steps, each of which has been described below.

Step 1: Identifying global challenges

In a multi-phase attempt, The Millennium Project had derived 15 global challenges between 1996 and 1999. All phases involved several hundred experts, futurists and decision-makers from around the world; in total, more than 4,000 experts were involved in the SOFI process since 1996. In the first phase lasting 1996–97, 182 issues were collected which then were summarised into 15 global issues. The next phase took place in 1997–98, during which 180 opportunities were gathered and again synthesised into 15 global opportunities. During 1998–99, the global issues and opportunities were combined and 15 global challenges were derived that currently form the basis of SOFI. The 15 global challenges are described in detail at https://themp.org/. In this study, we only list them in the order they were originally compiled. Although the challenges were derived much earlier than the Stiglitz–Sen–Fitoussi report was released, their contents and main messages are quite well matched.

1. Sustainable development and climate change: How can sustainable development be achieved for all while addressing global climate change?
2. Clean water: How can everyone have sufficient clean water without conflict?
3. Population and resources: How can population growth and resources be brought into balance?
4. Democratisation: How can genuine democracy emerge from authoritarian regimes?

5. Global foresight and decision-making: How can decision-making be enhanced by integrating improved global foresight during unprecedented accelerating change?
6. Global convergence of IT: How can the global convergence of information and communications technologies work for everyone?
7. Rich-poor gap: How can ethical market economies be encouraged to help reduce the gap between the rich and poor?
8. Health issues: How can the threat of new and re-emerging diseases and immune micro-organisms be reduced?
9. Education: How can education make humanity more intelligent, knowledgeable and wise enough to address its global challenges?
10. Peace and conflict: How can shared values and new security strategies reduce ethnic conflicts, terrorism and the use of weapons of mass destruction?
11. Status of women: How can the changing status of women help improve the human condition?
12. Transnational organised crime: How can transnational organised crime networks be prevented from becoming more powerful and sophisticated global enterprises?
13. Energy: How can growing energy demands be met safely and efficiently?
14. Science and technology: How can scientific and technological breakthroughs be accelerated to improve the human condition?
15. Global ethics: How can ethical considerations become more routinely incorporated into global decisions?

Step 2: Selecting the indicators

During 2000–2001, experts from The Millennium Project participated in a Delphi study in which those indicators were selected that are most suited to measure progress in the 15 global challenges. To calculate the global and the National Comparison SOFI, the following 26 indicators are currently used:

1. CO_2 emissions (percent of global emissions);
2. Electricity production from renewable sources, excluding hydroelectric (percent of total);
3. Food availability (Kcalories/day per capita);
4. Forest lands (percent of national land area);
5. Freedom level (Freedom House country scores; 1= completely free; 7= completely not free);
6. GDP per capita (2,000 USD PPP);
7. GDP per unit of energy use (2,000 USD PPP per kg of oil equivalent);
8. Homicides, intentional (per 100,000 population);
9. Infant mortality (deaths per 1,000 live births);
10. Internet users (per 1,000 population);

11. Levels of corruption (Transparency International; Corruption Perception Index);
12. Life expectancy at birth (years);
13. Literacy rate, adult total (percent of people aged 15 and above);
14. Number of refugees displaced from the country (percent of national population);
15. People killed or injured in terrorist attacks (percent of national population);
16. People voting in elections (percent of national population of voting age);
17. Physicians (per 1,000 people);
18. Population growth (annual %);
19. Population lacking access to improved water sources (percent of national population);
20. Poverty headcount ratio at $1.25 a day (PPP) (percent of national population);
21. Prevalence of HIV (percent of national population);
22. R&D expenditures (percent of GDP);
23. School enrolment, secondary (percent gross);
24. Seats held by women in national parliament (percent of all national members);
25. General government gross debt (percent of GDP);
26. Unemployment (percent of national labour force).

Step 3: Setting up the database

For the analysis, variable values for 20 years between 1995 and 2013–14 were collected. Missing data were replaced using interpolation. The following sources were used to set up our database:

- World Bank's World Development Indicators (WDI);
- Freedom House;
- International Monetary Fund – World Economic Outlook (IMF-WEO);
- Pardee Center for International Futures at the University of Denver - International Futures forecasting system (IF);
- Hungarian National Election Office (HNEO);
- International Institute for Democracy and Electoral Assistance (IDEA);
- World Health Organisation (WHO);
- US Energy Information Administration (EIA).

To ensure maximum compatibility, we chose sources where both the Hungarian and the Slovakian time series were available.

Step 4: Forecasting the indicators

The indicators were extrapolated to the 2015–25 period using the database containing 20-year time series data. Mostly linear trend was used for the extrapolation. If external forecasts were available for a series, those were used instead of own extrapolation. Where the indicator was very close to the extreme value and it showed a stable pattern, the last (2014) actual value was held constant and carried over for the entire 2015–25 period. Table 1 shows what method was used to obtain future indicator values in case of all 26 variables.

Table 1

Characteristics of the 26 indicators

Indicator	Extrapolation	WeighT	Worst	Best	Type
1	Linear trend	7.82	10.00	0.00	bad
2	Linear trend	8.05	0.05	20.52	good
3	External: IF	7.08	2205.00	3525.00	good
4	Linear trend	7.21	20.63	40.53	good
5	Last actual value held constant	7.52	7.00	1.00	bad
6	External till 2019: IMF, then linear trend	7.50	5491.00	44833.33	good
7	Linear trend	8.00	2.51	26.00	good
8	Linear trend	6.92	14.66	1.06	bad
9	External: IF	7.01	89.00	2.60	bad
10	Logarithmic trend	7.90	5.23	927.00	good
11	External: IF	8.57	3.31	6.15	good
12	External: IF	7.14	65.05	81.00	good
13	External: IF	7.45	78.87	100.00	good
14	Last actual value held constant	6.93	10.00	0.00	bad
15	Last actual value held constant	7.66	0.10	0.00	bad
16	Last actual value held constant	7.19	30.00	84.30	good
17	Linear trend	7.50	1.46	4.30	good
18	External: IF	7.27	-0.60	2.00	good
19	Last actual value held constant	8.33	30.00	0.00	bad
20	External: IF	7.84	26.49	0.00	bad
21	External: IF	5.97	1.91	0.01	bad
22	External till 2020: EU strategy, then constant	8.63	0.46	4.00	good
23	External: IF	8.09	59.15	103.70	good
24	Linear trend	6.78	6.86	30.20	good
25	External till 2019: IMF, then linear trend	6.79	86.36	7.58	bad
26	External till 2019: IMF, then linear trend	8.28	19.46	3.90	bad

Source: the authors.

Step 5: Standardising the indicator values

Because of the different orders of magnitude, every indicator has to be rescaled to a 0–1 scale before the index is calculated. The rescaling is done with the help of the worst and best values provided by The Millennium Project, and Table 1 contains them. Whether the best value is higher or lower than the worst one depends on whether the given indicator is a 'good' or 'bad' one (last row of Table 1). We differentiate between 'good' and 'bad' indicators based on the direction of change that is needed if we want them to improve: an improvement of a 'good' indicator means its value needs to increase, while a 'bad' indicator improves if its value decreases.

The formula used for rescaling is very simple: (Indicator value – Worst)/(Best – Worst).

Step 6: Assigning weights to the rescaled figures

Based on the Delphi analysis carried out by The Millennium Project, weights are estimated for every indicator (see column 3 of Table 1). The rescaled values are multiplied by these weights.

Step 7: Calculating the baseline SOFI

For every year in the 1995–2025 period, an indicator total is calculated by summing up all 26 rescaled and weighted indicator values. The total shows whether the 26 indicators combined improved (increasing total) or worsened (decreasing total) over the period. The baseline SOFI is calculated by choosing a year as a reference (2014 in our analysis), and then dividing all indicator totals with the indicator total of the reference year. The baseline SOFI of the reference year is 1; if this value goes above 1 in the period after the reference year, this implies that the overall socioeconomic conditions improved in the country.

Step 8: Trend impact analysis

It may turn out that the indicator values change very differently from what is expected based on the trend calculations. In that case, the SOFI will also be different from the baseline version. The Millennium Project developed a method based on expert opinions. This method is used to highlight possible areas where there is likely to be a deviation from the trend.

Since the trend impact analysis suggested by The Millennium Project is extremely time and energy consuming, we adopted a simplified version of the method. We used three different scenarios for an indicator: optimistic, baseline (extrapolated from the time series) and pessimistic. We invited experts and asked them to assess the realistic value of the indicator in these three scenarios (e.g. in case of per capita GDP, one of our experts may suggest 17,000 for the optimistic scenario and 13,000 for the pessimistic one; there is no need to assign a value to the baseline version, since it is already calculated). It is also the task of the experts to assess the likelihood of a scenario to come true (e.g. one of our experts mentions a number of events that might occur and will lead to the positive scenario, then he predicts the likelihood of the occurrence of these events – let us say 20%; the same has to be done with the positive scenario, and a likelihood has to be assigned to the baseline as well).To simplify the task, some indicators were omitted from this process (because they either seemed to be very stable or had less importance in this region). Thus, our experts finally had to assess 17 indicators (Kolos 2015).

The trend impact analysis adds an extra layer to the analysis of the socioeconomic development paths. It may highlight the critical areas. Moreover, it can call for attention to those indicators whose values could be significantly improved if certain circumstances arise. Thirteen experts participated in the Hungarian simplified trend analysis, and ten in the Slovakian one. The Hungarian experts were all involved in futures research, mainly coming from the field of social sciences, while most of the Slovakian experts were economists.

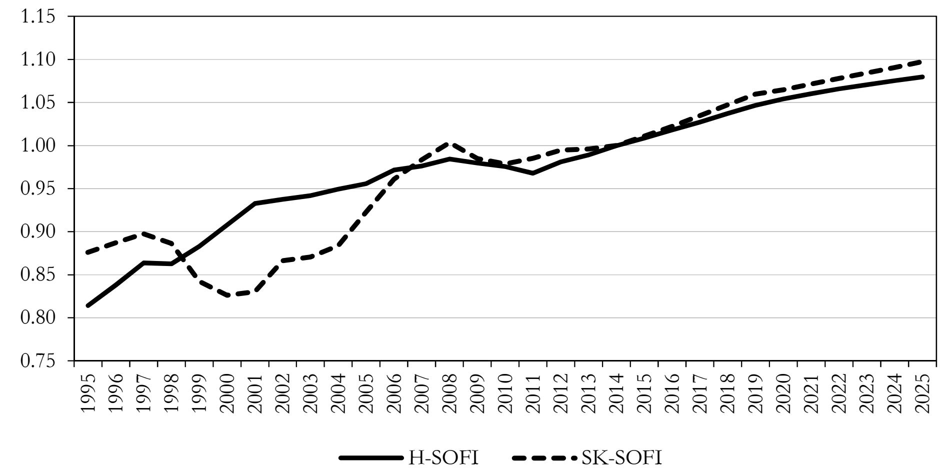
Baseline SOFI for Hungary and Slovakia

The baseline SOFI (Figure 1) suggests that the development trends of Hungary and Slovakia were very different over the 1995–2014 period. Hungary's socioeconomic performance increased dynamically in the 1995–2001 period, and by 2001, the SOFI reached 93% of its 2014 value. After 2001, however, the pace of development slowed down and there was even a slight decrease in the early 2010s. On the other hand, the socioeconomic performance of Slovakia stagnated or shrank until 2001, which was followed by a massive increase during 2001–2008. The 2008 crisis hit Slovakia harder than Hungary; however, the recovery process was also quicker. Our trend analysis suggests that Slovakia will continue to slowly pull ahead of Hungary in the next ten years.

It is hard not to find a connection between economic policy reforms and SOFI changes in these two countries. Hungary went through a number of rigid reforms in 1990–1995, after which there was a dynamic improvement in the SOFI. Slovakia's reforms began after the 1998 elections brought in a new government and the dynamic SOFI change followed from 2001. The effects of economic policy reforms on the SOFI, however, need further analysis. The reforms carried out in the two countries often involved changes in the structure of government expenditures (e.g. spending less on the poor, healthcare or education) which negatively affect the SOFI. Thus, the dynamic improvement can partially be caused by a recovery from the initial negative budgetary shock.

Figure 1

Baseline SOFI for Hungary and Slovakia (Reference year: 2014)

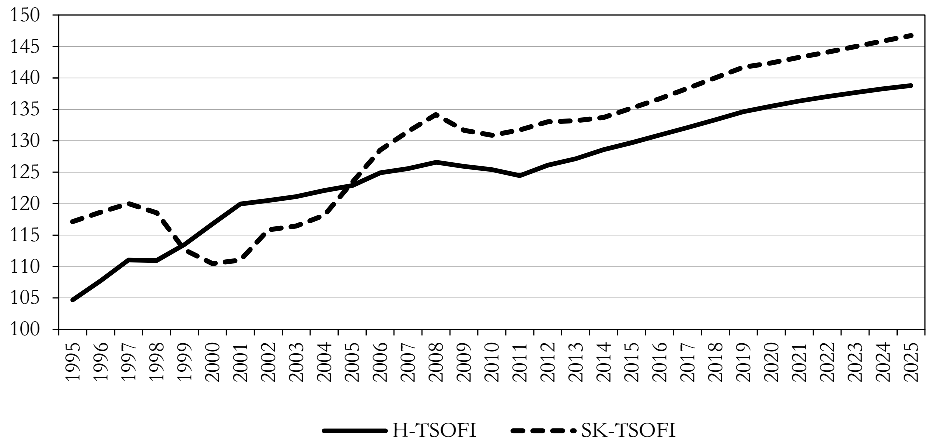


Source: own calculations.

Figure 2 shows how the SOFI totals (not divided by the total of the reference year) changed during the period. The SOFI totals depict a similar picture to what we observed in case of the HDI in the Introduction. Slovakia begins from a higher level; however, subsequently, Hungary catches up and is ahead between 1999 and 2005. Slovakia pulls ahead again from then on, and according to our extrapolations, will continue to offer a better socioeconomic environment to its citizens in the 2015–2025 period as well. Again, the SOFI totals suggest that Slovakia is on a better socioeconomic development path.

Figure 2

SOFI totals for Hungary and Slovakia



Source: own calculations.

Discussion of SOFI components

The CO_2 emission (indicator 1) has been decreasing in both countries as a percentage of the global emission. Regulations helped in getting the emission of greenhouse gases under control (CO_2 quota trade, support for renewable resources), but it is mostly influenced by the energy mix of the countries. The absolute values differ significantly in the two countries, because of the energy mix (Table 2), and also thanks to differences in the volume of energy and industrial production as well as in population size. The difference in CO_2 emission between the two countries will remain in the future, because of the different size and structure of the two economies. Both countries spend a considerable amount of money on decreasing the emission: Hungary spends 519 USD/capita (ranked 54 among 147 countries), while the value for Slovakia is 640 USD/capita (rank: 43) (Andersen 2015).

Table 2

Primary energy production by resources 2013

(1000 toe)

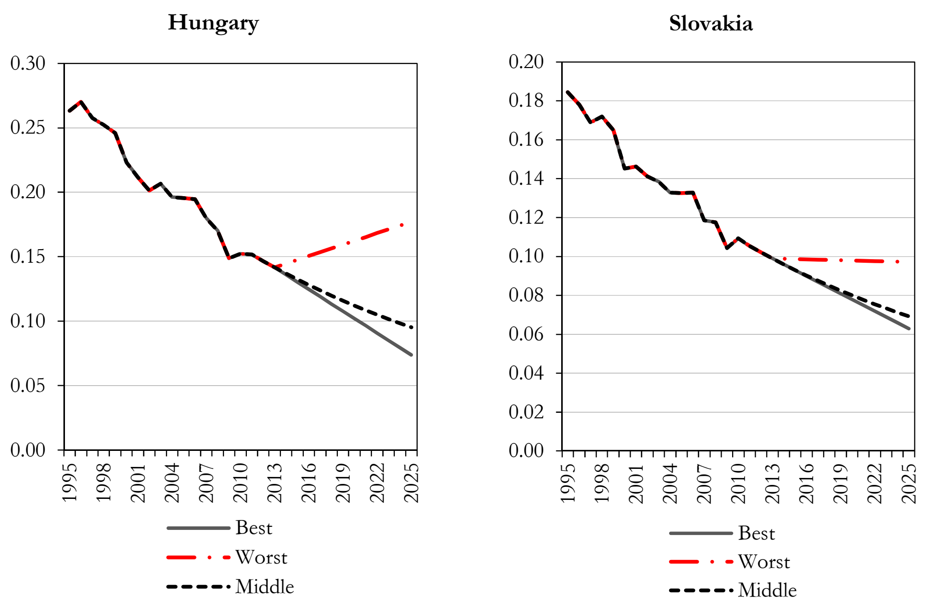
Type	Hungary	Slovakia
Solid	1,611	584.3
Crude oil	582	9.7
Natural gas (liquid)	279	2.7
Natural gas	1,543	104
Nuclear	3,976	4,106
Renewable	2,074	1,466

Source: Eurostat.

The yearly CO_2 emission was 62.48 million tons in Hungary and 43.2 million tons in Slovakia in 2012. Although their respective share in the global emission has been decreasing, in case of Hungary, the trend might change according to our experts. If Hungary wants to become the most industrialised nation in Europe (a long-term goal put forward by the Hungarian government after 2014), then Hungary's share might increase in the future (Figure 3).

Figure 3

CO_2 emission as a percentage of global emission and projection in Slovakia and Hungary

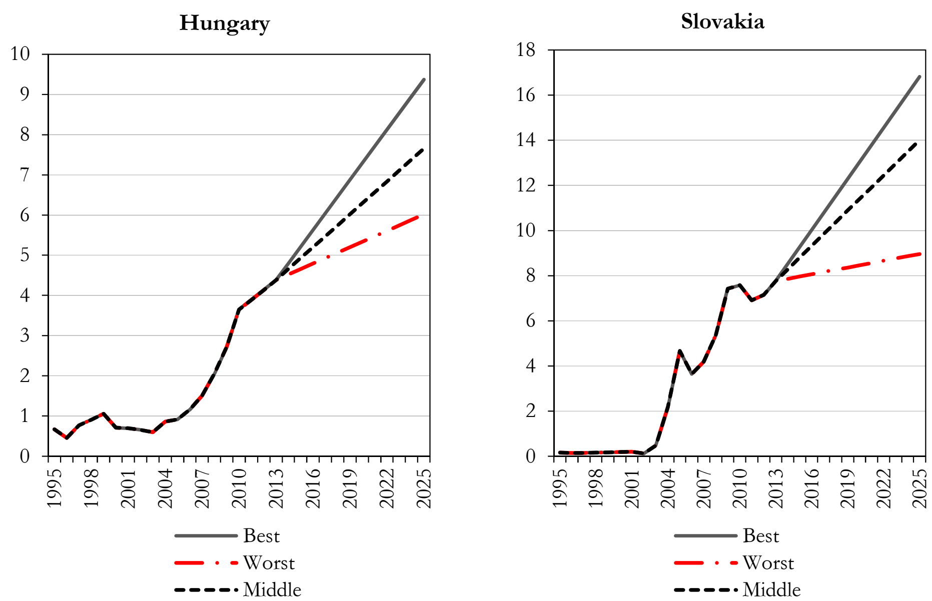


Source: WDI and own calculations.

The main way of decreasing CO_2 emission is to increase the share of renewables (indicator 2) in the energy mix. The share of renewable energy sources from the total electricity production is much lower in Hungary than in Slovakia. According to the energy strategy of the two countries, by 2025, the share of renewables from electricity production will have to be between 6 and 9 percent in Hungary, and between 9 and 16.5 percent in Slovakia (Figure 4). The key objectives of Slovakia's energy policy are increasing efficiency, reducing demand for energy, reducing dependence on energy imports, expanding the use of nuclear power and increasing the share of renewable sources (MoES 2014). The goal of the Hungarian Energy Strategy is similar. It is necessary to change the Hungarian energy structure by 2030 by achieving the following objectives: energy efficiency measures spanning the entire supply and consumption chain; increasing the share of low CO_2-intensive electricity generation based primarily on renewable sources of energy (waste to energy); promoting renewable and alternative methods of heat generation; and increasing the share of low CO_2-emission modes of transport. The Energy Strategy envisages six energy mix scenarios and proposes the Nuclear-Coal-Green scenario as recommended in the future (NES, 2030). There is scope for further and faster development, as Hungary has significant geothermal potential (Árpási 2003) and for industrial use, the energy intensity is increasing (Kádárné 2013).

Figure 4

Electricity production from renewable energy



Source: WDI and own calculations.

In food availability (indicator 3) there is no major difference between the two countries, and the tendencies are also quite similar. In forest lands (indicator 4) Slovakia has a relatively much higher advantage (24.5% compared to 40.5%), but this is largely due to the natural endowments. The historical data of freedom level (indicator 5) does not show relevant differences in the two countries. The future prospects are also similar, although Hungary's political rights rating has declined from 1 to 2 recently.

The differences in GDP per capita (indicator 6) were already mentioned in the Introduction. Slovakia has had a relatively more dynamic economy, and thus, our experts have assigned a higher likelihood to the positive scenario in the case of Slovakia than in the case of Hungary.

In energy efficiency (indicator 7) Hungary has an advantage over Slovakia, and will continue to have the advantage according to our extrapolations. In intentional homicides, infant mortality and internet users (indicators 8–10), there are no major differences between the two countries. These indicators are expected to slowly improve over the 2015–25 period.

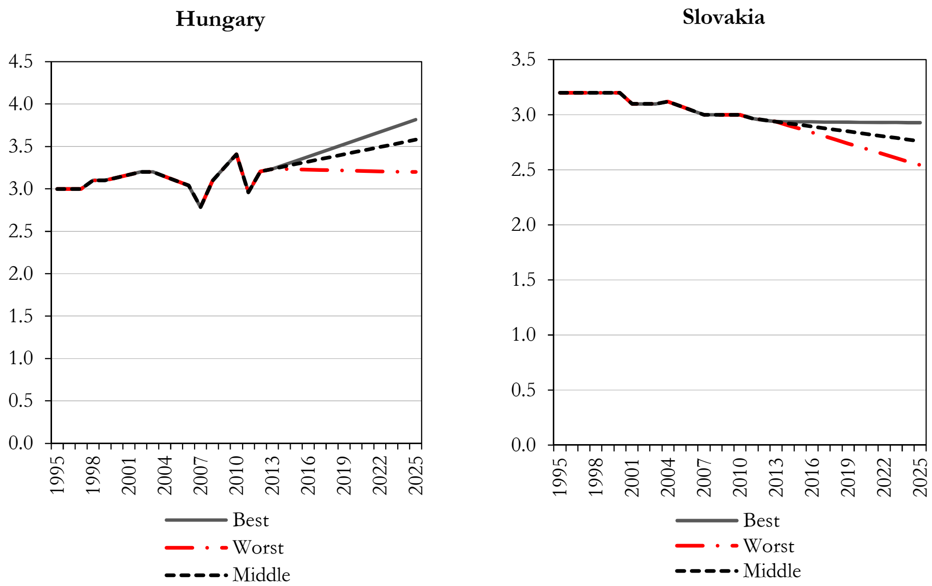
The current level of corruption (as measured by the Transparency International surveys, indicator 11) is the same in Hungary and Slovakia, and the future trends are also similar. A slight improvement is expected in both countries. Corruption is a major problem in the region, and because it is influenced strongly by cultural characteristics (Réthi 2012), corruption levels can only be expected to change in the very long term.

Life expectancy at birth (indicator 12) has caused one of the biggest problems for Hungary. Slovakia is not performing better either (by 2025, Hungary and Slovakia can expect to have a life expectancy around 75–77.9 and 75.9–78.4 years, respectively), but Hungary has the lowest life expectancy among the European OECD members and the third lowest among all OECD members. It is largely attributed to the fact that within the OECD, Hungary has the highest mortality rate from cancer and the second highest mortality rate from cardiovascular diseases (OECD 2014).

In literacy rate, refugees displaced from the country and people killed or injured in terrorist attacks (indicators 13–15) the two countries are similar, and the actual and forecasted values are close to the optimal ones. The recent refugee crises and the terrorist attacks are new signs that might prompt more negative scenarios, but the likelihood of those is still very small. Voter turnout (indicator 16) is higher in Hungary. Turnout is an important indicator, and the fact that it is higher in Hungary, definitely gives it an advantage over Slovakia; however, it is also an indicator that is highly volatile and difficult to predict.

Figure 5

Number of physicians per 1,000 inhabitants in Hungary and Slovakia



Source: WDI and own calculations.

Hungary has more physicians per 1,000 inhabitants (3.23) than Slovakia (2.94). Another difference is that the Hungarian value is quite variable, which implies that its future path is basically impossible to predict, while the Slovakian value shows a very clear, decreasing trend (Figure 5). The wage difference between the Western and Eastern parts of the European Union and the on-going East–West flow of physicians are significant threats to both countries, although our analysis shows that Slovakia's outlook is worse.

Both countries are predicted to have a negative population growth (indicator 18) in the future. The share of population lacking access to improved water sources (indicator 19) is minimal in both countries, and the poverty headcount ratio (indicator 20) also shows a favourable picture. Poverty, however, is a problem in Hungary as well as in Slovakia. The reason why there are no warning signs within the standard SOFI environment is that the measurement method (people living on less than 1.25 USD per day), is not relevant for the region. According to OECD statistics, the poverty rate is increasing in both Hungary and Slovakia (OECD). In HIV prevalence (indicator 21) the countries are performing well, and although there are some warning signs, no major changes are expected in this field.

Slovakia has quite a terrible score in R&D expenditure (indicator 22). While Hungary's score is also not favourable compared to other European countries, it is still almost twice as high in per GDP terms. According to our extrapolation and experts, Hungary will continue to have an advantage: the 2025 R&D expenditure per GDP is expected to be in the range of 1.4–2.2 in Hungary and 0.8–1.5 in Slovakia.

Secondary school enrolment (indicator 23) again shows a favourable picture. The share of seats held by women in the national parliament (indicator 24) is traditionally low in the region and is the lowest in Hungary.

The government debt/GDP ratio (indicator 25) is another area where Slovakia dominates Hungary (80% vs. 50%). The tendencies, however, are quite different. Hungary's debt ratio has been stagnant, and as economic growth kicks in, it can decrease at a significant pace. Slovakia's debt ratio, on the other hand, has escalated after the 2008 crisis. According to the best-worst scenarios, Hungary could have a lower ratio by 2025. The stability programme put forward by the Slovakian Ministry of Finance in April 2015, however, suggests that the Slovakian debt ratio has stabilised and will slightly decrease in the 2015–18 period (MoFSK 2015, pp. 29).

A considerable difference can be detected in the unemployment levels (indicator 26) as well. Hungary's unemployment level is around 6.5%, while Slovakia's is almost 11%. The difference is largely due to the major public employment programme started in Hungary. The high unemployment levels are partially caused by the unfavourable structure of labour supply and a high proportion of uneducated labour force. Unemployment is highest among the Romani: the employment rate among them is 15% in Slovakia and 23% in Hungary (Gál 2012).

Conclusions

One of the standard methods to measure the standard of living in a country is the per capita GDP. In this respect, Hungary had an advantage over Slovakia in the 1990s, which slowly evaporated, and by the 2010s, Slovakia was dominating. However, after the 2009 Stiglitz–Sen–Fitoussi report, it has become even more important to find other measures for the well-being of a country. The SOFI methodology presented in this study is in line with most of the principles of the 2009 report. Moreover, this method can be used to predict future well-being. Some of the variables, however, are not relevant for the Central and Eastern European region (notably indicators 3, 10, 14, 15 and 21), or the use of a different indicator would give us a clearer picture about the trends (e.g. indicators 1, 4, 8, 13 and 20). Thus, an analysis conducted with a different set of indicators could lead to even more accurate results. Indicators measuring inequality, deprivation, habitat conditions, the nutrition structure, the acquired skills, the ratio of certain products and services in the budget of an average household and so on would be the ones that are worth discussing as better replacements for the already existing measures.

In our SOFI analysis, we found that Hungary did not have an advantage in the 1990s over Slovakia. In fact, Slovakia was ahead, and Hungary was able to catch up around the millennium. After that, Slovakia pulled ahead again, and our analysis suggests that it will continue to do so in the 2015–25 period as well. The comparison highlighted a few areas where Hungary had or will have an advantage over Slovakia, as well as those, where considerable improvement is needed for Hungary. The most important of these areas are the following:

1. Life expectancy at birth: Hungary has the lowest life expectancy among European OECD members, and there is slow improvement in this field. The rate of change is way too slow.
2. Per capita GDP: Slovakia grew 1.4%/year faster than Hungary in this respect, and that enabled the former to pull way ahead. A change of trends is needed if Hungary wants to catch up. However, our experts did not give much likelihood to the positive scenario that would allow this to happen.
3. Use of renewable energy sources: Hungary is lagging behind, and the recent changes in the Hungarian regulation makes it likely that the distance is going to further increase between the two countries.
4. CO_2 emission: Slovakia has an advantage both because of the different size of the two economies and because of the more favourable energy mix.
5. Government debt/GDP: An interesting area for Hungary to concentrate on, as during the 1995-2015 period, Slovakia had a much more favourable ratio, although the advantage seems to be evaporating.

Notable areas where the advantage lies with Hungary:

1. R&D expenditure per GDP: Even though Hungary's ratio is way behind the European targets, it is still almost twice as high as it is in Slovakia.
2. Unemployment rate: Hungary is among the top performers in Europe as far as the unemployment rate is concerned. However, it is worth mentioning that its current value is largely due to the public employment programme, and the programme's sustainability is questionable.
3. Voter turnout: This is a highly volatile indicator, but Hungary has been consistently having higher turnouts than Slovakia. Thus, the Hungarian electorate seems to be more involved in public affairs.
4. Physicians per inhabitants: There is not a huge difference between the two countries with regard to this area. However, Slovakia's trend shows a consistent and slow drop, while Hungary's time series is variable.

In some areas, both countries have scope for improvement. Demography (population change) and the level of corruption seem to be the most important ones.

REFERENCES

ANDERSEN, C. (2015): *Climate change performance of Slovakia, Poland, Hungary, Belorus and Ukraine* htt://climatepositions.com/update-climate-finance-as-share-of-climate-debt-by-country/ (downloaded: Dec 2015).

ARPASI, M. (2003): Geothermal development in Hungary - country update report 2000–2002. *Geothermics* 32 (4–6): 371–377.

BARTHA, Z. – TÓTHNÉ, K. SZ. (2015): SOFI Results: Hungary. In: KOLOS, N. – JUTKIEWICZ, P. (eds.): *V4 State of the Future Index* pp. 13–19., Polish Society for Futures Studies, Warsaw.

GÁL, ZS. (2012): *Hungary's Past – Slovakia's Future?* CENAA Working Paper http://cenaa.org/en/wp-content/uploads/2012/12/Zsolt-Gal-analysis-final.pdf (downloaded: Dec 2015).

GÁSPÁR, T. (2013): A társadalmi-gazdasági fejlettség mérési rendszerei *Statisztikai Szemle* 91 (1): 78–92.

GLENN, J. C. – FLORESCU, E. (2015): *2015-16 State of the Future* The Millennium Project, Washington DC.

GLENN, J. C. – GORDON, T. J. (2001): *2001 State of the Future* The Millennium Project, Washington DC.

KÁDÁRNÉ, H. A. (2013): Áttekintés Magyarország végső energiafelhasználásának alakulásáról *Magyar Energetika* 20 (6): 27–31.

KLINEC, I. (2015): *SOFI Results: Slovakia* In: KOLOS, N. – JUTKIEWICZ, P. (eds.): V4 State of the Future Index pp 29–34., Polish Society for Futures Studies, Warsaw.

KOLOS, N. (2015): V4 SOFI Analysis – methodological approach In: KOLOS, N. – JUTKIEWICZ, P. (eds.): *V4 State of the Future Index* pp 8–12., Polish Society for Futures Studies, Warsaw.

MINISTRY OF ECONOMY OF THE SLOVAK REPUBLIC (MOES) (2014): *New version Energy Policy of the Slovak Republic* http://www.economy.gov.sk/energy-policy-of-the-slovak-republic_october-2014-qci/145533s (downloaded: Dec 2015)

MINISTRY OF FINANCE OF THE SLOVAK REPUBLIC (MOFSK) (2015): *Stability Programme of the Slovak Republic for 2015–2018* http://www.finance.gov.sk/en/Components/CategoryDocuments/s_LoadDocument.aspx?categoryId=347&documentId=650 (downloaded: Dec 2015).

OECD (2014): *Health Statistics 2014 – How does Hungary compare?* http://www.oecd.org/els/health-systems/Briefing-Note-HUNGARY-2014.pdf (downloaded: Dec 2015).

RETHI, G. (2012): Relation Between Tax Evasion and Hofstede's 4+2 Model *European Journal of Management* 12 (3): 61–72.

SIKULOVÁ, I. – FRANK, K. (2013): *Large-Scale Transformation of Socio-Economic Institutions - Comparative Case Studies on CEECs* Background Paper 1: Comparative Country Study - Slovakia. WWWforEurope Working Paper no 17., Bratislava.

STIGLITZ, J.E. – SEN, A. – FITOUSSI, J-P. (2009): *Report by the Commission on the Measurement of Economic Performance and Social Progress* www.stiglitz-sen-fitoussi.fr (downloaded: Dec 2015).

DATA SOURCES

EIA, US Energy Information Administration: http://www.eia.gov/

Eurostat: http://ec.europa.eu/eurostat/data/database

Freedom House: https://freedomhouse.org/report/freedom-world/freedom-world-2015#.VmQASeKbEVc

HNEO, Hungarian National Election Office: http://valasztas.hu/

IDEA, International Institute for Democracy and Electoral Assistance: http://www.idea.int/resources/databases.cfm

IF, Pardee Center for International Futures at the University of Denver – International Futures forecasting system: http://pardee.du.edu/access-ifs

IMF-WEO, International Monetary Fund – World Economic Outlook: http://www.imf.org/external/pubs/ft/weo/2015/01/weodata/index.aspx

OECD, Organisation for Economic Co-operation and Development- iLibrary: http://stats.oecd.org/Index

UNDP, United Nations Development Programme – Human Development Reports: http://hdr.undp.org/en/content/human-development-index-hdi-table

WDI, World Bank World Development Indicators: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators

WHO, World Health Organisation: http://www.who.int/gho/database/en/

Understanding the Changing Geography of Labour-Intensive Industries from a GPN Perspective: Case Study of the Hungarian Leather and Footwear Sector

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Labour-intensive industries have declined in the East Central European economy after the beginning of the millennium. Given this deterioration, significant employers are vanishing from rural areas, leaving behind serious employment problems in regions which are less capable of resilient restructuring. This article examines this shrinkage from a geographical aspect in the context of the Hungarian leather and footwear industry. This study focuses on the interpretation and explanation of the spatial differentiation that accompanies this shrinking process. The aim of this paper is to reveal the influencing factors that stand in the background of spatially uneven development. The analysis – embedded in the theoretical framework of global production networks – is based on the corporate database of the Hungarian Central Statistical Office and invokes the experience of interviews carried out with representatives of industrial actors as well. In addition to an understanding of spatial processes, the intention of the authors was to investigate the issues to be addressed in certain locations and under what conditions the long-standing industrial culture related to the sector can be preserved.

Keywords:
global production networks,
labour-intensive industries,
leather and footwear industry

Introduction

Whereas the labour-intensive leather and footwear sector is a *globally growing industry*, it has experienced a *spectacular decline in Hungary* and in most countries of East Central Europe. The shrinkage is coupled with a *structural change* that is clearly visible in the footwear sector. Because of the disappearing cost advantages, mass production based on large subsidiaries and subcontractors faced fewer possibilities after the turn of the Millennium. In contrast, the small series production of own brand products for special niche markets that appreciates the role of creativity, innovation, and flexibility, is gaining in importance (Cseh et al. 2002, Laki 2005, Molnár 2013). The tendencies can be explained by the *intermediate position* of the region between the leather and footwear centres of developed economies that concentrate the strategic functions of global production, and the cost-efficient mass production locations within developing economies that acquire increasing competencies in the international division of labour (Bertram 2005, Schamp 2005, Schmitz 2006).

During the socialist period, the leather production and footwear industry had *different geographical patterns* based on its various location factors. The first sector, primarily located on raw materials and industrial traditions, was *relatively concentrated*, whereas the second factor, as a tool to industrialize the rural space using a cheap labour force, disengaged from agriculture spread *almost throughout the country* (Barta 2002, Kiss 2010). A common feature of the industry's development after the change in regime is the *spatially uneven shrinking process*, the *description* and *explanation* of which is the main objective of this study using the recent theory of global production networks. The *strongly internationalized character* of the sector validates the application of the concept and explains the spatial division of labour during a period of globalization. The examination provides experiences which can be *generalized for a broader set of labour-intensive industries*. Formerly large employers face mostly similar challenges in Europe and in regions characterized by different labour-intensive industries with an intermediate position within the international division of labour of these sectors (for example, in East Central Europe – Scott 2006, Roukova et al. 2008, Crestanello–Tattara 2011, Cutrini 2011).

This article consists of three structural units. The first section, based on a literature research and review, briefly presents the *global production network (GPN) concept* that emphasizes the elements that are relevant to explaining spatially uneven sectoral development within a national economy. The second part, based on enterprise data of the Hungarian Central Statistical Office, concentrates on the *description of spatial dynamics*. The examined years of 1998 and 2013 may be initially justified by the fact that, within this time interval, the decline and structural change after the turn of the Millennium (considered a major milestone) can be examined. Secondly, the relatively homogenous enterprise data available for 1998 at the earliest and (at least for the authors) for 2013 at the latest are also important. The aim of the third unit, using primary information collected through semi-structured interviews by enterprises and organizations, is the *explanation of spatial dynamics*. This study investigates the issue of the extent to which the experience of the empirical research underpins the observations for reasons of uneven regional development, which can be deduced from the theoretical concept.

Spatiality in the theory of global production networks

According to the concept, *GPNs* are mostly globally organized systems of interconnected functions and operations related to enterprises and institutions, in which framework the production, distribution, and consumption of goods and services are realized. (1) On the one hand, GPNs are *existing economic structures*: from UNCTAD estimations, 80 per cent of international trade is arranged through GPNs. Some people consider these organizations (or organized settings) as the backbone of the global economy. (2) On the other hand, the GPN as a *theoretical construction* is rooted in prior research on global value chains and the activities of the Manchester School of Economic Geography. The aim of the concept is to explain the spatial economic disparities of the contemporary economy. The concept integrates the *approach of global value chains* and emphasizes the importance of external connections and the *theories of new regionalism* (industrial districts, clusters), which discuss the role of local factors in regional development (Coe et al. 2004, Coe–Hess 2011, Yeung–Coe 2015).

What is essential in terms of the present examination is the fact that the GPN theory *exceeds and goes beyond the GCC and GVC approaches*, which formerly attempted to interpret the spatial economic processes of globalization and its impact on spatial development. The latter are considered inappropriate for explaining geographical changes at the subnational level because of their static character (classification of already evolved systems based on their functional mechanisms), and their insensitivity to the effects and impacts prevailing at various spatial levels (Cséfalvay 2004, Gereffi et al. 2005, Yeung–Coe 2015). Contrary to these approaches, the 'original' GPN theory already included the *regional assets*, which draws attention to the role of such factors (e.g. cooperative firms, potential suppliers, qualified labour force, special infrastructure) in shaping GPNs. GPNs are regarded as local from the aspect of the global economy, but otherwise prevail at *different spatial levels* (not only at supranational levels and nation-state levels but also at subnational spatial levels). The GPN perspective also gives place as participants for *different institutions* (supranational organizations, government actors, industrial organizations, trade unions, non-governmental organizations). The theory describes the spatiality of different economic activities and their regional development effects as a r*esult of the strategic coupling of GPNs and regional economies*. The locations can be differentiated by the quality of their milieus; however, their advantages can truly be utilized if these (slowly transforming) regional assets meet the (rapidly changing) strategic needs of GPNs (Coe et al. 2004, Coe–Hess 2011).

On the basis of the revised and refined (dynamic) version of the GPN theory ('GPN 2.0'), the emergence and development of GPNs can be traced back to *three motives as drivers* (cost-capability ratio, market development, and financial discipline) *that generally prevail in capitalist economic conditions*. These drivers can generate four basic types of corporate strategies (internalization or intrafirm coordination, interfirm control, interfirm partnership, and extrafirm bargaining) in environments *characterized by different inherent risks* (economic, regulatory, environmental, product, and labour risks) (Yeung–Coe 2015). The spatial aspect emerges in the concept in the following manner: the drivers and risks that determine corporate strategies can indicate *geographical differences* which can be interpreted at diverse spatial levels and which exhibit *unique combinations* even with respect to a single subnational region. According to the theory, even actors of the same industry or that function in the same regional (or national) economy might have different corporate strategies (Yeung–Coe 2015) which determine the subsequent spatial development of transnational organizational processes.

Among the factors that determine corporate strategies, the highest level of direct regional (subnational) definiteness can be witnessed in the case of the cost–capability ratio. Production costs (for instance, the cost of labour) can present remarkable differences within a national economy. According to the theory, the *development of capabilities* might be a possible answer for and solution to increasing costs. The *source of competences* necessary for advancement is to be sought *largely in the local economic environment*, where the concentration of sector-specific knowledge, skills, and expertise (economies of scale), and the possibility of cooperation and learning from each other (economies of scope) may be given (Coe–Hess 2011, Yeung–Coe 2015). The dimensions of *industrial upgrading* that generate higher local value-added activities represent one of the most popular research fields in the literature underlying the research on the GPN theory (Humphrey–Schmitz 2002, Kaplinsky 2004, Gereffi–Humphrey–Sturgeon 2005, Schamp 2008). However, *it would be a mistake to solely trace back the explanation of spatial differences at the subnational level to the cost–capability ratio* because different market conditions, diverse financial disciplines, and various risks stand behind companies exploiting local opportunities. Therefore, in the current examination which focused on the cost–capability ratio, the authors also refer to these situations in which this factor *per se* is not sufficient for explaining spatial differences at the subnational level.

Spatial dynamics of the Hungarian leather and footwear industry

Drawing on the experience of former examinations carried out by the authors related to the industry (Molnár 2013) and by relying on the new fundamentals of the GPN theory as introduced in the previous section, this research focuses on the *cost–capability ratio*. This ratio indicates the strongest direct spatial embedment when examining the development of the leather and footwear industry within the national economy. According to the theory, the two options for achieving a lower cost-capability ratio – regarded as desirable to enhance competitiveness – might generate different spatial development processes. (1) The cost reduction path assumes a biased *shift of labour-intensive industries to peripheral regions* that provide an inexpensive labour force. (2) In contrast, the development of capabilities results in an *increasing appreciation of industrial concentrations* which represent a higher probability of providing qualitative location factors, qualified labour, and special inputs.

It is highly recommended that *small and micro enterprises* (5 to 49 employees) and *large and medium-size enterprises* (50 employees or more) be distinguished when analysing the database. This step is justified by the presumable *difference between the activity structures* of the two entrepreneurial groups. The manufacturing of higher value-added, locally based own brand products might even play an exclusive role within the activities of smaller firms, whereas larger-scale employment is a feature of subsidiaries of foreign companies, or of domestic companies which carry out toll manufacturing for foreign companies. This fact basically indicates the predominance of productive functions, even if the company implemented an outstanding upgrade and/or also appeared on the market by introducing its own brand of products in addition to the toll manufacturing segment. In our interpretation, the different activity structure refers to the possibility of increasing the appreciation of different location factors. In contrast, corporations representing different company sizes are influenced by diverse *capitalist drivers and the risks prevailing in different geographical scales.*

As the *framework for a spatial examination*, the administrative units of the *districts* that correspond approximately to the order of magnitude of a functional urban area were used. In this way, the research facilitates a more refined picture of the geography of the sector than an examination based on the level of much larger and more heterogeneous counties. The data used in this research stem from the *enterprise database of CSO Hungary* (Cég-Kód-Tár) for the years 1998 and 2013. All firms in the leather and footwear industry *employing at least five individuals* were considered in the analysis. The reasons for neglecting smaller actors were dual: (1) we found it important to harmonize this examination with the available county-level employment statistics based on the data of such enterprises, and (2) we assumed that the data of larger enterprises that provided the majority of the sector's performance are more reliable than those of more frequently changing micro enterprises. Because firms are registered by their headquarters' location at the settlement level, we aggregated them according to the units of the territorial administration system in effect in 2015.

As a *general tendency*, there is a *shrinking process* of actively functioning firms for all company sizes and spatial categories. The *stock of enterprises* showed significant *fluctuations.* Among the active firms that employ at least five people, only approximately 14% of the actors which existed in 1998 also functioned in 2013. Enterprises that had larger average employment shrank and declined in higher number than expanding and new enterprises (Tables 2–4). Total enterprise decline was 55%, whereas within a restructuring process, the overall share of small and micro enterprises increased from 66% (1998) to 73% (2013). There was also a *decline in the* *number of locations* of the sector between 1998 (98 districts) and 2013 (56 districts). The spatial concentration of the sector declined moderately, thus reducing the spatial concentration of micro and small enterprises, coupled with a *growing spatial concentration of medium- and large-scale enterprises*.

(1) On the basis of the *level of economic development of the districts*, a *dichotomy* can be perceived in the spatial tendencies. Approximately half of the total number of enterprises was located in the *developed areas outside Budapest*, primarily because of the importance of certain county seat-centred districts traditionally concentrated in the sector. The capital city plays an important role in the geography of micro and small firms (in the enterprise stock of 2013, the share of new entrants to the market since 1998 was the highest in Budapest, suggesting the emergence of new, creative players), whereas medium-size and large actors engaged rather in mass production were situated to a greater extent in rural districts with medium or low development. Between the two examined years, the *developed and the most backward districts increased their weight*: the former with respect to small and micro enterprises, and the latter with respect to large and medium-size enterprises (Table 1). The enterprises seemed more stable outside Budapest, whereas growing companies – considering both number of firms and average company size – primarily overcompensated the shrinking ones in the developed and backward districts. Although the new entrants did not supplement the eliminated ones in either case, the two categories were closest to each other in the developed and backward districts in terms of number of firms and average company size (Table 2).

Table 1

Distribution of leather and footwear enterprises in 1998 and 2013 according to the development categories of the districts based on 1998 estimated per capita GDP data

(%)

	Budapest	Developed districts	Medium-level districts	Undeveloped districts	Total
Small and micro enterprises (1998)	26	45	15	14	100
Small and micro enterprises (2013)	22	51	12	15	100
Large and medium-size enterprises (1998)	*11*	*47*	*27*	*16*	*100*
Large and medium-size enterprises (2013)	*0*	*47*	*31*	*22*	*100*
Enterprises total (1998)	**21**	**46**	**19**	**15**	**100**
Enterprises total (2013)	**16**	**50**	**17**	**17**	**100**

Development level was defined based on the aggregated data of a settlement's economic power: in addition to Budapest, the 174 districts were categorized into three groups with equal number of members (58-58-58) using 1998 data.

* The GDP estimation on a district level was based on the calculation of 'settlement's economic power' according to the method described by Lőcsei–Nemes Nagy 2003 (also referred to by Pénzes 2014). After a settlement-level disaggregation of county GDP data on the basis of the number of registered enterprises, local tax income, and taxable revenues, a district-level summarization of the generated settlement data was fulfilled.

Source: data of HCSO, Hungarian State Treasury, Tax and Financial Control Authority.

Table 2

Dynamics of leather and footwear enterprises between 1998 and 2013 according to the development categories of the districts based on firms' employment categories

	Budapest	Developed districts	Medium-level districts	Undeveloped districts	Total
Existing firms in both years (in percentage of the 1998 number)	5	15	21	18	14
Shrinking firms (%)	0	36	33	10	28
Stagnating firms (%)	25	28	47	60	39
Expanding firms (%)	75	36	20	30	33
Average employment of shrinking enterprises (1998, capita)	0	113	290	75	169
Average employment of stagnating enterprises (1998, capita)	8	107	75	103	85
Average employment of expanding enterprises (2013, capita)	28	156	142	112	125
Number of firms fell out (in percentage of 1998)	95	85	79	82	86
Number of firms newly entered (in percentage of 1998)	31	35	19	35	31
Average employment of enterprises fell out (1998, capita)	58	93	100	59	81
Average employment of enterprises newly entered (2013, capita)	17	61	30	56	47
Total number of enterprises (2013, in percentage of 1998)	**36**	**50**	**40**	**53**	**45**

Development level was defined based on the aggregated data of a settlement's economic power: in addition to Budapest, the 174 districts were categorized into three groups with equal number of members (58-58-58) using 1998 data.

Source: data of HCSO, Hungarian State Treasury, Tax and Financial Control Authority.

(2) On the basis of *the industrial concentrations of the districts*, *dual tendencies* also prevailed. In both years, approximately half of all firms were located in high concentration districts. In particular, medium-size and large actors were situated in the key areas of the sector. Within the examined period, *micro and small enterprises* shifted to *low concentration districts*, whereas *medium-size and large players* were more concentrated *in the key districts* of the sector (Table 3). The *relative stability of industrial concentration* is reflected in the largest proportion of the former companies remaining active in these regions. In addition, among these 'survivor' companies, far more were expanding and stagnating than shrinking. The size of the shrinking firms is smaller than the national average, whereas this indicator is larger than the national average for stagnating and expanding agents. The proportion of eliminated firms lagged behind the national average only in these areas, and the average company size of the new entrants

was the largest in this case. What is in favour of *deconcentration* is the point that the proportion and average company size of the new entrants approximated the most respective values of the eliminated companies in low-concentration regions (Table 4).

Despite the disappearance of its large and medium-size companies, given its several existing enterprises, Budapest can be classified as a *'hot spot' of the Hungarian leather and footwear industry*. In the eastern part of Hungary's districts of Nyíregyháza and Szolnok, the Transdanubian region's districts of Pécs and Szombathely stand out from the developed rural districts containing notable industrial concentrations, which are substantial in terms of spatial patterns and industry restructuring (the former districts are more stable, whereas the latter ones lost their weight to a greater extent). Given the dynamics of small and micro enterprises, some developed districts which are of marginal relevance in terms of the industry can exhibit even an absolute increase, typically around the capital city (Budakeszi, Szentendre) and regions affected by tourism (Hajdúszoboszló, Kőszeg). The relatively stable industrial concentrations of the less developed rural area districts of Bonyhád and Szigetvár can be highlighted in the Transdanubian region, whereas the districts of Csenger and Kiskunfélegyháza in the eastern part of Hungary can be underlined. The losses in the role of Kecskemét and Gyomaendrőd and the expansion of the districts of Kunszentmárton and Mezőcsát – among the most backward and underdeveloped districts – largely contributed to the industry's shift towards the periphery and areas representing lower concentrations (Figures 1–2).

Table 3

Distribution of leather and footwear enterprises in 1998 and 2013 according to sectoral concentration categories of the microregions based on 1998 data

(%)

	Budapest	High concent-ration districts	Medium concent-ration districts	Low concent-ration districts	Total
Small and micro enterprises (1998)	26	43	21	10	100
Small and micro enterprises (2013)	22	43	19	16	100
Large and medium-size enterprises (1998)	*11*	*60*	*29*	*0*	*100*
Large and medium-size enterprises (2013)	*0*	*73*	*27*	*0*	*100*
Enterprises total (1998)	**21**	**49**	**24**	**6**	**100**
Enterprises total (2013)	**16**	**51**	**21**	**12**	**100**

'High concentration' means at least four enterprises and one medium-size / large firm, 'medium concentration' indicates at least two enterprises or one medium-size / large firm, 'low concentration' means one micro / small enterprise.

Source: enterprise data of HCSO Hungary.

Table 4

Dynamics of leather and footwear enterprises between 1998 and 2013 according to the concentration categories of the microregions based on firms' employment categories

	Budapest	High concent-ration districts	Medium concent-ration districts	Low concent-ration districts	Total
Existing firms in both years (in percentage of the number in 1998)	5	19	12	13	14
Shrinking firms (%)	0	28	45	0	28
Stagnating firms (%)	25	36	36	100	39
Expanding firms (%)	75	36	18	0	33
Average employment of shrinking enterprises (1998, capita)	0	150	209	0	169
Average employment of stagnating enterprises (1998, capita)	8	106	78	28	85
Average employment of expanding enterprises (2013, capita)	28	130	238	0	125
Number of firms fell out (in percentage of 1998)	95	81	88	88	86
Number of firms newly entered (in percentage of 1998)	31	27	28	71	31
Average employment of enterprises fell out (1998, capita)	58	112	59	26	81
Average employment of enterprises newly entered (2013, capita)	17	74	43	16	47
Total number of enterprises (2013, in percentage of 1998)	**36**	**47**	**40**	**83**	**45**

'High concentration' means at least four enterprises and one medium-size / large firm, 'medium concentration' means at least two enterprises or one medium-size / large firm, 'low concentration' means one micro / small enterprise.

Source: enterprise data of HCSO Hungary

Figure 1

Large and medium-size as well as small and micro enterprises in the leather and footwear industry, 1998

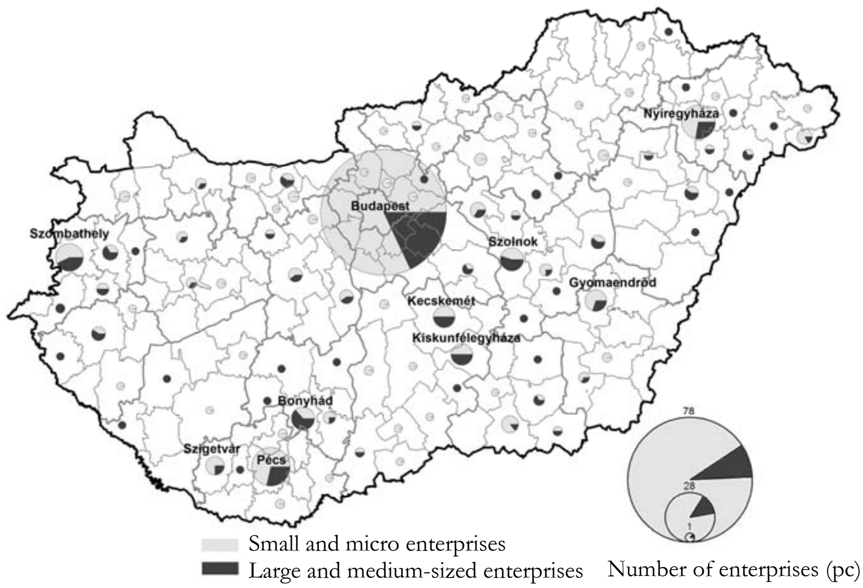
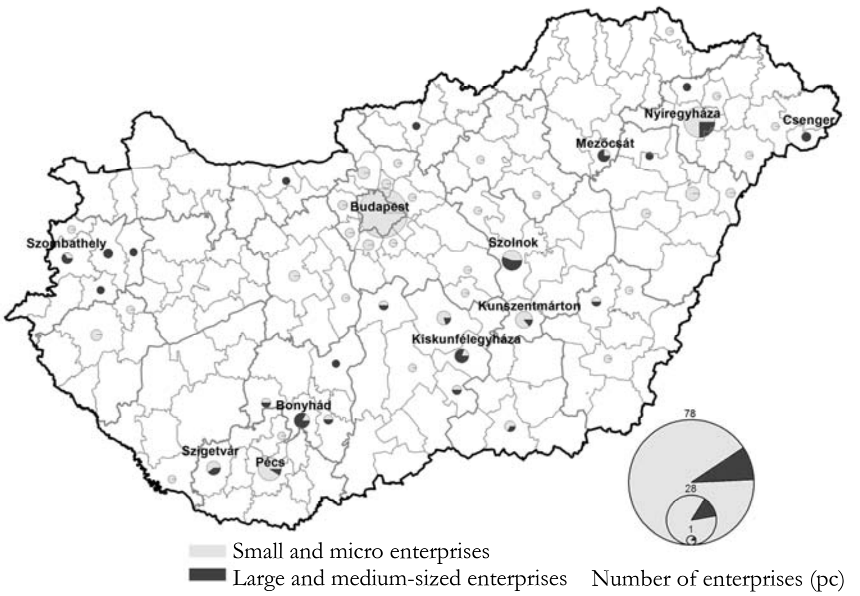


Figure 2

Large and medium-size as well as small and micro enterprises in the leather and footwear industry, 2013



The dichotomy of the spatial tendencies previously outlined (significant weight and relative stability of more developed regions and industrial concentrations; increasing appreciation of the most backward districts and regions outside the industrial concentrations) implies the *parallel and simultaneous prevalence of qualitative criteria and cost-efficiency considerations*.

Explanation of spatial development tendencies

According to the authors' experience, the geography of the leather and footwear industry was heavily influenced by the successful salvaging of the capabilities that prevailed before the regime change. By the turn of the Millennium, the *knowledge base and network of relationships accumulated in the socialist period* in the significant centres of the industry strongly affected its positions. Enterprises in these centres were already integrated into GPNs before the regime change given west-oriented toll manufacturing – having a foundation predominantly in westerly toll manufacturing substantially facilitated their restructuring after the regime change. In the socialist period, the principal company was also searching for industrial partners on basis of the existence and *availability of adequate (technological) competences*. This selection process resulted in, for example, the cooperation of Adidas and the Tisza Shoe Factory in vulcanized technology, and the developments of the Kiskun Shoe Factory were also affected by the needs of the principal company. In those days, when the eastern markets collapsed and the domestic markets were shrinking, *connection to GPNs* was *crucial* for companies. Foreign direct investments mainly turned up in these centres as owners, typically on the basis of former toll manufacturing relationships.

The *emergence of toll manufacturing and foreign capital* was essential not only to compensate the lost markets but also because it was relevant to finance production, which proved to be an invincible barrier for several enterprises – especially in the midst of the inflationary conditions and bank interest rates of the 1990s. In terms of the subsistence of industrial actors and the differentiated survival of their inherited knowledge, the role of the *institutional side* should not be underestimated in the medium of economic policy, which was generally insensitive towards problems of light industry. For example, actors representing Tisza Shoe Factory managed to lobby for a debt consolidation programme for the company and succeeded in allocating reorganization funds and ownership loans. Primarily, they argued over the firm's considerable weight in employment. The transformation of the company, which remained in state ownership for the longest period, was in line with the principle of maintaining its functionality. The trade union also had a substantive effect on its privatization.

Upgrading the 'survivor' actors within GPNs constituted fundamental importance both before and after the turn of the Millennium. The process is considered to be in the *common interest* of western companies intending to relocate an increasing proportion of their production to more cost-efficient locations, and to Hungarian actors as well who were eager to utilize their capacities and increase their revenues. Thus, efforts that aimed to reduce the cost–capability ratio can be witnessed from both sides of the actors, that is, the sector was able to achieve stability in regions which were the most capable of realizing this upgrading process. In relation to the principal companies and their subcontractors, the case of *interfirm control* prevailed characteristically. This phenomenon is demonstrated by the fact that raw material management remained in the hands of the principle company and production is implemented in accordance with submitted specifications. Moreover, process engineers (technologists) delegated from the parent states to Hungarian shoe manufacturers serve as spectacular evidence. In many cases, the *internalization of relationships* occurred, which entailed that the Hungarian location became a subsidiary of the principal company. Partly risk-mitigation considerations (in the case of Salamander, the fear of bankruptcy, and the termination of the Tisza Shoe Company) and, supposedly, the intention to increase the significance of the location in question within the company (Berkemann concentrated its production in Kiskunfélegyháza; Legero and then Lorenz concentrated their production in Martfű) stood in the background of this process.

In the long run, no clearly visible difference exists between the effects and *impacts of the two management models* (interfirm control, internalization) *on* the *upgrading* process. The shifting towards manufacturing *various products* targeting higher-quality segments by using *multiple product technologies* and *more efficient work organization* is observed in both cases. In several cases, the principal company also fostered its partner in the advancement of production efficiency and in replacing amortized equipment through investments in machinery that aimed to take the place of manual labour and increase the capability to manufacture new products. The *functions* of the domestic locations within the GPNs expanded to the *entire production process* and, in many cases, *went beyond that* (most often in the fields of model-shoe manufacturing and logistics). The factory of the German-interested Berkemann in Kiskunfélegyháza appears exceptional because this location, as the production centre of the group serves managerial tasks related to development, raw material procurement, and production management for other sites operating in the region and provides marketing functions covering numerous countries in the region (however, the company's upheaval is underpinned by personal factors which are regarded as firm-specific features).

During the great secession wave witnessed in the footwear industry after the turn of the Millennium, it became evident that the *chances of retaining the Hungarian production* mainly *depended on the products and their markets.* That is, contrary to the previous period, not the national differences in the cost–capability ratio, but companies' external (mainly market) definiteness matter in shaping the spatial pattern of the industry. Principally, the manufacturing of higher-priced, smaller series products competing in the fields of quality and flexibility remained in Hungary. This selection process had a differentiating effect on the spatial dynamics of the industry. The *different market orientations and competitive corporate strategies* of the foreign principal companies (dominant cost reduction vs. quality and market resilience, combined with lean production) stand in the background of the different development paths of the deteriorating footwear manufacturing of Szombathely and the more stable sector of Kiskunfélegyháza. Moreover, the examples of Legero (gradual degradation of production in Martfű) and Lorenz (at the same time sustained concentration of production to Martfű) indicate that corporate strategies may vary concerning one and the same location. As Hungarian production became costly, the *success of the upgrading strategy* – and, hence, the role of the industry's traditional centres – became *questionable.* Given cost-efficiency considerations, significant amounts of toll manufacturing orders left the country and several subsidiaries were terminated. In some cases, Hungarian enterprises started outsourcing their activities to toll manufacturers located beyond the borders of Hungary, indicating at the same time that *not the domestic backward regions constituted the next stage of relocation*. We can talk about only two or three districts (Kunszentmárton, Mezőcsát) for which their increasing appreciation cannot entirely be detached from the antecedents.

The diminishing Hungarian production sheds light on the *long-term unsustainability of corporate strategies based on toll manufacturing,* which was only very temporarily remedied by the establishment of multi-way relationships. Although higher stability of toll manufacturing and even the partial retrieval of previously lost orders can be experienced in the field of qualitative products, *manufacturing of own brand products* increasingly came to the forefront in the spirit of capability enhancements. The attempts of the domestic shoe manufacturers to introduce own brand products target the *medium- and higher-priced special niche markets*; however, these tenors are also influenced by actors' professional experience and technological constraints. The most remarkable strategic directions are based on small series and flexible production and are typically aimed at such market segments for which competition from competitor agents in mass production prevails to a lesser extent. The authors of this article have little knowledge about the geography of own brand product manufacturing, and investigations concerning this field are currently in progress.

The *stability of the industrial concentrations* is supported and facilitated by other potential benefits in addition to inherited skills and competencies. For the purpose of flexible capacity utilization and cost reduction, domestic toll manufacturers and own brand product manufacturers, as well as subsidiaries of foreign companies, take the advantage of *partial outsourcing of upper leather production*, which is regarded as the most labour-intensive phase of footwear manufacturing. Because this process partly lies on the logic of geographical proximity, it has a positive effect on the stability of industrial players located relatively close to each other. This coexistence offers other opportunities: the *common supply of raw material* or *leasing out of modern machinery for each other* constitutes another example of cooperation. The collaborations are mostly based on personal relations and trust: more firms had the same roots in the socialist period and most of the actors know each other. *Some greenfield investments* (mostly automotive suppliers such as Eagle Ottawa, Eissmann Automotive, and Seton) which played their role in the renewal of the previously almost entirely liquidated leather industry were located in the surroundings of the traditional centres of the leather and footwear industry (perhaps not in such a manner completely independent from the antecedents), hence *increasing the stability of the industrial concentrations* (Molnár–Lengyel 2015).

Although *industrial concentrations* may offer *more favourable conditions* for businesses to stabilize their situation and to realize and accomplish the process of upgrading, the authors *do not intend to* overrate and *overemphasize their significance* for several reasons. (1) On the one hand, the *qualitative labour shortages* and the efforts to restart vocational training, which was stopped in many locations, suggest that the professional knowledge and 'industrial milieu' underlying the former upgrading process is being heavily eroded today because of the aging of older generations of technicians. (2) On the other hand, the traditionally weak *background of related industries* – apart from a few exceptions – *almost completely disappeared* after the regime change. This statement can be applied to the manufacture of raw and accessory materials (particularly leathers and soles or treads) that are indispensable to the footwear industry. This industry was destroyed partly because of *shrinkage* and by producers' *integration into GPNs* and the internationalization of their procurements. The industry was also ruined in part by *other reasons* related to a transformation crisis and legal harmonization with the EU. The previously described ascertainment is valid for the manufacture of machines and tools for the leather and footwear industry as well.

The *increasing appreciation of developed regions – formerly marginal in terms of the industry –* can hardly be explained by cost advantages and sector-specific qualitative location factors. The dynamics of urban agglomeration characterized by a growing population, as well as the performance of districts significantly affected by tourism can be more or less traced back to *market reasons*. The role of this factor is assumed to stand in the background of the outstanding dynamics of firms located in Budapest and might serve as an explanation for the urban concentration of certain specific segments (such as the orthopaedic footwear industry).

To summarize the research experience, before the turn of the Millennium, in an industrial environment featured by *increased interest towards Hungarian production*, the domestic spatial structure of the sector was determined by the *success of integration into GPNs* just as by the capabilities and local differences of upgrading. Subsequently, as *domestic production became costly*, the *external (mainly market) definiteness of foreign companies* became increasingly dominant in shaping the spatial processes. The attempts of domestic companies to *establish own brand products* (and production networks) and mostly not to compensate for losses can be interpreted as responses to their exclusion from GPNs.

Summary

In the case study, the authors attempted to *explain the spatially uneven development of a shrinking labour-intensive industrial sector* – the Hungarian leather and footwear industry – within the *conceptual framework of the GPN 2.0 theory*. On the one hand, the organizational manner and the spatially well-fragmented (structured) international character of the industry enabled the examination; moreover, improvements in the theory integrating spatial and dynamic aspects also underpinned the experimentation. The capitalist drivers and risks that determine corporate strategies and influence the development of GPNs, primarily in the case of the *cost-capability ratio*, can assist in discovering such regional elements which might serve as explanations for the uneven spatial development at a subnational level. As the spatial pattern of the two types of strategic options, including capability enhancement and cost reduction, aimed to achieve a lower cost–capability ratio (as the key to competitiveness), the possibility of the increasing appreciation of *industrial concentrations* (providing qualitative location factors) and – as an alternative option – the growing appreciation of *underdeveloped peripheries* (allowing more cost-efficient production) can be assumed.

The findings of the investigations proved the *parallel and simultaneous existence* of the two processes. On the one hand, this existence is regarded as the result of the *structural transformation* of the sector, namely the coexistence of mass production and own brand product development frequently manifested within one and the same company. On the other hand, the *'homogenization' of regional capabilities* is considered typical: industrial concentrations increasingly lose their sector-specific advantages and, at the same time, the domestic periphery does not constitute a real alternative in terms of cost efficiency. Thirdly, the *local differences in the costs and capabilities* increasingly became of *secondary importance* for the international actors. Domestic locations can only function as alternatives for each other in such product segments, for which the relatively expensive Hungarian production does not mean an insurmountable competitive disadvantage given its market position. Resolving the issue of in which locations the *preservation and survival of this heritage arising from the industrial culture* appears most realistic requires further in-depth examinations.

Last but not least, the authors leave three remarks in connection with the GPN theory. (1) The problems which arose during the empirical examination indicate that, although the *spatial approach applicable to the subnational level* appeared in the GPN theory, this field of the concept requires more thorough and detailed elaboration. (2) The example of the leather and footwear industry exemplifies the concept that *integration into GPNs cannot be regarded as a one-way process*: deeper engagement in the circumstances and impacts that emerge when exiting the system require more attention. (3) A morale related to the findings of the paper is that *capabilities inherited from the past have a notable impact on present economic activities*, thus proposing and underpinning the junction between the theoretical approaches of evolutionary economic geography and the GPN theory.

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REFERENCES

BARTA, GY. (2002): *A magyar ipar területi folyamatai 1945–2000* Dialóg Campus Kiadó, Budapest–Pécs.

BERTRAM, H. (2005): Das Wandern der Schuhindustrie innerhalb Europas *Geographische Rundschau* (12): 46–53.

COE, N. M. – HESS, M. – YEUNG, H. W. – DICKEN, P. – HENDERSON, J. (2004): „Globalizing" regional development: a global production network perspective *Transactions of the Institute of British Geographers* (4): 468–484.

COE, N. M.–HESS, M. (2011): Local and regional development. A global production network approach In: PIKE, A.–RODRÍGUEZ-POSE, A.–TOMANEY, J. (eds.) *Handbook of Local and Regional Development*. pp. 128–138., Routledge, London – New York.

CRESTANELLO, P.–TATTARA, G. (2011): Industrial Clusters and the Governance of the Global Value Chain: The Romania-Veneto Network in Footwear and Clothing *Regional Studies* 45 (2): 187–203.

CUTRINI, E. (2011): Moving Eastwards while Remaining Embedded: the Case of the Marche Footwear District, Italy *European Planning Studies* 19 (6): 991–1019.

CSÉFALVAY, Z. (2004): *Globalizáció 2.0* Nemzeti Tankönyvkiadó, Budapest.

CSEH, J. et al. (2002): *Könnyűipari ágazatok az Európai Unióban és Magyarországon: textil-, ruházati, bőr- és cipőipar* Magyar Kereskedelmi és Iparkamara, Budapest.

GEREFFI, G.–HUMPHREY, J.–STURGEON, T. (2005): The governance of global value chains *Review of International Political Economy* (1): 78–104.

HUMPHREY, J.–SCHMITZ, H. (2002): How does insertion in global value chains affect upgrading in industrial clusters? *Regional Studies* (9): 1017–1027.

KAPLINSKY, R. (2004): Spreading the Gains from Globalization. What Can Be Learned from Value-Chain Analysis? *Problems of Economic Transition* (2): 74–115.

KISS, É. (2010): *Területi szerkezetváltás a magyar iparban 1989 után* Dialóg Campus Kiadó, Budapest – Pécs.

LAKI, M. (2005): A magyar cipőpiac átalakulása 1989 után, avagy a gyenge pozitív visszacsatolás esete *Bőr- és cipőtechnika, -piac* 55 (6-7): 191–205.

LŐCSEI, H.–NEMES NAGY, J. (2003): A Balatoni régió gazdasági súlya és belső térszerkezete. In: NEMES NAGY, J. (ed.). Kistérségi mozaik Regionális Tudományi Tanulmányok 8., pp. 134–149. ELTE Regionális Földrajzi Tanszék – MTA-ELTE Regionális Tudományi Kutatócsoport, Budapest.

MOLNÁR, E. (2013): Egy zsugorodó iparág újrapozícionálásának kérdőjelei: Magyarország cipőgyártása a rendszerváltás után *Tér és Társadalom* 27 (4): 95–113.

MOLNÁR, E.–LENGYEL, I. M. (2015): Újraiparosodás és útfüggőség: gondolatok a magyarországi ipar területi dinamikája kapcsán *Tér és Társadalom* 29 (4): 42–59.

PÉNZES, J. (2014): *Periférikus térségek lehatárolása. Dilemmák és lehetőségek* Didakt, Debrecen.

ROUKOVA, P.–KEREMIDCHIEV, S.–ILIEVA, M.–EVGENIEV, E. (2008): Footwear Industry: Delocalisation and Europeanisation In: LABRIANIDIS, L. (ed.) *The Moving Frontier: The Changing Geography of Production in Labour Intensive Industries* pp. 205–227., Ashgate, Aldershot England.

SCHAMP, E. W. (2005): Decline of the district, renewal of firms: an evolutionary approach to footwear production in the Pirmasens area, Germany *Environment and Planning A* (37): 617–634.

SCHAMP, E. W. (2008): Globale Wertschöpfungsketten. Umbau von Nord-Süd-Beziehungen in der Weltwirtschaft *Geographische Rundschau* (9): 4–11.

SCHMITZ, H. (2006): Learning and Earning in Global Garment and Footwear Chains *The European Journal of Development Research* 18 (4): 546–571.

SCOTT, A. J. (2006): The Changing Global Geography of Low-Technology, Labour-Intensive Industry: Clothing, Footwear and Furniture *World Development* 34 (9): 1517–1536.

YEUNG, H. W.–COE, N. M. (2015): Toward a Dynamic Theory of Global Production Networks *Economic Geography* 91 (1): 29–58.