STUDIES

Private capital in the rural development programme: the case of the Apulia Region, Southern Italy

Donatello Caruso
(corresponding author)
University of Foggia, Italy
E-mail: donatello.caruso@unifg.it

Francesco Conto
University of Foggia, Italy

Keywords:
EU Rural Development Programme, Apulia region Italy, generalised propensity score, public aid in agriculture, private capital

This study analyses the role of private capital in modernising agricultural holdings, as implemented by the Rural Development Programme (RDP). Specifically the authors refer to the Measure 121 (Axes I) of the RDP 2007–2013, as decided by the Apulia Region; the main aim of this measure, in accordance with Art. 20(b)(i) of Council Regulation (EC) No. 1698/2005, is the modernisation of agricultural holdings through grants to be invested in farm machinery and equipment. The aim of this work is to verify how private capital (co-financing) that an agricultural holding is willing to invest influences the amount of public aid received. Leveraging the generalised propensity score (GPS) method, a dose-response function is estimated based on a dataset of Apulia farms. The results highlight the influence of private capital in increasing the probability of firms being granted public aid.

Introduction

In European funding contests, evaluations of investment projects and their sustainability over time are important in making business management decisions. As noted in some official reports and scientific works, observations as to whether European Union (EU) aid earmarked for modernising agricultural holdings has been directed to EU priorities and the specific needs of EU member states has been a relevant issue (European Court of Auditors 2012, Lukesch–Schuh 2010). Additionally, researchers such as Materia et al. (2015) have investigated the role of scientific merit in the peer-review-based selection process, specifically for agricultural research projects. Importantly, our study is among the first to investigate the role of private capital (i.e. co-financing) being invested in agricultural holdings, relative to the amount of public aid received for an agricultural holding modernisation project. This work analyses in particular the influence of private capital on the RDP between 2007 and 2013 on Apulia agricultural holdings. As part of the RDP, a programming document was prepared by EU member states, with the aim of planning and implementing the EU's rural development policy; this document has been approved by

the European Commission (EC). An RDP document can be prepared at regional or national level; in the case of Italy, one has been prepared by each region, and the measures therein define the rules according to which projects can be financed within an axis.

The EU finances investment projects with respect to agricultural holdings, through the enactment of its rural development policy. In the most recent programming period (i.e. 2007–2013), EUR11.1 billion (as of January 2012) was budgeted for a specific investment measure called the 'modernisation of agricultural holdings'. EU funding was complemented by national public expenditures to cover part of the total investment cost. In this context, the Apulia Region adopted the measure devoted to the reorganisation and modernisation of regional agricultural holdings. That measure – namely, Measure 121 (Axes I) of the RDP – aims to modernise agricultural holdings by offering subsidies that can be invested in farm machinery and equipment (e.g. tractors, harvesters, farm buildings, manure storage, irrigation facilities); this measure is executed in accordance with Art. 20(b)(i) of Council Regulation (EC) No. 1698/2005. In particular, policy intervention within the context of this measure entails a co-financing mechanism, on the basis of which private capital is called for covering at least 30% of the amount proposed as an investment. The remaining percentage represents the maximum quota of non-repayable public subsidies given in support of private capital.

Most of the recent policy impact evaluation literature has focused on evaluating the causal effects of a binary treatment. One stream of the literature pertains to propensity-score matching (i.e. comparing the income of companies participating in a project with that of non-participating companies with similar characteristics). According to Imbens (2000) and Lechner (2001), extended propensity-score matching can be used to employ a categorical treatment variable. Hirano and Imbens (2004) introduced the concept of the GPS and extended the results of Rosenbaum and Rubin (1983) to a continuous-treatment case. In the current study, beginning with the consideration of the first public call, public aid levels differ depending on the level of private capital; therefore, we consider as a treatment variable private capital – and public aid as an outcome – to estimate various private capital levels' average treatment effects on public aid. We do so by using the GPS approach introduced by Hirano and Imbens (2004). More specifically, we first estimate the GPS using a generalised linear model; we then estimate the dose–response function (DRF), using a flexible parametric form for the regression function of the outcome, for treatment and the GPS. Ultimately, we attempt to identify the co-financing that a farm is willing to invest, by referencing quantitative changes to certain variables (e.g. private capital and public aid levels).

The remainder of this paper is organised as follows. Section 2 offers a short literature review on the crucial role of the RDP; it then analyses various funding evaluation methodologies. Section 3 briefly reviews and describes the approach utilised

while leveraging the GPS. Then, section 4 presents the data we used and our results. Finally, section 5 summarises our conclusions.

Literature review

The RDP strategy takes up the three general objectives of the EU Regulation 1698/2005 – namely, improving the competitiveness of the agricultural and forestry sectors, enhancing the environment and the countryside, and improving quality of life in rural areas and encouraging the diversification of their economic activity. These objectives are structured in terms of the 12 priorities identified in the National Strategic Plan (NSP). Within this framework, and in line with European and national guidelines, regional features and needs were identified in the context analysis work, to inform the specific objectives of each of the axes and the related measures. Ultimately, the endpoint was to pursue the following objectives: promote modernisation in the agri-food sector (i.e. at the farm and agri-food industry level, and to improve supply chain integration), promote sustainable agricultural development, safeguard forests and increase their surface area, improve the effectiveness of local governance that aims to develop strategies by which to increase local employment, promote economic diversification and improve services in less-favoured rural areas. The need to reduce the growth gap between affluent and industrialised areas has driven disadvantaged rural areas within the EU to implement local development policy tools from the initial structural programming stage (Casieri et al. 2010). The key factors contributing to the local success of the implemented tools surely derive from multi-level cooperation among various public, private, and civil stakeholders at local level (Perger 2016). From there, fluent communication among public and private organisations, not to mention the effective integration of objectives and policies, will prove essential for setting up appropriate governance patterns (Brunori–Rossi 2007).

The function of policies in facilitating or promoting private local development depends upon the institutional and social 'ability' of stakeholders in leveraging available policies (Mantino 2005). On the other hand, many factors that have contributed to the success (and failure) of EU programmes have often been attributed to their localisation in a specific territorial context (Lukić–Obad 2016). Several scholars have highlighted how agricultural plurality, diversification, and institutional networks can play critical roles in developing rural capital, one of the most important indicators of rurality (Lukić 2013, McAdam et al. 2016, McKitterick et al. 2016). The evaluation of public subsidies on the post-project income of a firm is often of great interest to policy-makers and academic researchers, and considerable interest has been evident in the recent literature (Xiaoyong–Cheng 2015). The governments of developing countries are increasingly turning to private investment as a means of stimulating rural development: in this way, private investment can be considered an

engine of rural development (German et al. 2016), even if financial support from private creditors (i.e. banks) remains crucial (Badulescu et al. 2015). Researchers such as Lengyel and Leydesdorff (2015) show that foreign direct investment has had diverse effects on regional innovation systems. Finally, given the considerable role of private capital in enhancing rural development, its participation needs to be promoted through a number of possible channels (Wang–Sun 2016) – even if, historically, private capital has been disinclined to invest in agriculture in the absence of state support, and states have practiced varying degrees of regulation vis-à-vis private finance within the agricultural sector (Martin–Clapp 2015). Then, the process by which a policy's effects are evaluated becomes essential – not only in terms of policy implementation and more effective resource use, but also as a tool for redefining conceptual and operational approaches to policies.

Evaluations of the impact of policies require appropriate methodological responses. These responses can be usefully discussed under the rubric of two key issues: the *impact of what* and the *impact on what*. These two issues point to a key challenge in undertaking an impact evaluation – namely, the scope of the impact evaluation (Leeuw–Vaessen 2009). Researchers such as Bradley et al. (2010) stress that evaluations of rural development policies are mandatory for each member state during the programming period of their RDPs, with spot checks undertaken by the EC. Obviously, from the outcomes of previous programmes, it can be known that various techniques and temporal-distance phases have limitations that will impact future programming; nonetheless, an evaluation process can promote the quality and eventual success of an implemented policy. Starting with these main considerations that affect the evaluation process, and with a view to measuring the impacts, the EU regulation 1698/2005 acts as a general parameter that includes all the policies that aim to develop the food sector and the rural areas. Here, a multitude of tools are used to increase human capital; strengthen the structure of agricultural, food-quality, and agro-environmental policies; and diversify policies pertaining to productivity and improvements to quality of life in rural areas. These objectives are present in the strategic documents of the National Strategic Framework and the NSP, and they relate to the priority actions of the National Development Plan. The aforementioned regulation allows each EU member state to modulate its financial commitment to each thematic axis, so as to allocate financial resources in line with its own socioeconomic requirements for each intervention area. Each member state can also make adjustments on the basis of where needs are greatest – knowledge of which generally stems from *ex ante* assessments drafted in the preliminary phase of each RDP. The need to control and audit, public spending has led in recent years to a constant deepening of evaluation with respect to public policies. The aim here has been not only to generate knowledge that can better inform decision-making and programme implementation, but also to support certain moral aspects (i.e. the use of public resources necessitates accountability and transparency).

The scientific literature has paid particular attention to the issue of policy evaluation. There are at least two reasons for this growing interest (Esposti–Sotte 2013). First, the scientific community has recognised the legitimate challenge inherent in assessing policies, including those pertaining to economics and rural-based appraisals. This recognition relates to the fact that policy evolution – including that in the agricultural sector – has produced certain levels of procedural complexity (Imbens–Wooldridge 2009). These procedures are dedicated to the identification and development of multiple and heterogeneous methods and various assessment tools. Therefore, the evolution of the agricultural sector has resulted in considerable evaluation complexity, largely related to the number of objectives to be pursued and the number of objectives within each policy program. (EU member states have developed many new agricultural policies, and redesigned others with new and multiple objectives.) In this way, determining the tangible impacts of multiple and heterogeneous policy objectives has become an increasingly complex task.

Imbens and Wooldridge (2009) state that this policy-evolution process has brought about a new discipline that will present opportunities and, at the same time, a certain level of risk. Opportunities are identified in the course of undertaking research that relates to the development of policy assessment tools, and related risk becomes more apparent as policy evaluations leverage an increasingly restricted number of methodological approaches. The scientific community has confirmed the presence of this risk, in particular, over the previous decade, on account of its special attention to quasi-experimental methods and their application to evaluations of economic and rural-based outcomes. Additionally, researchers such as Alboiu et al. (2011) have shown that the use of enhanced eligibility criteria, the capture of more information, and the growth of awareness among farmers and local administration have improved access to credit. Thus, there is no single method by which to assess the effects of a considered intervention or policy; various techniques and statistical methods are available and chosen, depending on the data and information at hand and the evaluation questions for which one seeks answers.

The various evaluation approaches can be grouped into two main types, each of which features similar methods and evaluation processes. Let us look at each of these approaches, in turn.

1) **The approach based on theory ('theory-based evaluation').** The methods of this type do not produce quantitative results; however, they do provide some answers to the initial research questions: *Why do some programs work well while others do not? What are the effects of a given policy? For whose benefit are these policies enacted?*, and *In what context do these policies have an impact?* These methods therefore aim to capture, through survey responses, the impact of a particular program or policy; this information quickly translates into data that can be useful in making political decisions, and in measuring the impact of a program or a public policy (Weiss 1998, Merlo 2014).

2) **The counterfactual approach.** This approach – which is frequently leveraged in the field of economics – is a basic tool used to evaluate public policy. According to Lankoski and Ollikainen (2013), counterfactual analysis seeks to provide an answer to the question *What would happen if...?* In other words, counterfactual analysis is implemented by examining an unobservable case (i.e. the counterfactual) and comparing it to policies that can be evaluated: indeed, a comparison of the counterfactual and the real can assist in crafting estimates and in understanding the factors that explain policy effects. Public aid levels differ, depending on the level of private capital involved; therefore, to estimate the effects of public aid in relation to various private capital levels, the current study makes use of the GPS approach of Hirano and Imbens (2004). The propensity-score method is an increasingly popular means of undertaking estimations in the fields of agricultural and development economics (Lampach–Morawetz 2016). Other researchers have used GPS approach to estimate the capitalisation of a single-payment scheme in land values (Michalek et al. 2014) and to estimate net cherry returns and cherry yield (Ali et al. 2013). In the current study, *based on the GPS method, a DRF is estimated to verify the effect of private capital on the probability that a given firm will be granted access to public aid.*

Materials and methods

The firm-level data used in the current study were obtained from the Management Authority of the RDP of the Apulia Region. These data were drawn from the general database, which contains full information on those firms that had requested consideration for benefits by virtue of Measure 121, Axes I, of the RDP 2007–2013, through the first public call of 17 May 2012 no. 71. Parametric regression methods are used to investigate the relationship between private capital and public funds, as well as other variables (e.g. farm size, size of workforce, and cost), following a linear functional form:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots + \beta_m X_m. \quad (1)$$

Hirano and Imbens (2004) apply an extension of the propensity-score method to a setting with a continuous treatment, to investigate whether the effects of private capital (i.e. co-financing) on public subsidies differ, depending on the level of private capital involved. Imbens (2000) and Hirano and Imbens (2004) each generalise the unconfoundedness assumption for binary treatments (Rosenbaum–Rubin 1983) to multi-valued and continuous treatments. The key assumption is weak unconfoundedness:

$$Y(t) \perp T | X \text{ for all } t \in T. \quad (2)$$

The assumption implies, conditional on the observed covariates X, that the potential outcome Y(T) is independent of the level of treatment T. This assumption makes the private capital random, by ruling out systematic selection into certain treatment levels. To make this assumption more plausible, the covariates X should include variables that determine the public selection of subsidised firms. Therefore, the average DRF, $\mu(t) = E[Y_i(t)]$, can be obtained by estimating average outcomes in subpopulations separated by pre-treatment covariates and different levels of treatment. However, it is difficult to simultaneously adjust for multiple covariates. Let r(t, x) be the conditional density of the treatment, given the covariates:

$$r(t,x) = f\,t|x(t|X = x). \tag{3}$$

Then, the GPS is R = r(T, X). The GPS has a balancing property similar to the binary treatment case. Within strata with the same value of r(t, X), the probability of t = T is independent of the covariates X:

$$X \perp 1\{T = t\}\,|\,r(t,X). \tag{4}$$

Combined with the weak unconfoundedness assumption, the balancing property implies that assignment to the treatment level is unconfounded, given the GPS. Let fT be the conditional probability of receiving T. Then, for every t:

$$f\mathrm{T}(t|r(t,X),Y(t)) = f\mathrm{T}(t|r(t,X)). \tag{5}$$

This result allows for the estimation of the average DRF, by using the GPS to remove selection bias associated with differences in the covariates. Following Hirano and Imbens (2004), bias removal via the GPS is carried out in two steps. In the first step of analysis, we estimate the expectation of the outcome as a function of the observed treatment level (T) and the estimated GPS (R). Therefore, we first obtain:

$$\beta(t,r) = E[Y(t)\,|\,r(t,X) = r] = E[Y|T = t,R = R]. \tag{6}$$

In the second step, we estimate the value of the DRF at each specific treatment level, by averaging β(t, r) over the GPS values at that particular level of treatment:

$$\mu(t) = E[Y(t)] = E[\beta(T,r(t,X))]. \tag{7}$$

Hirano and Imbens (2004) stress that the regression function of Equation (5) does not have a causal interpretation; however, in calculating the average DRF in this way, Equation (6) does have one. GPS implementation relies on a number of assumptions, including parameterisations and functional forms. We employ a flexible parametric specification while paying considerable attention to testing the validity of these assumptions. First, a lognormal distribution is employed to model the conditional distribution of the treatment T, given the covariates X:

$$\ln(T_i|X_i) \sim N(\beta_0 + \beta'_1 X_i, \sigma^2). \tag{8}$$

If the lognormal distribution model is statistically approved, the estimated GPS can be obtained after estimating $(\beta_0, \beta_1, \sigma^2)$ by ordinary least squares:

$$\hat{R}_i = \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{1}{2\sigma^2}\left(\ln(T_i) - \hat{\beta}_0 - \hat{\beta}_1 X_i\right)^2\right) \quad (9)$$

Second, we model the conditional expectation of the outcome as a function of the observed treatment level and the estimated GPS. A quadratic approximation is employed:

$$E[Y_i | T_i, R_i] = \alpha_0 + \alpha_1 T_i + \alpha_2 T_i^2 + \alpha_3 R_i + \alpha_4 R_i^2 + \alpha_5 T_i * R_i. \quad (10)$$

Finally, the value of the DRF at the treatment level t can be obtained by averaging the estimated parameter of Eq. (9) over the distribution of the GPS:

$$\hat{E}[Y(t)] = \frac{1}{N} \sum_{i=1}^{N} \left(\hat{\alpha}_0 + \hat{\alpha}_1 t + \hat{\alpha}_2 t^2 + \hat{\alpha}_3 \hat{r}(t, x_i)^2 + \hat{\alpha}_4 \hat{r}(t, x_i)^2 + \hat{\alpha}_5 \hat{r}(t, x_i)^2 \right) \quad (11)$$

By repeating pattern Equation (11) at different treatment levels, we obtain an estimate of the full DRF. Furthermore, bootstrap methods are implemented to pattern standard errors and confidence intervals.

With regard to data collection, through a specific agreement between the Management Authority of the RDP of the Apulia Region and the Department of Economics at the University of Foggia, we gathered data pertaining to the measure in question – and which are not publicly available – including individual accounting items from the balance sheets that firms declared when submitting their application to participate in the public call over the 2007–2013 period. These data allow us to observe how 1,299 of 2,076 firms were actually granted benefits by virtue of Measure 121. Moreover, for each agricultural holding, the database provides the following information: a) amount of the proposed investment, b) public aid granted, c) the number of family and extra-family workers, d) revenue, e) production costs, and f) income levels prior to investment implementation.

Table 1 provides descriptions of the variables considered in this study.

Table 1

Descriptions of variables used in the current study

Variable	Description
Invest	Total amount of investment proposed by the firm; derives from the sum of public aid and private capital (EUR)
PublicAid	Amount associated with the contribution granted by the regional Authority (EUR)
Private capital	Private amount of the investment required for co-financing (EUR)
Farm size	Size of the farm (ha)
No_Workforce	Number of external workers (except those from the farmer's family)
Revenues	Total amount of revenue from the firm's agricultural activity (EUR)
Cost	Total amount of production costs, from the firm's agricultural activity (EUR)
Income	Income derived from the firm's agricultural activity, as recorded before the investment implementation (EUR)

To apply the GPS method, we must first model the conditional distribution of the treatment (in our case, private capital), given the covariate. Results of the Kolmogorov–Smirnov test for normality suggest that the transformed logarithm approximately follows a normal distribution; this is a commonly employed specification in the GPS literature (Hirano–Imbens 2004, Kluve et al. 2012).

Results

The GPS is defined as the conditional density of the actual treatment, given the observed covariates. To be effective, GPS methods should balance characteristics across treatment groups; the extent to which this has been achieved can be explored by comparing balance in the pre-treatment covariates before and after adjusting for the estimated GPS. In the current study, we apply the GPS method to investigate how the private capital an agricultural holding is willing to invest influences the amount of public aid received for project financing. Table 2 reports the results of our descriptive analysis. As one can see in the standard deviation values, the information we consider in our data is characterised by a high level of variability; this characteristic justifies making it a subject of econometric investigation. Furthermore, one can see the mean values of firm income (EUR45,009), farm size (41.97 ha), and workforce (15 units): broadly speaking, these figures suggest firms of very modest size and means. One can see that the mean investment amount is also modest (i.e. EUR158,182); as a result, even private capital and public aid quotas are quite small, and their mean values are about EUR83,000 and EUR75,000, respectively.

Table 2

Descriptive analysis of variables

Variable	Observations	Mean	Standard deviation	Skewness
Invest (EUR)	1,299	158,182	235,891.2	5.191
PublicAid (EUR)	1,299	75,132.39	112,767.2	5.35
Private capital (EUR)	1,299	83,049.64	126,640.9	5.37
Farm size (ha)	1,299	41.97	58.14	5.08
No_Workforce	1,299	15.27	213.16	30.42
Revenues (EUR)	1,299	159,600.2	197,457.8	4.45
Cost (EUR)	1,299	114,590.2	153,869.8	4.96
Income (EUR)	1,299	45,009.95	64,701.05	4.81

Source: Authors' elaboration based on the Measure 121 database of the Apulia Region.

Table 3 reports the results of the regression model (Equation (1)).

Table 3

Results of regression model analysis

Source	Sum of squares	*df*	Mean square
Model	1.4667e+13	4	3.6667e+12
Residual	1.8391e+12	1,294	1.4212e+09
Total	1.6506e+13	1,298	1.2716e+10
Number of obs.	1,299		
$F(4.1294)$	2,579.97		
Prob > F	0.0000		
R-squared	0.8886		
Adjusted R-squared	0.8882		
Root MSE	37,699		

PublicAid	Coefficient	Standard error	t	$P > \|t\|$	95% Confidence interval	
Private capital	0.8455073	0.0089126	94.87	0.000	0.8280226	0.862992
Farm size	45.53136	19.58191	2.33	0.020	7.115588	83.94714
No_Workforce	9.924991	5.037065	1.97	0.049	0.0432821	19.8067
Cost	–0.0364672	0.00772	–4.72	0.000	–0.0516124	–0.0213221
_Cons	7,029.201	1,461.723	4.81	0.000	4,161.595	9,896.807

We then obtain the following equation.

$$Y= 0.845X_1+ 45.53X_2+9.92X_3–0.036X_4 \quad (12)$$

where: Y = Public aid, X_1 = Private capital, X_2 = Farm size, X_3 = Number of workforce, X_4 = Cost.

As one can see, all variables considered in the regression model are statistically significant (p-value < 0.05): in particular, private capital is highly significant (p-value < 0.001). This indicates that the treatment variable (i.e. private capital) can be explained well by the covariates. In particular, in this case, we consider the firm size variable as a covariate. As Hirano and Imbens (2004) stress, estimated coefficients provide no direct meaning, but the results can be interpreted as a test of whether the covariates introduce any bias. In this way, using the estimated coefficients, the GPS estimation can be obtained via Equation (8). To assess whether the estimated GPS is adequate, we investigate how it affects the balance of the covariates. If the GPS is correctly estimated, the balancing properties should be satisfied. In the first step, we divide our range of observations into four treatment groups according to the quartile of the treatment variable; in the second step, we divide the range of private capital into four treatment groups. We then calculate the estimated GPS at the median of the treatment for all covariates within each group.

The balancing property (Table 4) is satisfied at a level lower than 0.001.

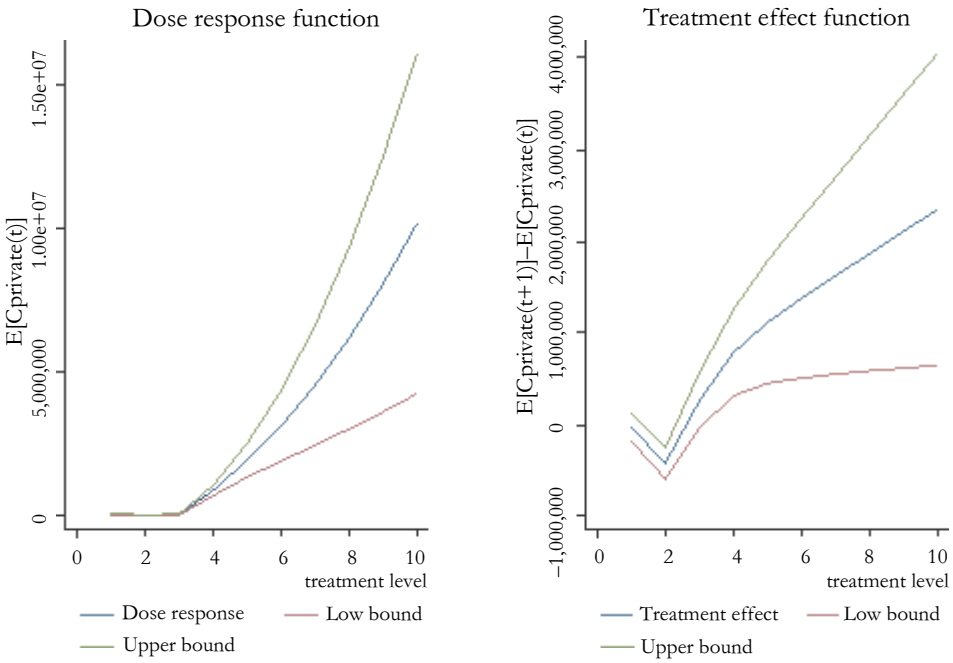
Table 4

Results of the balancing property

PublicAid	Coefficient	Standard error	*t*	$P > \|t\|$	95% Confidence interval	
Cprivate	1.156118	0.0327807	35.27	0.000	1.091809	1.220427
Cprivate_sq	–3.18e–07	3.11e–08	–10.21	0.000	–3.79e–07	–2.57e–07
pscore	55,861.78	13,090.46	4.27	0.000	30,181.15	81,542.4
Cprivate_pscore	–0.7668125	0.1219935	–6.29	0.000	–1.006137	–0.5274878
_Cons	–17,499.62	5,145.415	–3.40	0.001	–27,593.8	–7,405.436

Our main purpose in this study, ultimately, is to estimate the DRF. Therefore, we first regress the outcome (public aid) on the treatment (private capital) and the GPS (see Equation (9)). As one can see in the Figure, the estimated DRF shows the relationship between private capital and treatment level. As seen in panel A of the Figure, the slope of the DRF approximates zero over the first range of treatment dose – in other words, for farms that employ a low level of private capital – but the slope strongly grows when the amount of private capital goes beyond the fourth interval.

Average DRF and 95% confidence bands for public aid



Confidence bounds at 95% level
Dose response function = Linear prediction

Confidence bounds at 95% level
Dose response function = Linear prediction

Conclusion and discussion

This study applied a generalised propensity score (GPS) method to analyse the role of private capital in the process of modernising agricultural holdings, as seen in data pertaining to the Rural Development Programme (RDP) in the Apulia region of southern Italy over the 2007–2013 period. We introduced the general method applied by Hirano and Imbens (2004), who apply an extension to the propensity-score method in a continuous-treatment setting to investigate whether the effects of private capital on public subsidies differ with the level of private capital. Researchers such as Hirano and Imbens (2004) generalise the unconfoundedness assumption for binary treatments (Rosenbaum–Rubin 1983) to multi-valued and continuous treatments. Using data from the Management Authority of the RDP of the Apulia Region, we saw that 1,299 of the 2,076 firms who had applied for benefits through Measure 121 actually gained access to this funding. Using these data, we found that holding private capital increases the probability of firms receiving public aid benefits. Our study is amongst the first to investigate the role of private capital that an agricultural holding is willing to invest, in relation to the amount of public aid it will receive in support of its modernisation.

The results of this study are relevant to both the Apulia region and the national level: they speak about the function of policies in facilitating or promoting private local development, and how this function is contingent upon the institutional and social 'ability' of stakeholders to make use of available policies (Mantino 2005). On the other hand, as mentioned, evaluations of public subsidies and how they affect post-project firm income are often of interest to policy-makers and academic researchers, and interest in this area is seen in the literature (Xiaoyong–Cheng 2015). The governments of developing countries increasingly look to private investment as a means of stimulating rural development. For this reason, it can be considered a driver of rural development (German et al. 2016), even if financial support from private creditors (i.e. banks) remains crucial (Badulescu et al. 2015).

In accordance with the literature, and as Edmiston (2007) demonstrates, there is no clear evidence that small businesses are more effective innovators. Nonetheless, small firms create the majority of net new jobs and are critical innovators, and so efforts to encourage the formation and growth of small enterprises are likely sensible in most cases. Among EU member states, there is a great demand for public aid in the area of rural development policy, and such policies will push firms to make new investments that will, ultimately, have tangible economic effects at the regional and national levels.

Measure 121 (Axes I) of the most recent RDP (i.e. 2007–2013) has been essential to the success of several firms, within regional, national, and European contexts. It has had positive and significant effects on medium and large firms in particular, and one could say that supporting small firms is likely a good growth strategy for both the region and the nation. Therefore, our results suggest public policies and rural development policies by which small firms – which are more in need of benefits – could secure funding.

Indeed, the European policy strategy should help provide more economic aid for small firms, to help them grow, even when there is a relative dearth of private resources. Such strategies would help in defining the effectiveness of a regional policy and preclude the waste of economic resources; it may also encourage the use of tax abatements or capital investments from banks, in addition to any private capital. In any case, further theoretical research is needed.

The results of this work could inform future rural development policy at the regional and national levels. In this way, it could contribute to the crafting of public policy and to the creation of more instruments by which various projects (e.g. investment projects related to agricultural holdings that have small private capital amounts) could increase their probability of securing financing.

Acknowledgements

We are grateful for financial support from the Management Authority of the Rural Development Programme of the Apulia Region. We thank the editor and an anonymous reviewer for their constructive comments, which helped us improve this paper.

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Two faces of peripherality: labour markets, poverty, and population dynamics in Hungary and Czechia*

Gergely Tagai
Hungarian Academy of Sciences
Centre for Economic and Regional Studies
Institute for Regional Studies, Hungary
E-mail: tagai@rkk.hu

Josef Bernard
Czech Academy of Sciences
Institute of Sociology, Czechia
E-mail: josef.bernard@soc.cas.cz

Martin Šimon
Czech Academy of Sciences
Institute of Sociology, Czechia
E-mail: martin.simon@soc.cas.cz

Bálint Koós
Hungarian Academy of Sciences
Centre for Economic and Regional Studies
Institute for Regional Studies, Hungary
E-mail: koosb@rkk.hu

Keywords:
peripheralisation,
Central Europe,
labour market,
socio-spatial inequality

This study investigates socioeconomic peripherality in Hungary and Czechia. Despite the current attention devoted to peripheries in post-communist societies, the authors argue that there is a lack of data-driven international comparisons of the socio-spatial outcomes of peripheralisation processes. In the study, the situations in Hungary and Czechia are compared to assess the validity of peripheralisation as a mutually reinforcing economic, social and demographic decline specifically affecting rural areas. First, the concentration of social problems such as unemployment and poverty is examined in economically weak rural areas. Second, the role of transport accessibility and remoteness is analysed. Third, the links between socioeconomic peripheralisation and population development are explored. The results indicate basic structural similarities in the development of peripherality in Czechia and Hungary; however, the Hungarian case corresponds much more than the Czech case to the concept of peripheralisation defined as interrelated processes of economic problems, the accumulation of poverty and social exclusion, and population shrinkage that especially affect remote rural localities. The authors conclude by discussing the role of historically shaped settlement structures, current population compositions, and overall development at the country level.

* The article is output of the research projects 'Social disadvantage in rural peripheries in Czechia and in eastern Germany: opportunity structures and individual agency in a comparative perspective' funded by the Czech Science Foundation (No. GA18-05704J) and 'Governing urban marginality in shrinking cities' funded by the Hungarian National Research, Development and Innovation Office (K 119465), and the joint research project 'Spatial polarization (peripherisation), territorial governance and social consequences' of the Institute for Regional Studies at the Centre for Economic and Regional Studies of the Hungarian Academy of Sciences and the Czech Sociology Institute of the Czech Academy of Sciences.

Introduction

Increasing spatial inequalities following the regime change have led an enhanced focus on peripheries in Central and Eastern Europe. Regional peripheralisation can be understood in terms of the cumulative processes of economic decline, deteriorating living conditions, the concentration of social problems and demographic shrinkage, accompanied by a loss of political capabilities and stigmatisation (Kühn 2015, Steinführer et al. 2016). These processes operate at different spatial scales (Šimon 2017), affecting not only large regions (Gorzelak et al. 1995), but also contributing to socioeconomic polarisation between small spatial units. In many cases, peripheralisation processes particularly affect rural areas (Turnock 1996).

The debate on peripheralisation and its social consequences has been especially stimulated by German geography and sociology describing the problems eastern Germany has faced since the 1990s. The former East Germany's transformation resulted in a long-term high unemployment rate, poverty, and social exclusion, as well as a strong out-migration to the western part of the newly unified state. This age-selective migration has led to a significant imbalance in the social structure and accelerated population ageing. Specifically, younger, more educated people has left the eastern part of the country, with more women leaving than men (Leibert 2016). Rural areas were particularly affected by the combination of socioeconomic disadvantage and demographic shrinkage; collectively, these processes have created a downward spiral of decline. Similar tendencies have been recognised in other post-socialist Central European countries too; however, the dynamics and outcomes of peripheralisation markedly differ across countries and regions (Banski 2005, Bihari–Kovács 2005, Musil–Müller 2008, Pénzes 2013a).

Despite the attention devoted to this issue, there is a lack of truly comparative studies to assess the similarities and differences of peripheralisation in individual countries. Such comparative studies could not only investigate whether the socio-spatial manifestations of peripheralisation can be generalised, but also identify the limits of such generalisations. In this study, we comparatively analyse the spatial patterns of socioeconomic disadvantage and population dynamics in two Central European countries: Czechia and Hungary. We also aim to examine comparatively two basic elements of the peripheralisation thesis as formulated in the German milieu. First, we analyse the extent to which such social problems as unemployment and poverty are concentrated in economically lagging rural areas. Second, we explore whether peripheralisation's socioeconomic outcomes are indeed accompanied by a population decrease, thus creating a vicious circle of decline. We also detail the relationship between disadvantage on one side and settlement structure and transport accessibility on the other. We demonstrate that the situations in Czechia and Hungary differ despite basic structural similarities, and we discuss the causes of these differences.

The article is structured as follows. First, we briefly review the research on peripheralisation in Central Europe. We define the territory of Central Europe to include the Visegrád countries – Czechia, Slovakia, Poland, and Hungary – and the former East Germany. These countries have all experienced the post-socialist transition, in terms of an interrelation of delayed post-industrial transformations with a specific, post-totalitarian political change (Hampl 2007). Second, we investigate and compare the spatial patterns of poverty and social exclusion indicators on the one hand, and economically lagging rural areas in Czechia and Hungary on the other. Third, we analyse peripherality through the perspectives of settlement structure, transport accessibility and demographic change. The article concludes by discussing the similarities and differences in patterns of social disadvantage and peripherality.

Peripheralisation in Central Europe

Research on peripheries and the peripheralisation process reveals an ambiguity of definitions, hindering the comparability of research results across countries. These differences stem not only from the conceptualisation of peripherality, but also from the spatial scale on which peripheries are explored. Generally, peripheries' emergence and persistence are part of a more general spatial polarisation process. A comparison can be drawn between successful and growing metropolitan areas as development cores, and peripheries in terms of declining regions in a dependent position, or with deteriorating economic and social conditions. Scientific studies place different emphases on the individual facets of this process, thus using different approaches to delimit peripheries. They either emphasise the geometric aspect of peripherality as it relates to poor accessibility (Novotný et al. 2015), or its relational nature. Peripheries are too loosely related to centres providing jobs (Sýkora–Mulíček 2009), or largely depend on them and face potential discrimination from the centre (Nolte 1991). Other contributions highlight the challenging economic situation and potential for economic development (Leibert 2013), or peripheries' social conditions and exclusionary effects on the population (Bihari–Kovács 2005, Musil–Müller 2008).

Recently, an academic debate has emerged regarding the dynamic aspects of the peripheralisation process, predominantly in German geography and sociology (Barlösius–Neu 2008, Keim 2006, Kühn 2015, Leibert–Golinski 2016). This approach strongly reflects on the former East Germany's territorial transformation, which had resulted in job loss, unemployment, and out-migration to western Germany. Rural areas were more severely affected by peripheralisation than cities (Steinführer et al. 2016). Against this empirical background, peripheralisation has been repeatedly conceptualised as a complex process, consisting of mutually reinforcing economic, social, and demographic factors resulting in a territory's decline (Keim 2006). All three factors are essential in the peripheralisation process, but simultaneously rein-

force each other. The decoupling of regions from the prevalent economic dynamics of prosperous urban agglomerations results in constrained labour markets in rural areas. Thus, challenges include the access to employment and limited employment choices particularly in rural regions. A vulnerable labour market is accompanied by unemployment, poverty, and social deprivation, contributing to local communities' deterioration. Out-migration and decreasing population can further reduce regions' economic potential and human capital, and can complicate the provision of public and private infrastructure and services. Consequently, a vicious circle of regional decline emerges to further consolidate the peripheries' structural deficits (Barlösius–Neu 2008) and downgrade one region relative to others (Kühn 2015). Although conceptualising the cumulative processes of regional decline theoretically relies on classical polarisation theories (Myrdal 1957), it also more strongly emphasises the quality of living conditions, wealth, demographics, and political interdependencies. Similar complex, vicious circles of regional decline have also been proposed in Czechia and Hungary to explain peripheralisation and the reproduction of core-periphery relations (Bihari–Kovács 2005, Musil–Müller 2008, Nagy et al. 2015b, Ouředníček et al. 2011, Pósfai–Nagy 2017, Virág 2006).

Many studies have mapped the spatial patterns of peripheries in individual countries (Musil–Müller 2008, Pénzes 2013a) and described not only the economic problems of peripheries (Leibert 2013), but also peripheral regions' demographic dynamics (Leibert 2016), social conditions and problems (Bernard et al. 2016). Aside from these general challenges, numerous studies have focused on the specific problems of peripherality associated with employment and commuting (Alpek et al. 2016, Hardi 2015, Pálóczi 2016, Pénzes 2013b) as well as with consumption and services (Nagy et al. 2015a), or on the role of borders (Hardi 2015). In Czechia, Musil and Müller (2008) coined the term 'inner periphery' to describe areas with the worst social conditions and living standards, located predominantly on regional borders. Novák and Netrdová (2011) later found a similar spatial pattern of areas in decline. Further, Bernard and Šimon (2017) differentiated multiple types of peripheral areas in Czechia, arguing that previous studies had failed to distinguish between different forms of disadvantage in peripheries.

Several Hungarian papers have focused on the differentiation between forms of peripheralisation. A series of studies edited by Kanalas and Kiss (2006) defined several forms of core-periphery relations, such as geographical, economic, or social aspects and power relations. These investigations distinguished between different types of inner peripheries and other peripheral areas located along Hungary's border. Nemes Nagy's (1996) earlier works presented similar results in an examination of core-periphery relations after 1990.

Only a few of these studies were comparative in nature, and works by Pénzes (2013a), Egri and Tánczos (2015), or Novotný et al. (2015) on Central Europe's

peripheral areas are particularly remarkable. Pénzes (2013a) demonstrated that Central European countries' regional transformations exhibit several common aspects. One of these involves the strengthening of capital cities' economic dominance, the converse of which has been the economic downturn in various regions. On the one hand, negative peripheralisation processes have been recorded in regions affected by structural economic problems and in strongly industrialised regions in particular. On the other hand, traditionally economically weak territories (especially remote rural areas) have further weakened. The ongoing weakening of these traditionally rural regions indicates the formation of a new type of regional disadvantage – in which economic and social marginalisation simultaneously occur – called either 'disconnected rural areas' (Lennert 2017) or 'regional ghettos' (Virág 2006) in Hungary.

Unexpectedly, the German debate on mutually reinforcing economic, social, and demographic peripheralisation processes has been only sparsely reflected in empirical research on peripheries in other post-communist Central European countries, with the exception of Bernard and Šimon (2017). Despite the theoretical formulation of vicious circles of cumulative regional disadvantage, empirical studies have failed to address whether the assumption of mutually reinforcing economic, social, and demographic factors holds true, resulting in the formation of peripheries affected by economic marginalisation restricted labour markets, unemployment, and poverty, and accelerated demographic changes. Evidence even exists that these processes can, in fact, be decoupled from each other. Bernard and Šimon (2017) demonstrated that Czechia has four different types of disadvantaged rural areas: 1. rural peripheries characterised by low qualifications, lower living standards, and the absence of a middle class; 2. peripheries with an increased risk of social exclusion; 3. peripheries with poor accessibility; and 4. peripheries facing demographic challenges. These four types of peripheries overlap rather weakly.

Data and methods

Logic and flow of analyses

Peripheralisation includes three interrelated aspects as highlighted in this paper's theory: social exclusion, manifesting as increased poverty or social vulnerability; certain areas' general economic weakness, mostly related to labour market conditions; and decreased populations, resulting in an unbalanced population structure. First, we use the same set of indicators for both Hungary and Czechia to map the spatial patterns of areas facing problematic, constrained labour markets with low economic opportunities, and areas distinguished by increased unemployment, poverty, and social exclusion. Secondly, we investigate the extent to which these two types of disadvantaged areas overlap, and we examine these areas' population dynamics. The analysis was conducted on a detailed spatial level using LAU 2 units:

6,251 in Czechia and 3,154 in Hungary. As peripheralisation processes operate at different spatial levels, they affect different-sized regions. Using small units enabled us to reveal the resulting spatial patterns of peripheralisation outcomes, including the clustering of peripheral areas within larger regions.

Analysing the socioeconomic manifestations of peripheralisation implies several considerations that must be taken into account when choosing tools to investigate and interpret evidence. One consideration is that social systems' dysfunctions – as generators of processes leading to the exclusion of certain social groups from their relationships with society – are often marked by a clear spatial manifestation (Madanipour et al. 2015, Nagy et al. 2015b). Another consideration is that while these manifestations illustrate peripheralisation's different dimensions, they are also multidimensional, which implies that multiple indices should be chosen to explore the characteristics of peripheralisation. Thus, a principal component analysis (PCA) was used as a dimensionality reduction tool and translated the studied phenomenon's multidimensional features into single measures, which were easier to compare and interpret. The PCA is commonly used in research on area-level disadvantage and deprivation to create composite indices that can be included in statistical models (Kearns et al. 2000, Koós 2015, Messer et al. 2006).

The comparison of the PCA model's results between the two countries was further advanced by considering how the investigated aspects of peripheralisation relate to different spatio-structural characteristics. As a part of this analysis, we investigate the interrelations between the types of disadvantages represented by different components and the settlement structure, transport accessibility, and population development in each country. We anticipate not only that the spatial distribution of social exclusion and labour market constraints would exhibit regional specificities, but also that a position in the settlement structure might characterise how peripheralisation affects different territorial units. Therefore, the PCA's results are examined using a cross-section of municipalities' population size categories. Further, the distance from/access to more central parts of the settlement structure might shape spatial patterns of social exclusion and the labour market. As services and opportunities are selectively concentrated in urban centres, these are more available to – and accessible by – populations living in proximal areas. Thus, living in poorly accessible areas might lead to socioeconomic disadvantages due to the higher costs related to transport or the restricted access to urban services and opportunities. The lack of access to centres could enhance socioeconomic disadvantages and lead to peripheralisation, while accessibility patterns themselves could be regarded as indices of peripheries. This paper analyses Czech and Hungarian municipalities' accessibility to urban centres of different sizes (5,000–10,000–20,000 inhabitants) in a cross-comparison with the PCA's results. These results are further compared with selected demographic indicators to reflect the demographic challenges related to periph-

eralisation. This part of the analysis provides an insight into population development in areas affected by the socioeconomic aspects of peripheralisation.

Data description

The analysis involves socioeconomic indicators, those related to the settlement structure and demographic indicators (see Table 1). The data were selected at the municipality level (LAU 2) in both Czechia (n = 6,251) and Hungary (n = 3,154) by using 2011 as the reference year. The period between 2001 and 2011 was used in the case of dynamic variables. The primary sources for data collection included Czech and Hungarian census databases, as these datasets provide the widest range of socioeconomic variables and represent each country's entire population at a low administrative level. The income measures incorporated data from other sources: the Czech Ministry of Finance and the Hungarian National Tax and Customs Administration database.

Variables related to the socioeconomic aspects of peripheralisation

A pool of potential indicators of peripheralisation was collected to cover two dimensions of disadvantage. The first reflects the aspects of constrained labour markets, with little innovation, poor income opportunities, low-skilled jobs, and above-average agricultural employment. The second reflects the aspects of poverty and social exclusion among marginalised population groups, including unemployment, early school leaving, poor education, and low-quality housing. We explicitly limited the number of indicators to cover some basic aspects of the concepts under study.[1]

Indicators of settlement structure and transport accessibility

Patterns of socioeconomic disadvantage are influenced by their position within the settlement structure. Two types of such measures were considered: 1. the municipality's size; and 2. its accessibility to the nearest urban centre. Municipality size categories are represented using the number of inhabitants, with thresholds of 200–500–2,000–10,000–100,000 inhabitants and the capital city. Instead of the settlements' legal status, municipality size was selected to ensure comparability, as no legal difference exists between villages and towns in Czechia, and their role and function in the settlement structure predominantly depend on their size.

Transport accessibility to the nearest urban centre refers to the difficulties in accessing services and (employment) opportunities as a result of the growing distance

[1] This approach is explicitly deductive. A limited number of indicators were selected to express important aspects of previously defined theoretical concepts, similar to the process of developing various area-level deprivation indices (e.g. Kearns et al. 2000, Messer et al. 2006). Approaches based on including a broader range of indicators (e.g. Novák–Netrdová 2011) proceed inductively, aiming to investigate existing socio-spatial patterns in an explorative way. A deductive, theory-driven approach seems more reasonable for our analysis, in which the peripheralisation theory represents a theoretical point of departure.

from towns and cities. The multiplicity of services and infrastructure that people commonly access – such as jobs, healthcare, education, and shopping – was operationalised to a simple model based on the accessibility of cities of three different sizes, allowing for direct, cross-national comparisons. Towns and cities with population sizes of 5,000+, 10,000+ and 20,000+ were selected as centres of accessibility for services (Hungary: $n_{5,000} = 278$, $n_{10,000} = 142$, $n_{20,000} = 61$; Czechia: $n_{5,000} = 256$, $n_{10,000} = 130$, $n_{20,000} = 62$). Further, every service has a catchment area that depends on a minimum number of users required for a service to be run both effectively and in an economical manner. Three different sizes were selected as approximations of differences in particular services' catchment areas. We opted for a lower-level urban hierarchy, as smaller cities contain most of the basic everyday services used by the population in everyday life. This decision was further supported by the fact that most of the travel for services occurs over short distances, or typically within a 15-minute drive. The accessibility model is based on the actual road network, and it measures the travel distance[2] from every municipality to each site's closest centre of accessibility. The method for shortest path accessibility measurement reflects the rational decision to visit the closest service available.[3] The index of accessibility measures how many kilometres one must travel from a municipality to reach the closest urban centres for three defined sizes in every Czech and Hungarian municipality.

Demographic indicators

The goals of this study involve investigating how socioeconomic disadvantage and peripheralisation processes relate to population dynamics as well as the resulting population structure imbalances in Czechia and Hungary. Several demographic indicators were selected to answer this question and were analysed in a cross-section of socioeconomic disadvantage as caused by peripheralisation: age structure, gender balance, and the components of population change.

[2] Measurements could be improved by replacing travel distance indices with travel time indices; however, we did not have comparable datasets for both countries to allow for such an analysis. The analysis using travel distance indices is sufficiently robust to answer this study's research questions.

[3] As the accessibility model was computed only for urban centres within a country, it was not sensitive to possible centres of accessibility beyond a country's boundaries. Although the model only approximates reality, we are convinced that it is robust enough to capture the basic differences between municipalities with good, average and poor accessibility. The model's key added value is that it applies the same data and identical variables to delimit spatial accessibility in both Hungary and Czechia. Further, the grouping of three different centre sizes in Hungary and in Czechia is similar, thus supporting the results' comparability.

Table 1

Indicators used in the comparative analysis of peripheralisation in Czechia and Hungary

Indicator	Measure	Source	Year/ Period
A) Variables related to constrained labour markets			
Share of the employed in occupations (ISCO 1–2), aged 25–50	Per cent	Czech Statistical Office (ČSU)/ Hungarian Central Statistical Office (HCSO) census database	2011
Share of inhabitants with completed secondary (ISCED 3–4) or tertiary (ISCED 5–8) education employed in occupations for which completed secondary (ISCO 7+) or tertiary education (ISCO 4+) is typically not required[a)]	Per cent	ČSU/HCSO census database	2011
Share of economically active persons employed in agriculture (NACE Rev. 2)	Per cent	ČSU/HCSO census database	2011
Average monthly income from employment	CZK/HUF	Czech Ministry of Finance/ Hungarian National Tax and Customs Administration database	2011
B) Variables related to poverty and social exclusion			
Share of the unemployed in the number of economically active inhabitants	Per cent	ČSU/HCSO census database	2011
Share of the youth aged 18–24 out of education (Eurostat methodology)[b)]	Per cent	ČSU/HCSO census database	2011
Share of inhabitants aged 25–50 with elementary education (ISCED 0–2)	Per cent	ČSU/HCSO census database	2011
Share of occupied dwellings without comfort	Per cent	ČSU/HCSO census database	2011
C) Variables related to the settlement structure			
Municipality size categories by population	Inhabitants	ČSU/HCSO census database	2011
Accessibility to the nearest urban centres	Kilometres	Country road network	2011

(Continued on the next page.)

(Continued)

Indicator	Measure	Source	Year/ Period
D) Demographic variables			
Share of inhabitants aged 65+	Per cent	ČSU/HCSO census database	2011
Share of inhabitants younger than age 15	Per cent	ČSU/HCSO census database	2011
Female/male ratio in the 20–30-year age group	Per cent	ČSU/HCSO census database	2011
Relative population change	Per cent	ČSU demography database/ HCSO census database	2001–2011
Average yearly rate of natural increase	1,000 inhabitants	ČSU demography database/ HCSO census database	2001–2011
Average yearly gross migration rate	1,000 inhabitants	ČSU demography database/ HCSO census database	2001–2011

a) Over-qualification is traditionally measured as the years of education required for a job and the years spent in education (Brynin–Longhi 2009). Our case measured the educational degree obtained and compared it to the educational degree required, or that held by most employees with the same occupation. Given the rough categorisation of occupations using the ISCO's one-digit classification, the indicator should be understood as an approximation.

b) Early leaver from education and training refers to a person aged 18 to 24 who has completed, at most, an ISCED-2 educational level, and who is not involved in further education or training. See https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Early_leaver_from_education_and_training

Note. ISCED – International Standard Classification of Education; ISCO – International Standard Classification of Occupations; NACE – Statistical Classification of Economic Activities in the European Community.

The use of census data in the analysis partially guarantees the Czech and Hungarian cases' comparability. Regarding the European Union's 2011 population and housing censuses, European legislation has defined a high level of harmonisation regarding variables and data to be collected (Eurostat 2011). The Czech and Hungarian data's comparability has further improved by using international standards in the classifications related to economic activities (NACE Rev. 2), occupations (ISCO-08), and qualifications (ISCED 2011). Harmonisation issues have primarily affected housing and income data. Czech and Hungarian data related to low-comfort housing refers to slightly different types of housing standards. As these are complex measures, different combinations of vulnerabilities related to the availability of different types of housing amenities can be regarded as meaningful in each case. Therefore, the two countries' national standards are considered in denoting the two countries' housing disadvantages. The indicator of income from employment is suitable only for an indirect comparison, such as comparing the two countries' inequalities. In Hungary's case, this indicator was calculated by dividing the gross taxable income from employment by the number of income tax-payers, which refers to a wider population pool, in the absence of published data on the direct number of taxpayers based on income from employment. Regarding the Czech income data, the data provided by the Ministry of Finance have only covered employees who

processed their tax returns by themselves (approximately one-third of the employed population).

Analysis

Indices of disadvantage

The first set of variables (see Table 1, Part A) was used to produce an index characterised by high values in areas affected by constrained labour market conditions, with limited economic opportunities for the local population. The poverty and social exclusion index is based on the second set of variables (see Table 1, Part B). Both sets of variables correlate fairly well internally in both countries, although the correlations are generally higher in the Hungarian case; consequently, this indicates a stronger spatial overlap of different aspects of disadvantage in Hungary than in Czechia. The first principal component obtained by the PCA for each variable set was retained for further analyses. This component represents the unique linear combination accounting for the largest possible variation proportion of the underlying variables.[4] Tables 2 and 3 present the results of the PCAs of both datasets for both countries.[5]

Table 2

PCA results – Constrained labour markets, 2011

PCA result	First component loading	
	Czechia	Hungary
Share of the employed in occupations ISCO 1–2, aged 25–50	–0.84	–0.88
Share of overqualified, employed inhabitants	0.68	0.46
Share of the economically active employed in agriculture	0.57	0.61
Average monthly income from employment	–0.69	–0.82
Total variance explained (%)	49.10	51.00

[4] This study's deductive nature has led to separate analyses of the sets of variables, and in using the first principle component, which represents a major part of the underlying indicators' variation. A factor rotation would be more reasonable in an exploratory use of the factor analysis.

[5] We have controlled the resulting indices' robustness by comparing them to alternative composite scores, created by summing the underlying variables' normalised values. An extremely high correlation was found (r = 0.994 and 0.997 in the Czech case; r = 0.990 and 0.999 in the Hungarian case), indicating the indices' strong consistency.

Table 3

PCA results – Poverty and social exclusion, 2011

PCA result	First component loading	
	Czechia	Hungary
Unemployment rate	0.74	0.81
Early school leavers	0.70	0.87
Share of inhabitants aged 25–50 with elementary education	0.79	0.92
Share of occupied dwellings without comfort	0.50	0.79
Total variance explained (%)	47.60	71.20

Hungary's larger explained variance in the poverty and social exclusion index than in Czechia is an outcome of the latter's less inter-correlated variables, indicating fewer overlapping spatial patterns of different poverty and exclusion symptoms than in Hungary. Poor-quality housing, represented by the 'share of dwellings without comfort', is particularly weakly related to the other measures of disadvantages in Czechia. The resulting component scores were saved and used as index values in all subsequent analyses. Maps for both countries (see Figures 1 to 4) present the spatial distribution of both composite indices.

Tables 4 and 5 illustrate the mean values of the underlying indicators in areas represented by the highest, average, and lowest terciles of both composite indices. The results document remarkable differences between both countries' well and poorly performing areas. On average, approximately half share of people with highly qualified occupations live in poorly performing areas in terms of labour market constraints, compared to well-performing areas. Nearly twice as many residents experience over-qualification – or have higher education than normally necessary for their job – in low-performing areas. More than three times more people are employed in agriculture, and the average gross wages are approximately one-third lower than wages in well-performing areas. Despite the overall slightly worse situation in Hungary, the intra-country differences are remarkably similar for both countries; territorial differences in poverty and social exclusion are more pronounced. The unemployment rate in poorly performing areas is approximately twice as high as in well-performing areas, with four times more youth leaving school early, and three times more middle-aged residents with only an elementary education. Moreover, Hungary's poorly performing areas in terms of high poverty and social exclusion have more low-quality housing.

Figure 1

Index of disadvantage – Constrained labour market in Hungary, 2011

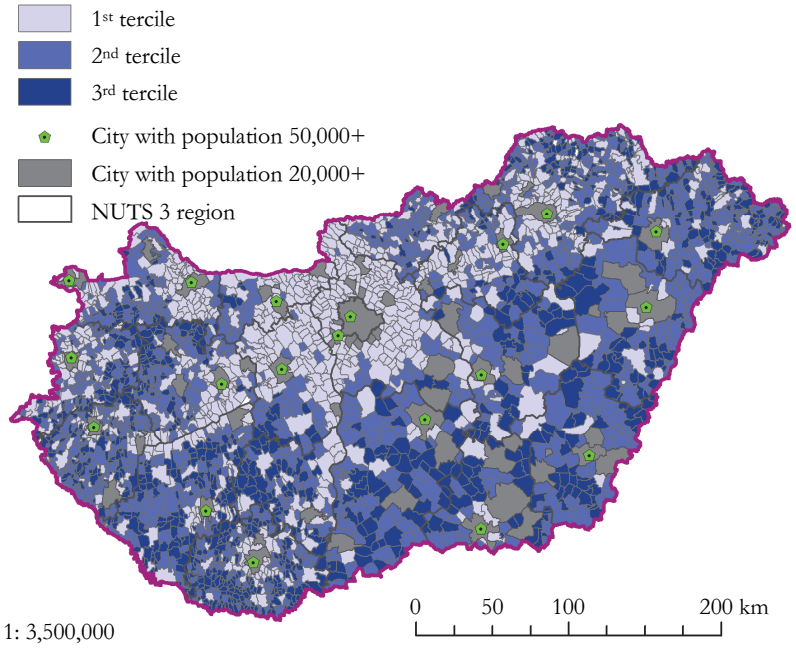


Figure 2

Index of disadvantage – Constrained labour market in Czechia, 2011

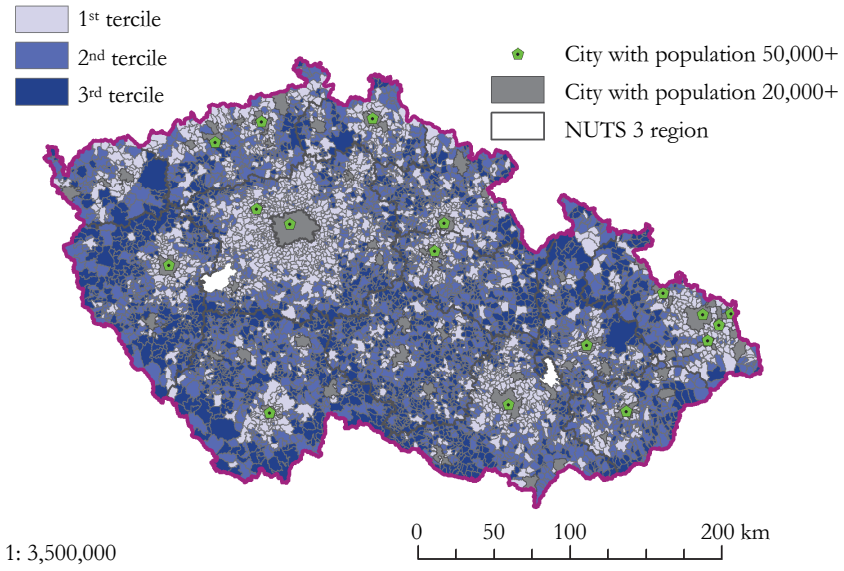


Figure 3

Index of disadvantage – Poverty and social exclusion in Hungary, 2011

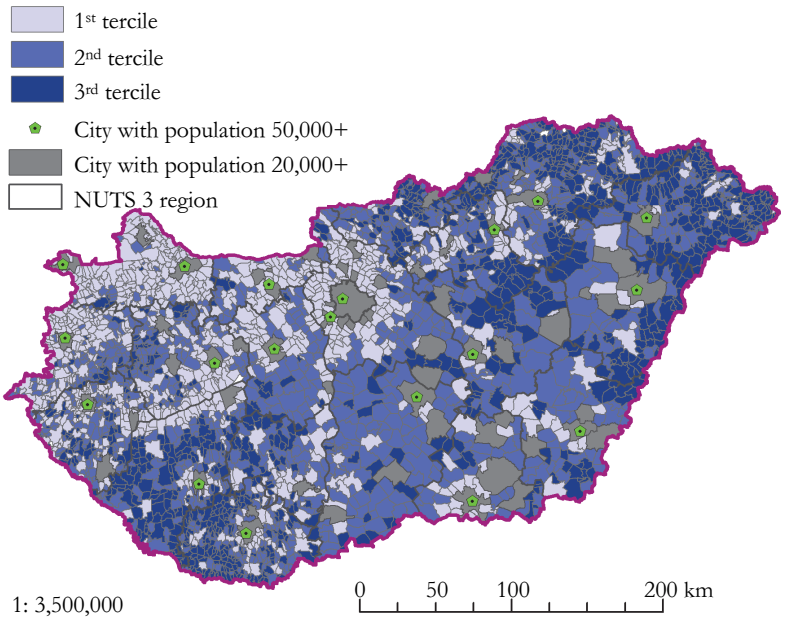


Figure 4

Index of disadvantage – Poverty and social exclusion in Czechia, 2011

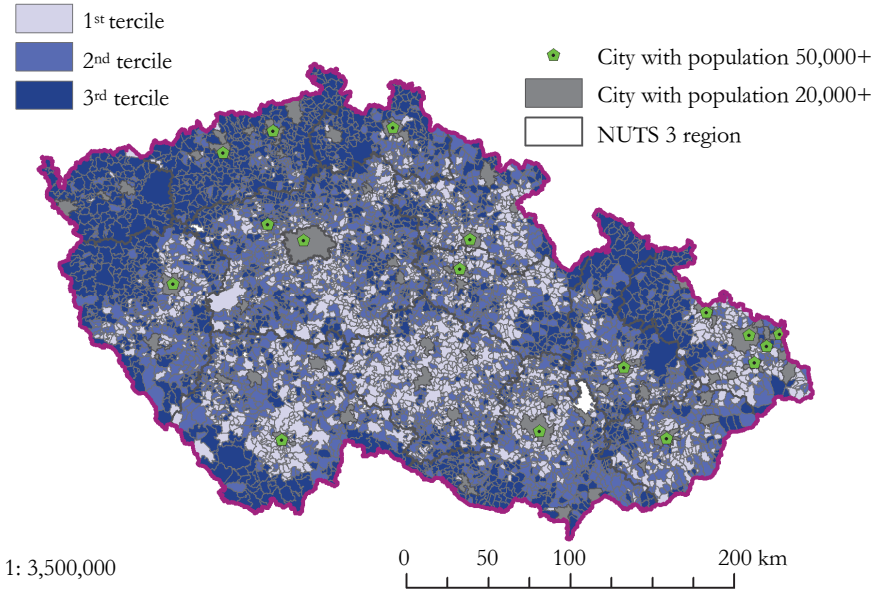


Table 4

Mean values of underlying variables in different areas according to the terciles of the composite index 'constrained labour markets', 2011

Area according to the 'constrained labour markets' composite index	Share of the employed in occupations ISCO 1–2, aged 25–50, %	Share of overqualified employed inhabitants in population, %	Share of the economically active employed in agriculture, %	Average monthly gross wage, EUR
Czechia				
Well-performing	23.6	15.5	4.6	1,146.40
Average	16.1	20.7	8.1	860.50
Poorly performing	11.0	27.3	14.4	756.60
Hungary				
Well-performing	18.6	24.1	4.8	472.20
Average	11.1	28.0	9.4	373.40
Poorly performing	6.8	32.4	16.7	302.20

Table 5

Mean values of underlying variables in different areas according to the terciles of the composite index 'poverty and social exclusion', 2011

Area according to the 'poverty and social exclusion' composite index	Unemployment rate, %	Share of early school-leavers in population, %	Share of inhabitants aged 25–50 with elementary education in population, %	Share of occupied dwellings without comfort, %
Czechia				
Low exclusion	7.1	2.6	4.1	4.7
Average exclusion	9.9	5.5	6.4	6.4
High exclusion	14.3	12.3	12.5	8.6
Hungary				
Low exclusion	9.6	8.2	13.1	6.1
Average exclusion	14.4	16.3	24.1	12.9
High exclusion	24.5	34.9	42.2	24.0

Indices of disadvantage within the settlement structure

The mean component scores by population size indicate remarkable systematic differences (see Table 6). The constrained labour market indicator in both countries documents a clear, expected pattern, with the settlements' size positively related to the labour market situation. Specifically, the smallest settlements experienced the least favourable labour market situation. In the case of poverty and social exclusion, only Hungary's relationship with population size is pronounced.

Table 6

Mean component scores by settlement population category, 2011

Population category (LAU 2)	'Constrained labour markets' composite index		'Poverty and social exclusion' composite index	
	Czechia	Hungary	Czechia	Hungary
0–200	0.447	0.536	0.077	0.496
201–500	0.149	0.438	0.070	0.227
501–2,000	–0.256	–0.022	–0.106	–0.036
2,001–10,000	–0.618	–0.497	–0.071	–0.328
10,001–100,000	–0.958	–1.360	0.003	–0.793
100,001+	–1.751	–2.236	–0.107	–1.066
Capital city (Prague/Budapest)	–2.862	–3.513	–0.503	–1.169

Spearman's correlation was computed to statistically assess the relationship between population size and component scores (see Table 7). A statistically significant ($p < 0.05$), negative correlation was found in every case, verifying the importance of municipality size. However, it should be noted that this correlation is always weaker in Czechia than in Hungary, with an especially striking difference in the correlation between municipality size and social exclusion (–0.0299 in Czechia and –0.2860 in Hungary). This correlation reflects this relationship's factual insignificance in Czechia, and points to a more socially polarised Hungarian settlement structure. The intercountry differences are smaller in the case of the constrained labour market indicator (–0.3715 in Czechia and –0.4497 in Hungary).

The correlation matrix also reveals the interplay of the socioeconomic aspects of peripheralisation as well as its country-specific nature. The correlation between the two composite indices was positive in both cases, indicating that the constrained labour market index score increases as the poverty index increases; however, Czechia exhibits a weak correlation between social exclusion and a constrained labour market (+0.2285), indicating that these two aspects of peripheralisation may be spatially separated. In a Czech municipality with constrained labour market conditions, the high probability of poverty and social exclusion cannot be directly predicted, as most rural villages struggling with limited job availability cannot be grouped with areas of increased poverty and unemployment. Thus, peripheralisation's economic and social aspects are spatially decoupled from each other in Czechia.

A stronger spatial overlap of different aspects of peripheralisation can be observed in Hungary, which is reflected in the higher correlation coefficient (+0.6288). Thus, areas in Hungary with increased poverty in many cases are rural villages affected by an underdeveloped labour market. Poor job availability, low economic innovation, and low qualifications closely connect to the spatial patterns of poverty, unemployment, and social exclusion.

Table 7

Relationship between population size and component scores in Czechia and Hungary (Spearman's correlation matrix), 2011

Category/index	Category/index					
	Czechia (n = 6,229)			Hungary (n = 3,141)		
	Population category	'Poverty and social exclusion' composite index	'Constrained labour market' composite index	Population category	'Poverty and social exclusion' composite index	'Constrained labour market' composite index
Population category	1.0000			1.0000		
'Poverty and social exclusion' composite index	–0.0299*	1.0000		–0.2860*	1.0000	
'Constrained labour market' composite index	–0.3715*	0.2285*	1.0000	–0.4497*	0.6288*	1.0000

* $p < 0.05$.

Disadvantage indices from the accessibility perspective

Spatial accessibility measures the access to services and opportunities provided in a limited number of places, such as urban centres. Thus, access to such centres is theoretically unequal by definition, and leads to disadvantage for the populations outside of such centres; however, an evaluation of any possible disadvantage cannot be performed solely using spatial accessibility measures. Various redistributive mechanisms, selective population mobility, and technological developments in contemporary societies can significantly modify spatial accessibility's role in social disadvantage, and thus, can mitigate or even negate poorer spatial accessibility's effects on disadvantage. The actual link between spatial accessibility and disadvantage *de facto* demonstrates the strength and effectiveness of redistributive and inclusive mechanisms in society, and in preventing exclusion by transport accessibility.

This comparison reveals two important findings. First, the key difference between rural areas in Czechia and Hungary is that in the former they are generally closer to urban centres than in the latter (see Table 8). This difference in the structure of settlement systems shapes the access to the services and infrastructure con-

centrated in cities and towns (see Figures 5 and 6). Thus, prevalent remote rurality can ignite more exclusion due to a lack of access to opportunities. Second, urban centres' accessibility affects the two dimensions of disadvantage more in Hungary than in Czechia. Regarding poverty and social exclusion, a clear link exists between transport accessibility and social exclusion in Hungary (R^2 = 0.208). In contrast, the link between social exclusion and accessibility is low in Czechia (R^2 = 0.053), and four times weaker than in Hungary. The disadvantage stemming from constrained rural labour markets relates to transport accessibility in similar ways in both Czechia (R^2 = 0.190) and Hungary (R^2 = 0.208). The smallest municipalities in Hungary (0–200 inhabitants) are excluded more often, even when they are relatively close to urban centres. Generally, Hungarian localities' transport accessibility matters regarding citizens' chance to be affected by social or economic disadvantage more than in Czechia; however, this difference is driven far more by the dimensions of social exclusion and poverty than by a constrained rural labour market.

Table 8

Dimensions of disadvantage in the accessibility framework, 2011

Area category	Index of accessibility, km	Czechia			Hungary		
		Share of the area category in the total area of the country, %	Mean value of the index of disadvantage	Standard deviation	Share of the area category in the total area of the country, %	Mean value of the index of disadvantage	Standard deviation
Poverty and social exclusion							
Urban areas	0	3.6	–0.18	0.68	2.3	–0.88	0.48
Suburban areas	1–30	41.5	–0.15	0.86	20.8	–0.52	0.64
Close rural areas	31–60	45.9	0.03	0.99	41.6	–0.09	0.86
Rural areas	61–90	8.4	0.58	1.42	28.0	0.33	0.99
Remote rural areas	91+	0.6	1.34	1.67	7.3	1.03	1.42
Constrained rural labour markets							
Urban areas	0	3.6	–1.07	0.84	2.3	–1.66	0.89
Suburban areas	1–30	41.5	–0.35	0.99	20.8	–0.67	1.03
Close rural areas	31–60	45.9	0.27	0.86	41.6	0.07	0.83
Rural areas	61–90	8.4	0.68	0.85	28.0	0.42	0.76
Remote rural areas	91+	0.6	0.75	0.73	7.3	0.42	1.11

Figure 5

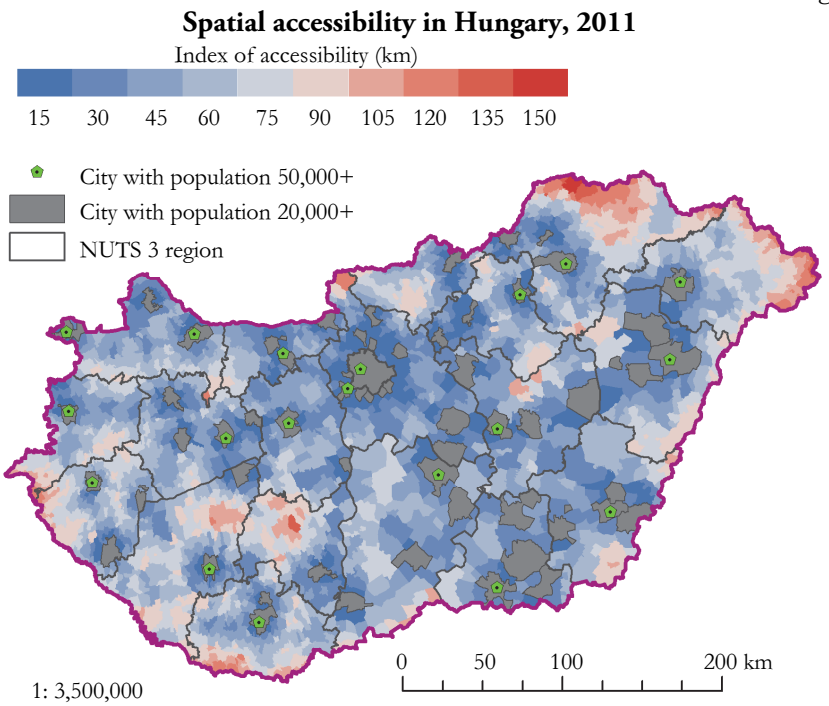
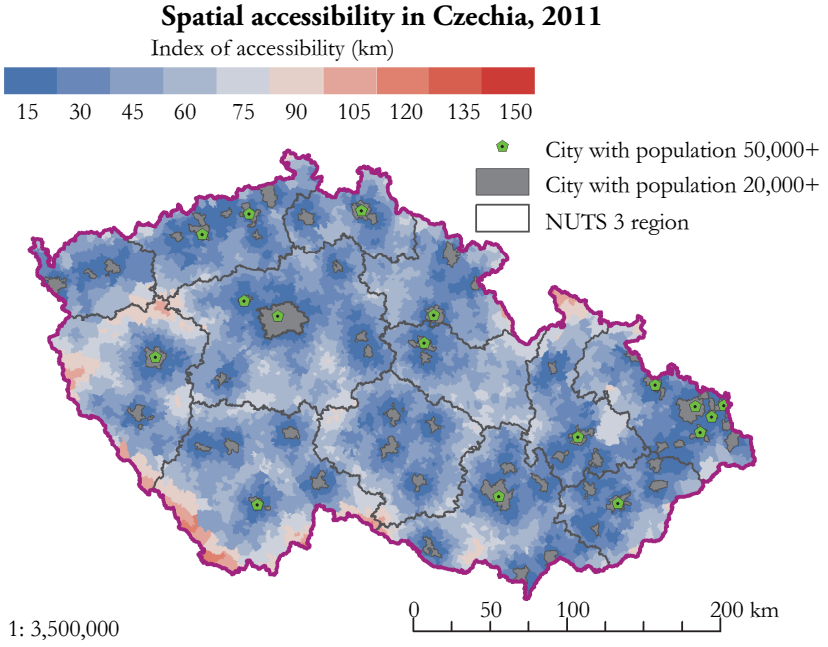


Figure 6



Disadvantage and demographic change

The investigation of demographic trends provides some insight into how the socio-economic aspects of peripheralisation are associated with a population's decline. The demographic trends in the two countries provide distinct profiles. While several central and eastern European Union member states have higher rates of population decrease – such as Croatia, Bulgaria, and the Baltic states – it is Hungary where the phenomenon of population loss has been present for the longest time, since the early 1980s (Monostori et al. 2015). In contrast, Czechia is one of three Central European countries – together with Slovakia and Slovenia – that still have positive population dynamics (EC 2015) driven by immigration from other countries.

Although the national demographic characteristics might differ, intra-country differences reveal structural similarities. Age structure indicators or the share of old and young age groups, demonstrate small differences between Czechia and Hungary (see Tables 9 and 10). The terciles of previous analyses' component values decompose the overall trends into specific territorial tendencies. While higher constraints regarding labour markets are associated with a higher share of older age groups in both Czechia and Hungary, the share of the population younger than age 15 is only higher in areas of Hungary that are more vulnerable to the socioeconomic disadvantage index. Regarding the index representing poverty and social exclusion, poor performance in the underlying indicators seems to be insignificant in shaping the age structure in Czechia, while the Hungarian figures indicate a higher vulnerability to poverty and exclusion that parallels a lower share of older age groups and a significantly higher share of younger age groups. This potentially signals the Roma population's disadvantaged position.

Female/male ratios in the 20- to 30-year age groups are generally higher in Czechia than in Hungary. The overall figures demonstrate that typically fewer women than men are in these age groups in both countries. The only exception relates to the group of areas in Czechia with low labour market constraints, as this group has a higher ratio of females in the population. This underlines the sex-selective nature of mobility by noting the higher mobility of women in younger age groups (Leibert 2016), and especially when facing labour market constraints. In Hungary, both components of socioeconomic disadvantage reveal that while female/male ratios in the 20- to 30-year age groups might be higher in areas with better performance, this is also true of the groups of areas with the highest disadvantage regarding labour market constraints or vulnerabilities to poverty and social exclusion (see Tables 9 and 10).

Table 9

Mean values of demographic variables in different areas according to the terciles of the composite index 'constrained labour markets', 2011

Area category	Share of inhabitants aged 65+, %	Share of inhabitants younger than 15, %	Female/ male ratio in the 20- to 30-year age groups, %	Relative population change, 2001–2011, %	Average yearly rate of natural increase, 2001–2011, 1,000 inhabitants	Average yearly gross migration rate, 2001–2011, 1,000 inhabitants
Czechia						
Well-performing	15.2	15.6	101.7	18.8	–0.5	15.7
Average	16.0	15.0	98.4	6.2	–1.4	6.8
Poorly performing	16.7	14.5	95.8	2.7	–2.2	4.2
Hungary						
Well- performing	17.5	14.8	92.3	0.4	–5.4	5.7
Average	18.0	15.1	89.6	–7.9	–6.7	–1.2
Poorly performing	18.7	15.8	93.6	–11.9	–6.9	–5.1

Table 10

Mean values of demographic variables in different areas according to the terciles of the composite index 'poverty and social exclusion', 2011

Area category	Share of inhabitants aged 65+, %	Share of inhabitants younger than 15, %	Female/ male ratio in the 20- to 30-year age groups, %	Relative population change, 2001–2011, %	Average yearly rate of natural increase, 2001–2011, 1,000 inhabitants	Average yearly gross migration rate, 2001–2011, 1,000 inhabitants
Czechia						
Low exclusion	15.9	15.4	99.6	12.9	–0.9	11.1
Average exclusion	16.2	14.9	98.2	8.6	–1.5	8.5
High exclusion	15.7	14.9	98.3	6.2	–1.7	7.2
Hungary						
Low exclusion	18.1	14.0	92.0	–0.3	–6.2	5.9
Average exclusion	18.9	14.0	91.0	–9.0	–7.5	–1.4
High exclusion	16.8	17.9	93.2	–10.1	–4.8	–5.3

The population change – such as a natural increase or decrease, or migration – indicates a significant interrelationship with the analysed peripheralisation factors. The investigation of the population dynamics between 2001 and 2011 reveals that Czechia's overall population increase and Hungary's overall population decrease were incredibly selective depending on the regions' socioeconomic status. As anticipated, these demographic trends are more positive in groups of municipalities with fewer disadvantages in both labour market constraints and poverty and social exclusion. Somewhat opposite trends characterise the Hungarian municipalities regarding their rates of natural population change. In this case, groups of areas with the lowest values of natural decrease face the highest exclusion. These areas often overlap with concentration of the Roma population, in which birth rates and the ratio of children in the total population are often higher (Pénzes et al. 2013).

Discussion and conclusions

The development of peripheries in Czechia and Hungary does not correspond without difficulties to the German peripheralisation model, defined as mutually reinforcing economic and social problems and demographic decline. The analyses confirm that the peripheralisation processes proceed in a distinctly differentiated way in Hungary and Czechia. On the one hand, both countries include territories with constrained labour markets, located in rural areas with poor transport accessibility. Struggling rural communities tend to have low-qualification inhabitants, few skilled jobs, and lower income levels, and economically depend on agriculture at above-average levels. The accessibility problem is more urgent in Hungary than in Czechia, as the former has larger rural areas with poor access, while the latter has a denser, more evenly distributed network of small towns that partially eliminates any accessibility problems. On the other hand, the nature of peripherality differs between Hungary and Czechia. Czech rural areas with constrained labour markets are distinctly separated spatially from areas affected by poverty and social exclusion. Poverty, unemployment and social exclusion are not predominantly rural problems in Czechia, and do not strongly relate to poor accessibility. On the contrary, a majority of the affected territories are located in highly urbanised regions, which previously were economically oriented to heavy industry. In contrast, Hungary's rural areas with constrained labour markets more highly overlap with areas of social exclusion. The concurrent impact of labour market-related problems, poverty and social problems has led to the emergence of areas with complex issues, in which such socioeconomic problems meet the risk of transport-related exclusion. In light of these findings, Bernard and Šimon's (2017) argument regarding the existence of periphery types differentiated according to their prevailing social problems seems to be more valid for the Czech case.

The population dynamics in both countries are unevenly spatially distributed and clearly differentiated according to peripheralisation indicators; however, Czechia's population is not decreasing due to the nation's overall population growth, even in communities suffering from economic and social issues. Rather, a population stagnation has occurred in such municipalities. In Hungary, the periphery has experienced a clear depopulation process, primarily due to migration. Further, evidence exists of increased ageing among both countries' peripheries, although a relatively modest natural decrease due to higher birth rates has limited further ageing in Hungary's peripheries.

In conclusion, Hungary's peripheralisation more highly corresponds to the idea of interrelated and mutually reinforcing economic peripheralisation processes. These manifest as limited job supply in the labour market, an accumulation of poverty and social problems, and population shrinkage, which particularly affect remote rural localities. Several differences exist in the how two countries' peripheralisation has developed.

First, one important difference arises from both countries' historically formed settlement structures. Although both Hungary and Czechia have similar degrees of urbanisation, they differ in their rural municipalities' accessibility and their economic interconnections with cities. Czechia has a dense network of small and medium-sized towns that provide jobs and services for rural inhabitants. Such a network covers a majority of the Czech territory, while a similar condition applies to only part of the Hungarian countryside. In many of Hungary's rural areas, access to urban centres is more demanding, and daily commuting is not a reasonable economic strategy for their residents. The mutual enhancement of peripheralisation factors typically occur in such locales, resulting in the development of 'disconnected' rural areas (Lennert 2017) with co-mingled social and economic problems.

Second, distinct spatial patterns of ethnic composition have influenced the forms of peripheralisation. The Roma are among the most vulnerable groups in both countries in terms of social exclusion (Revenga et al. 2002, Sirovátka–Mareš 2006), the Roma population lives predominantly in urbanised areas in Czechia as a result of communist-era industrialisation and resettlement policies. The Roma in Hungary are primarily concentrated in rural, often inaccessible areas. Thus, the ethnic and spatial aspects of social exclusion reinforce each other and contribute to the rise of social problems in the peripheral countryside (Brown–Schafft 2003).

Third, differences in both countries' overall demographic development explain their diverse peripheralisation processes. In particular, Czechia's economic and social disadvantages are not accompanied by a marked population decline. The country's overall population growth and its population's strong tendency towards spatial deconcentration as documented by Šimon and Bernard (2016) and Ouředníček et al. (2013) have caused peripheral areas to stagnate in terms of population development.

In contrast, Hungary's long-term population decline is strong in disadvantaged peripheral areas.

This study illuminates the situation in the two countries while contributing to a more general question, focused on the extent to which peripheralisation processes are contextually dependent. Despite the fact that Czechia and Hungary share many structural similarities, have experienced similar political and historical developments in recent decades, and have similar economic situations, the two countries have far from identical spatial development, with remarkably distinct peripheralisation processes.

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Depopulation tendencies and territorial development in Lithuania

Vidmantas Daugirdas
Lithuanian Social Research Centre
Institute of Human Geography and Demography,
Lithuania
E-mail:
vidmantas.geo@gmail.com

Gintarė Pociūtė-Sereikienė
Lithuanian Social Research Centre
Institute of Human Geography and Demography,
Lithuania
E-mail: gintarei.pociutei@gmail.com

The depopulation process in Lithuania is rapid, and the gap between the centre and periphery in the country is increasing, which allows one region to grow and others to 'fight' for survival. The main demographic indicators show particularly unfavourable trends in sparsely populated territories (SPTs) and deviate markedly from the countrywide average. To confirm these statements, this study presents the changes in the demographic and socioeconomic situation in Lithuania during the period of restored independence. The authors place special emphasis on rural SPTs of the country, and use statistical data as the main instrument to present the tendencies of sociospatial development. The analysis shows that Lithuania is experiencing territorial polarisation, with the greatest gap being between the major cities and the regions in Southern and North-Eastern Lithuania. Additionally, the results indicate that in the meantime, the western and central regions became the 'generators' of demographic and socioeconomic problems due to increasing depopulation. The sharpest results of depopulation are the decline of social networks and, simultaneously, the growing number of social problems. This situation increases residents' social and territorial exclusion, meaning that institutions are receding from those who remain in rural peripheral regions, leaving them to fight the consequences of peripheralisation alone without any clear regional policy strategies.

Keywords:
depopulation,
socioeconomic decline,
sparsely populated territories,
peripheralisation,
Lithuania

Introduction

Analysing demographic trends in Europe over the past twenty years shows that the European countries have a balanced demographic development pattern, almost without a natural change in population. Some countries, such as Germany, Italy, Russia, Scandinavian countries, or Austria (Dax–Fischer 2018) used to compensate for the loss of residents by accepting immigration. Today, the issue of immigration is rather complicated, and the 'welcoming countries' are regulating immigration more strictly. Despite the examples of countries with growing populations, many European countries, and especially their rural territories, are experiencing demographic decline (Copus et al. 2011). The phenomenon of demographic, social, and economic decline and increasing inequality is especially evident in Central and Eastern European (CEE) countries (Kühn 2013, Kühn–Bernt 2013, Lang 2015, Leick–Lang 2018, Nagy–Nagy–Dudás 2016, Nemes Nagy–Tagai 2011, Smętkowski 2018, Kovács–Bodnár 2017, Ilcsikné Makra et al. 2018). Leick and Lang (2018, p. 214.) stress that '…complex economic-social-demographic dilemmas shape the future of regional economic development in these cases (bearing in mind CEE countries [the authors' supplement]), implying persistent, and mutually self-reinforcing, processes of social and economic marginalization, spatial, political and discursive peripheralization (...), and even stigmatization (...).' Therefore, depopulation in Lithuania is not unique, but rather part of a general phenomenon of territorial polarisation and depopulation in CEE. Due to historical circumstances, the CEE region is unique in the European context, with a significant influence on the current demographic and socioeconomic situation (Krisjane 2001; Nagy 2005, 2010). The essential political, economic, and social transformation from a planned to market economy in the early 1990s changed the demographic structure considerably due to decreasing birth rates, ageing, and growing out-migration (Bernt et al. 2012, Philipov–Kohler 2001, Sobotka et al. 2003). The demographic changes and growing problems in CEE countries occurred in all territorial units, but with growing inequality between the centres and peripheries (Raagmaa 1996, 2003; Churski et al. 2014); and the changes affect peripheral rural territories the most (Amcoff–Westholm 2007, Kriaučiūnas 2010). The rural areas that were home to many residents during the socialist period cannot offer jobs for all of its previous residents, keep the same standard of living, or provide the same infrastructure as before the 1990s; therefore, life in rural areas no longer satisfies residents (Pociūtė-Sereikienė et al. 2014). However, the process of depopulation and changes in the network of settlements in post-socialist countries were not unexpected and stand as natural processes arising due to the collapse of the Soviet Union.

The depopulation process in Lithuania is rapid, and the gap between the centre and periphery in the country is increasing, allowing one region to grow and others to 'fight' for survival (Ubarevičienė–van Ham 2017). The three biggest cities in

Lithuania – Vilnius, Kaunas, and Klaipéda – stand as national centres (Burneika et al. 2017) and compete on a global scale; the other bigger Lithuanian cities – Šiauliai, Panevėžys, and Alytus – function as regional centres, which are essential for inner Lithuanian territories (Pociūté 2014). Meanwhile, the rural territories are rapidly depopulating, leaving several socioeconomic problems for the remaining residents in the region to face (Daugirdas et al. 2013, Kriaučiūnas 2010, Kriaučiūnas et al. 2014, Pociūté-Sereikienė et al. 2014). Despite the number of previous studies, we still lack information about the territorial differences in depopulation in Lithuania. There is still a great need to research sparsely populated and problem regions (SPRs) that are closely connected with increasing disparities in quality of life, welfare, and territorial exclusion in the country. Research examining the topic of polarisation and the expansion of SPTs that study Lithuania is lacking in the scholarly literature. With this study, we aim to discuss the changes that occurred within Lithuania in detail, with a focus on the lower regional scale areas (LAU 1 units) of the country.

This study presents the changes in the demographic and socioeconomic situation in Lithuania during the period of restored independence, focusing on the SPTs of the country. It is an analytical work that is rather data-driven and based on an analysis of statistical information.

We start with a methodological section in which we define the problem of SPTs and explain the process of socioeconomic exclusion in depopulating and lagging regions. Furthermore, we discuss the general demographic and social tendencies in the country, with a focus on SPTs. The results section presents a summary of the demographic and socioeconomic changes and increasing polarisation in Lithuania during the last ten years, while pointing out the 'weakest' regions. We end the article with concluding remarks, wherein we summarise our observations and discuss the prospects of depopulating territories.

Methodological background

Understanding the problem of SPTs

The spread of SPTs has become a serious challenge for CEE societies. Even special regional policies or subsidies for SPTs do not help to keep inhabitants in depopulating regions (Copus–Dax 2010, Jauhiainen 2000, Gløersen et al. 2009). The dispersion of sparsely populated areas has direct links with depopulation tendencies and the decrease in the average population density. However, the problem of increasing SPTs is not new, especially in Northern European countries, whose main feature is low population density in peripheral territories (Gløersen et al. 2006, 2009). Another example of SPTs is the Aragón region (Comunidad Autónoma de Aragón) in Spain, one of the most sparsely populated regions in Europe (Escalona-Orcao–Díez-Cornago 2007). Bulgaria is another

country suffering from intensive depopulation (Mladenov–Ilieva 2012). Mladenov and Ilieva (2012) point out that depopulation in Bulgaria hit mountainous and border villages the most. Dozens of villages were excluded from the national settlement registry[1] in Bulgaria. These are only a few examples, but we might find SPTs in many more countries, too. In the countries in which SPTs are spreading, similar problems arise: increasing depopulation, youth emigration, unemployment, deterioration of infrastructure, and decrease in the number of enterprises and social facilities (Daugirdas et al. 2013, Escalona-Orcao–Díez-Cornago 2007, Gløersen et al. 2006, Mladenov–Ilieva 2012). These characteristics make younger residents unwilling to settle in peripheral rural territories. The European Union (EU) regional policy documents (Margaras 2016, NSPA 2009, European Commission 2004, etc.) and other scientific publications (for example, Daugirdas et al. 2013; Escalona-Orcao–Díez-Cornago 2007; Gløersen et al. 2005, 2006, 2009; ADE 2012; Zasada et al. 2013) define SPTs as territories whose population density ranges between 5 and 60 inhabitants per square kilometre. Following this definition, in most cases (except for cities), Lithuania could be considered a sparsely populated country (its average population density at the beginning of 2018 was only 43 inhabitants per square kilometre). Therefore, we suggest that while analysing SPTs, we ought to pay the greatest attention to the most sparsely populated areas (Daugirdas et al. 2013). For instance, we can take Northern countries as an example, where SPTs have population densities below 8–12.5 inhabitants per square kilometre (NSPA 2009). When identifying SPTs in the Northern countries, scholars also consider the dimension of the sparseness of settlements' net and social infrastructure, which has a close connection with the distribution of inhabitants: 'Sparsity characterises regions where extremely low population densities and dispersed settlement patterns create specific challenges for economic activity and public service provision. In other words, low regional population densities are not sufficient to characterise a region as "sparse". Sparsity occurs insofar as the combination of low population densities and dispersed settlement patterns lead to specific challenges for economic activity.' (Gløersen et al. 2005, p. 3.).

The Third Report on Economic and Social Cohesion (European Commission 2004, p. 30.) emphasises that SPTs are frequently located in outlying territories: '…peripheral areas, far from urban centres and main transport networks. Their isolation is often due to their topographical features (such as a mountain range) and they tend to have an ageing population, poor infrastructure endowment, a low level of basic services and income per head, a poorly qualified work force, and to be not well integrated into the global economy.' We could accept this description for Lithuania as well, but instead of mountain chains, we need to pay attention to

[1] Based on data from the last census of Lithuania, 4,201 settlements in Lithuania did not have any residents in 2011 (Statistics Lithuania 2018).

soil fertility, forests, and lakes because these are the essential factors for the appearance of SPTs in the country.

In Lithuania, we define SPTs as territories whose rural population density is below 12.5 inhabitants per square kilometre (Daugirdas et al. 2013). More than fifteen years ago, when we began to research this topic, there were only a few SPTs in the country (see Figure 6). Since the beginning of our research, we have focused on the average density of the rural population in the most sparsely populated municipalities (SPMs). We have maintained this research line to compare new and old data and to observe the changes in SPTs in Lithuania.

We divide the results of this study into two parts: 1. a general analysis of the change in demographic and social indicators and the summary of the calculations of demographic and socioeconomic indicators; 2. a discussion of the municipalities that are experiencing demographic and socioeconomic decline. Furthermore, we present the methodology underlying these calculations.

Determination of depopulation and regions that lag socioeconomically

The study follows a quantitative research methodology with a special emphasis on analysing selected statistical indicators. For this analysis, we use statistics collected from the Statistics Lithuania database (2018). To better uncover the territorial differences, we examine the municipal[2] level. However, our selection of indicators was restricted by the ability to access data at the municipal scale.

For our analysis, we use a methodology adapted from a defended PhD thesis (Pociūtė 2014). The aim of the research is to point out the 'weakest' municipalities by clustering them into groups according to the deviation from the Lithuanian average. This work is performed while analysing a wide range of demographic and socioeconomic statistical indicators[3]. We chose these research dimensions because the demographic changes in the analysed regions are accompanied by socioeconomic underdevelopment. We selected the 2006–2016 period for the analysis to show the changes taken place in the country in a ten-year period. Since the latest social statistical data are from 2016, it was selected as the final year to be examined. We composed the matrix of indicators according to the academic literature and indicators presented by scholars (Copus 2001; Dax–Fischer 2018; Gutiérrez–Urbano 1996; Haase et al. 2014; Janc 2006; Marada et al. 2006; Misiūnas–Svetikas 2003; Nagy 2005, 2010; Smętkowski 2018; Vaishar 2006) and legal

[2] According to the European statistical system (Eurostat), Lithuania is divided into several territorial levels: 10 regions as NUT 3 (in Lithuanian *apskritys*), 60 as LAU 1 (municipalities [*savivaldybės*]), and around 500 as LAU 2 (wards [*seniūnijos*]).

[3] The following indicators were selected for the analysis: 1. demographic indicators: population density, natural change, net migration, ageing index; 2. socioeconomic indicators: unemployment rate, proportion between recipients of social assistance benefits and all population, gross earnings, school network density, foreign direct investment, number of newly built apartments.

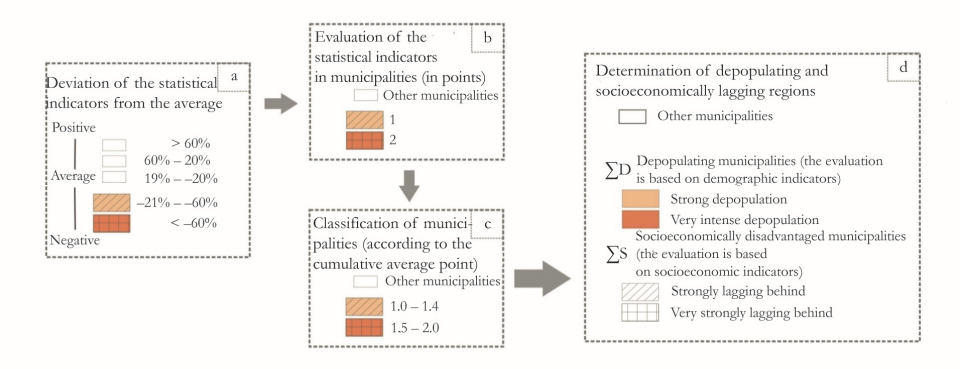
documents from the government of Lithuania (LR Vyriausybés 2003, National Regional Development Council 2017). We primarily focused on Pociūté's (2014) research and selected indicators. This work allowed us to choose demographic and socioeconomic indicators that best emphasise the regional differences in Lithuania. However, regional disparities may be studied in other ways too. With this study, we do not intend to point out that our evaluation is better than others are, but rather to provide a different approach to evaluation and present one more way to calculate and address the increasing polarisation of the country. We understand that the system of the selected indicators is rather subjective and greatly depends on our decisions as researchers to underline one issue or another.

To highlight the most prosperous, intermediate, and lagging territories, we divided municipalities into groups according to the deviation of their statistical indicators from the country's average (see Figure 1a), by equating the Lithuanian average to 0%. By the calculated percentage deviation from the Lithuanian average (0%), we classified all 60 municipalities of Lithuania into five groups. According to the resolution of the Government of the Republic of Lithuania (LR Vyriausybés 2003) and due to the desire to separate particularly lagging territories, we chose ±60% as critical margins for the most prosperous/troubled municipalities and ±20% margins for municipalities that were closest to the national average (both above and below average). Furthermore, two groups lay between the two types of margin points (from 20% to 60% and from –20% to –60%). In our case, we paid attention to two clustered groups of municipalities: those with the lowest indicator values (from –20% to –60% and below –60%, marked in darker and lighter orange in Figure 1a). We can thus determine the municipalities that are lagging the most.

After clustering municipalities into groups, we evaluated the two groups with the most negative indicator values (in points, see Figure 1b). Then we calculated the total points for both analysed years (2006 and 2016) and the cumulative average points (see Figure 1c). In order to examine only the municipalities with long-lasting problems, we gave points only to those municipalities that were clustered into the two excluded groups in 2006 and 2016. In the map presented in the results section (see Figure 9), we can see the municipalities having 1 to 2 cumulative average points; 2 is the maximum number of points showing the 'most negative' situation. Based on the cumulative average points, we can determine which regions are socioeconomically disadvantaged and depopulating the fastest (see Figure 1d).

Figure 1

Algorithm dividing Lithuanian municipalities (LAU 1) into clusters according to demographic and socioeconomic indicators



The trends in demographic changes in Lithuania

The depopulation in Lithuania started with the restoration of independence in the 1990s (Burneika 2012, Kriaučiūnas et al. 2014, Pociūtė-Sereikienė et al. 2014). However, the depopulation tendency emerged particularly after Lithuania's accession to the EU in 2004 (mainly due to the increase in emigration) (Kriaučiūnas 2010, Statistics Lithuania 2018). Sadly, one of the highest rates of depopulation in the EU remains in Lithuania: the decrease in residents was 2.7% in 2010, 1.4% in 2016 and 1.3% in 2017 (Eurostat database 2018). The causes of depopulation are apparent and similar to those of other countries: intensive emigration, low birth rates, and population ageing (Haase et al. 2014, Janc 2006, Kulcsár–Brown 2017, Pociūtė 2014, Smętkowski 2018). Lithuania is experiencing a demographic crisis. The result of this rapid depopulation is that the Lithuanian population in the last 25 years decreased by about 25%. According to Statistics Lithuania data (2018), 2,810,118 inhabitants lived in the country at the beginning of 2018, while in 1992, Lithuania had 3,746,400 residents (see Figure 2).

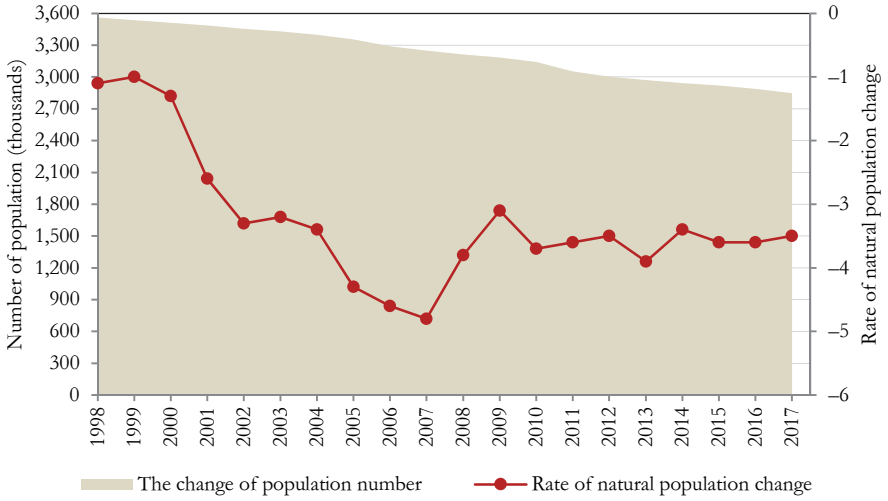
The demographic situation in the cities (except the capital, Vilnius) of Lithuania is declining and therefore similar to that in rural territories. The major difference between the shrinkage of rural and urban population is the reasons for the shrinkage. In the cities, the shrinkage is due first to emigration and suburbanisation. However, the population is growing in three exceptional municipalities in Lithuania: the Vilnius, Kaunas, and Klaipėda districts' municipalities (Burneika et al. 2017). These municipalities are growing at the expense of cities mostly due to the suburbanisation processes.

We can expect that the population will grow in and around metropolitan cities, but in SPTs and SPRs, it is hard to expect positive changes (Daugirdas et al. 2013).

There are two main reasons why we cannot expect population growth in peripheral areas in the near future: low birth rates and high emigration. According to official statistics (Statistics Lithuania 2018), natural reproduction in Lithuania has been negative for more than 20 years (see Figure 2). Therefore, all of Lithuania has very low fertility rates, especially in peripheral sparsely populated areas. In 2017, the birth rate was only 10.5%, and the rate of natural population increase was –3.5% in the country.

Figure 2

Decrease in Lithuanian population and fluctuation of the rate of natural population change

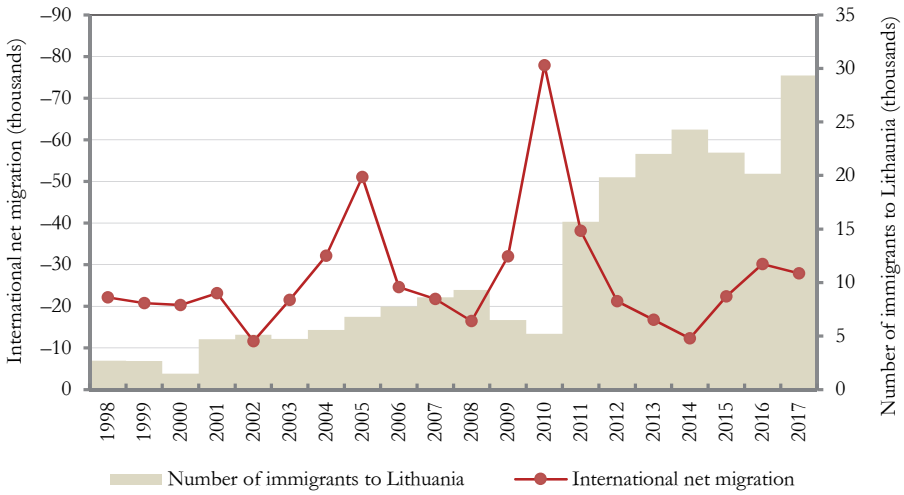


Source: Statistics Lithuania (2018).

The scale of emigration fluctuates but remains high. Last year, around 57,300 residents emigrated from Lithuania, while around 29,300 people returned or immigrated to the country (see Figure 3). Between 2001 and 2017, 699,124 residents left Lithuania, 109,243 (15.6%) of them were from SPMs (Statistics Lithuania 2018). During the same period, 217,691 residents immigrated to Lithuania, of which 27,460 (12.6%) moved to live in SPMs (Statistics Lithuania 2018). Due to such high emigration and low immigration, the phenomenon of migration plays a major role in depopulation. In recent years, the rate of net international migration has slightly increased due to the growing number of immigrants; however, we note that very few people are returning to declining rural peripheral regions.

Figure 3

International net migration and immigrants in Lithuania



Source: Statistics Lithuania (2018).

Population ageing

Due to negative net migration and low fertility rates, Lithuania has a fast-growing population-ageing index[4] (for more about population ageing in Eastern Europe, including Lithuania, see Kulcsár–Brown 2017). In 2001, this index was 71; in 2017, it reached 130, meaning that it has nearly doubled.

Territorial differences in the population ageing of Lithuania are also high. The highest ageing indexes are in North-Eastern and Southern Lithuania (see Figure 4), which regions are the most sparsely populated (see Figure 6). In some municipalities in SPRs, the index is twice that of the Lithuanian average. For instance, in Ignalina municipality (North-Eastern Lithuania), the ageing index was 239 (the Lithuanian average was 129), the population density was 11.3 people per square kilometre (the Lithuanian average was 44.2), and the natural change was –14.4 (the Lithuanian average was –3.6) in 2016.

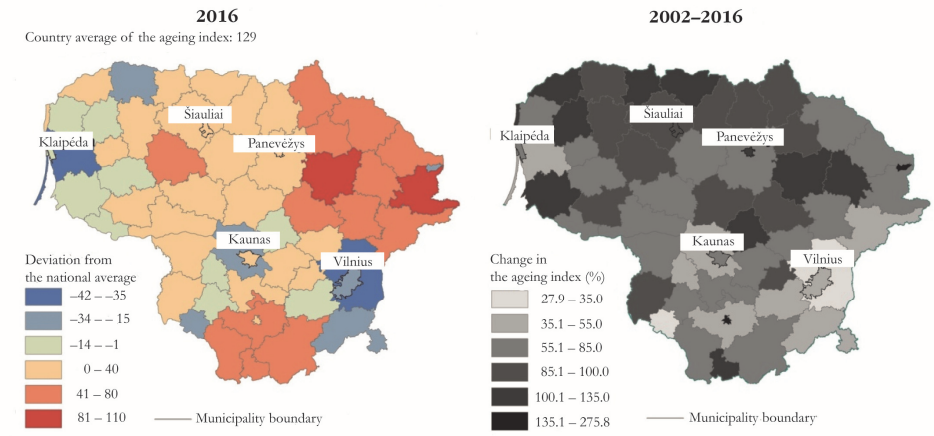
If we look at the ageing tendencies illustrated in the grayscale picture on the right of Figure 4, we see the rapid ageing in Western and Northern Lithuania and in some urban municipalities (such as Visaginas, Alytus, and Panevėžys), where the index approximately doubled. When Lithuania regained independence in 1990, the number of children and young people was the highest in Western Lithuania, and it was a 'baby-boom' period in that area. By the beginning of the 21st century, these

[4] Number of elderly people (65 years and older) per 100 children under the age of 15 (Statistics Lithuania 2018).

kids had finished primary and/or secondary school and due to the lack of workplaces, left the western municipalities and moved to major cities or abroad (Kriaučiūnas 2010), expecting to create a better life 'somewhere else', leaving 'less-mobile' older people in the rural regions.

Figure 4

Population ageing in Lithuanian municipalities



Source: Statistics Lithuania (2018). Graphics: Aušra Baranauskaité.

The influence of depopulation on the educational system

The disappearance of the network of schools is most closely linked to the demographic situation. Therefore, here we use the change in the number of general schools as an indicator to illustrate the link between the demographic and socioeconomic situation and to discuss depopulation tendencies. To illustrate these connections, we can compare Figures 5 (picture on the left) and 6 (presenting data for 2018).

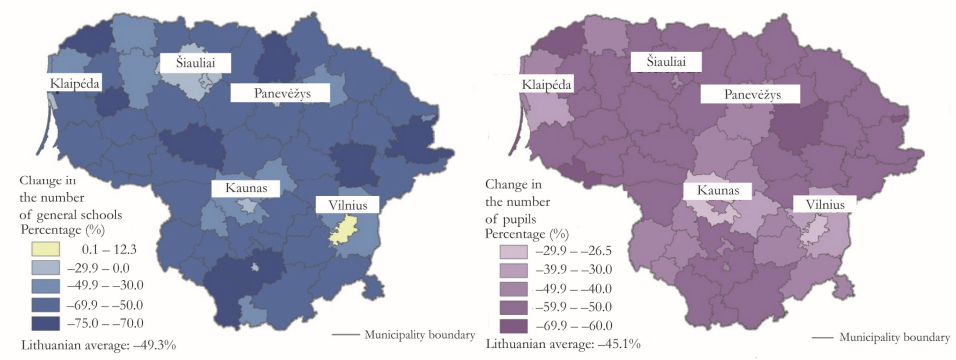
Statistics show that Lithuania has experienced a great decline of the education system (see Figure 5), which was mainly influenced by decline in the birth rate and emigration of young families (Sipavičienė–Stankūnienė 2013, Stankūnienė et al. 2012). Since 2001, the number of schools has decreased on average by 49.3% in the country, whereas in SPMs by 61.9%. The number of pupils in general schools shows similar tendencies. Since 2001, it has fallen on average by 45.1% throughout the country, while in SPMs by 55.1%. Most Lithuanian territories have experienced a 30–60% decline in the number of students. Due to strong depopulation, the municipalities of the southern and north-eastern regions have a very sparse school network that is still shrinking; for instance, in Varéna municipality, we counted 0.9 schools per 100 square kilometres in 2006 (the Lithuanian average was 2.3 at that time), while in 2016, the indicator was only 0.5 schools per 100 square kilometres (the Lithuanian average was 1.8). Consequently, due to the

decreasing number of children, the network of schools is disappearing all around Lithuania, leaving Vilnius city as the exception.

The biggest problem is that after school closures, other key institutions for the settlements, such as cultural centres, kindergartens, libraries, medical centres, post offices, banking departments, and shops are also closing (Kriaučiūnas et al. 2014, Pociūtė-Sereikienė et al. 2014). Public transport accessibility is decreasing as well. Schools are basic institutions, without which the territory becomes non-attractive for young families – and for others, too. Of course, some of the services can become mobile (e.g. shops or the postal service), but schools cannot become mobile; as they are getting more distant from many pupils' place of residence, territorial exclusion increases, and the quality of life decreases, which is closely connected with the peripheralisation tendencies in the country.

Figure 5

Change in the number of general schools and pupils in Lithuania, 2001–2016

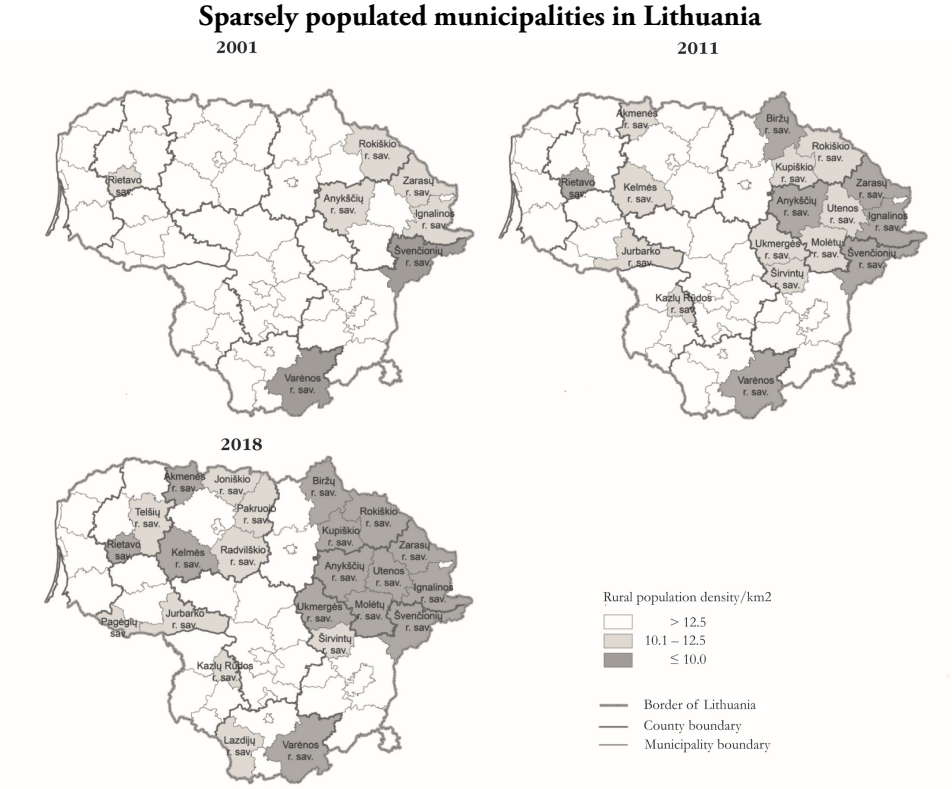


Source: Statistics Lithuania (2017), (2017). Graphics: Viktorija Baranauskienė.

Expansion of SPTs in Lithuania

Due to the negative demographic processes, we can see the formation and expansion of SPTs and SPRs (see Figure 6). The situation has substantially changed recently – SPTs has been already occupying around 45% of the territory of Lithuania. In 2018, (out of 60) 22 municipalities are sparsely populated, whereas in 2001 there were only seven such municipalities (see Figure 6). SPMs constitute large continuous regions in Lithuania. Therefore, an SPR should be defined as a large compound of SPTs characterised by not only demographic, but also specific socioeconomic behaviours and processes. North-Eastern Lithuania is the best example of the SPR phenomenon. In this part of Lithuania, 11 SPMs compose one solid region. However, similar groups of municipalities are already forming in Southern and Northern Lithuania (see Figure 6). In Lithuania, we find 14 municipalities in which the rural population does not reach 10 inhabitants per square kilometre.

Figure 6



Note. r. sav. means district municipality.
Source: Statistics Lithuania (2018). Graphics: Viktorija Baranauskienė.

In some north-eastern municipalities (Ignalina, Biržai, Zarasai), the number of residents decreased by one-third during the last twenty years (Statistics Lithuania 2018). These municipalities are among territories with the lowest population numbers and densities in this region. The number of abandoned houses, schools, cultural centres, and other institutions is rapidly increasing (Kriaučiūnas et al. 2014) in the declining SPMs (see Figure 7). In general, villages in problem regions are mostly small and still shrinking and they have only a few inhabitants left. Depopulation in SPMs leads to the disappearance of the network of education (see Figure 5) and other social service institutions. From previous studies (Daugirdas et al. 2013) and discussions with local authorities, we note that the massive renovation of schools, roads, infrastructure, and other public facilities does not help to keep the balance in such municipalities. Thus, we often raise the question in discussions with local authorities: 'Is it worth investing in schools of declining regions?' (as these schools are eventually closed anyway).

The responding officials usually answer that they understand the problem of depopulation, but they want to make their living places more beautiful and attractive for local residents and tourists (see Figure 8).

Figure 7

Abandoned houses in sparsely populated territories

Photos: Gintarė Pociūtė-Sereikienė and Edis Kriaučiūnas.

Figure 8

Renovated houses in sparsely populated territories

Photos: Gintarė Pociūtė-Sereikienė and Edis Kriaučiūnas.

Depopulation and socioeconomic decline in LAU 1 regions in Lithuania

The analysis of demographic and socioeconomic indicators shows the picture of a 'divided' Lithuania (see Figure 9). In general, the western part of Lithuania and the municipalities around the major cities of the country have better indicators. These results indicate that cities are the engines of the region, and in this case, Lithuania 'wins' by having big enough cities spread across the country (the heritage of the settlement system planning from the Soviet period) (Vanagas et al. 2002). On the other hand, the most recent studies (Ubarevičienė–van Ham 2017) underline the rapid decline in regional cities that cannot compete internationally, and by comparing 2006 and 2016 statistics, we might presume that we will soon see more 'orange' municipalities in Figure 9.

The calculations show that in the ten-year period, the most depopulating municipalities were in the southern and north-eastern parts of Lithuania (see Figure 9). These municipalities have the lowest population densities and are the 'oldest municipalities' with the worst indicators of natural change. They can be characterised by 'very intensive', long lasting depopulation (Daugirdas et al. 2013). However, in the southern and north-eastern municipalities, the net migration index is around the average because fewer people would like to emigrate from there (most of their population is old), and these regions are depopulating mostly due to strongly negative natural change. Meanwhile, in municipalities described by 'strong depopulation' in Figure 9, the population decline is largely influenced by a high emigration rate. According to 2016 data, the net migration indicator in most Western Lithuanian municipalities was smaller than –20%, (in Pagėgiai municipality, the net migration indicator was –30.5%), whereas the average for Lithuania was –10.5%. Currently, these municipalities face great demographic problems and the fastest depopulation tendencies in the country.

Figure 9

Lithuanian municipalities (LAU 1) experiencing demographic and socioeconomic decline, 2006–2016

Source: Own elaboration based on Statistics Lithuania data.

The analysis shows that the socioeconomically disadvantaged municipalities cover the depopulating regions (see Figures 6 and 9). Again, the southern and north-eastern regions are the most disadvantaged and very strongly lagging behind the economically strong centres. The municipalities of these regions are unattractive for foreign investors; for instance, Lazdijai did not receive any foreign direct investment in 2016.

The municipalities that were 'at the bottom of sequence' in 2006 in terms of unemployment rate, remained in the worst unemployment situation in 2016 as well. The figures allow us to examine long-lasting unemployment in North-Eastern Lithuania and the municipalities of the central and western parts of the country, wherein the unemployment rate is almost twice as high as that of the Lithuanian average. The ratio of the recipients of social assistance benefits to the total population in Lithuania has nearly tripled in ten years: it increased from 1.1 in 2006 to 3.1 in 2016. This indicator is closely connected with the unemployment rate, and we therefore find high values for the most disadvantaged municipalities in the southern and north-eastern regions and around the border. For instance, in Kalvarija municipality in Southern Lithuania, the indicator increased more than five times, from 2.2 to 9.2, from 2006 to 2016.

Summarising the ten-year tendencies, we can say that great depopulation and increasing polarisation are going on in Lithuania. However, some regions are more at risk as generators of demographic problems. The western-central part of Lithuania is in the 'riskiest' position. The municipalities in these regions are currently coping with great depopulation mostly due to the emigration of the young generation (Kriaučiūnas 2010). These municipalities are 'donors' of workforce for the major cities and foreign countries. If we look at the indicators from a 20-year perspective, we can see an even greater loss of human capital. For instance, in Kelmė municipality of Central Lithuania (marked with 'strong depopulation'), the population density was 24.9 residents per square kilometre in 1996, while in 2016, it was only 16.8. In a 20-year period, the municipality lost 34% of its residents. It is also one of the fastest ageing municipalities, where the ageing index was 103 in 1996, 118 in 2006, and 174 in 2016. High emigration from this municipality might be seen as one of the reasons for such fast ageing: the net migration rate was –3.5 (the Lithuanian average was –6.5) in 1996, –6.5 (the Lithuanian average was –1.4) in 2006, and –22.9 (the Lithuanian average was –10.5) in 2016. Kelmė municipality is just one of several rapidly depopulating municipalities in the western-central region of Lithuania.

The north-eastern and southern regions are 'very intensely depopulating', but their situation is different from that of the western-central region. The north-eastern and southern regions have been suffering from depopulation and ageing since long (Daugirdas et al. 2013). However, both regions become 'lively' in the summer as they are surrounded by lakes and woods, and thus city residents go to rest there and

own homesteads as weekend or summer houses. Based on current tendencies, it is likely that the north-eastern and southern regions will remain attractive; sadly, we cannot be so positive about the Central Lithuanian region, which is a more agricultural area.

Conclusion and discussion

Concluding remarks

Depopulation, youth emigration, ageing, the formation of SPTs, and other undesirable demographic phenomena appear in many countries in Europe. The processes look similar superficially, but a deeper look at the causes reveals some differences. In Lithuania, as well as in other CEE countries, the situation is different from that in the developed Western European countries. In western countries, the reasons are more 'traditional': demography and influences from social and urbanisation processes (Burholt–Dobbs 2012, Cawley 1994, Haase et al. 2016). Meanwhile, Lithuania saw a change in residents' values: the economic system created by the Soviet Union is transforming, receding from the agricultural sector that required a lot of manual labour. In addition, the artificial settlement system (Vanagas et al. 2002) is also transforming (reminiscent of 're-naturalisation', Kriaučiūnas et al. 2014). Nowadays, the choice of residence is not restricted; the population migrates and chooses the cities and territories that can provide them with more prosperity and a better quality of life.

Since Lithuania regained its independence, large territorial demographic differences have emerged, indicating the creation of two 'demographic Lithuanias'. The capital Vilnius and its surroundings, as well as the other major cities of Kaunas and Klaipéda with their suburban areas, stand as strong growing centres, while the rest of the country is experiencing the opposite developmental tendencies and their population is rapidly shrinking. Our data analysis and previous studies (e.g. Daugirdas et al. 2013, Pociūté 2014) reveal great demographic differences. North-Eastern and Southern Lithuania has depopulated mostly due to a negative birth rate and the demographic situation. These regions might be considered substandard and have been so for decades. We might consider the demographic situation in Western Lithuania as rapidly deteriorating. For some time, this region had a better population composition according to age, it did not have such a fast ageing process, and it had a high number of younger people. Therefore, we see currently high emigration indicators in this region, mostly of younger population, while there is no one to emigrate from North-Eastern Lithuania.

We emphasise two research dimensions because we believe that demographic and socioeconomic indicators are the cornerstone showing how well the country stands in the national and international arena. Both these dimensions highly

correlate with and influence each other. For example, the disappearance of the network of education and other social service institutions follows depopulation in Lithuania (Kriaučiūnas et al. 2014). While analysing the data, we find 'closed circles'; for example, ongoing depopulation influences the collapse of social infrastructure, and because of the loss of infrastructure, depopulation continues. This circle eliminates the possibility of improving the demographic situation. In addition, we see that the decreasing number of work places influences depopulation (usually emigration); but due to the absence of workforce, companies are not interested in locating in rural regions. Again, this leads residents to migrate from villages or towns out of the region. These examples illustrate the tight relations between demographic changes and socioeconomic underdevelopment.

Future research

So far, there are no existing demographic preconditions for the improvement of the situation or a change in tendencies. We must understand that depopulation will continue: villages and smaller cities will become less populated. This process is inevitable and natural in the era of globalisation. There is no reason to expect that the wooded or infertile peripheral regions will exhibit population growth in the near future. The sharpest result of depopulation is the decline of the social network, which increases residents' social and territorial exclusion. This means that the institutions are receding from the residents of SPRs. People need to travel further to schools, medical institutions, post offices, shops, and other institutions. This tendency has been particularly sharp since 2004, when Lithuania joined the EU. On the other hand, there is no reason to encourage population growth in SPTs. Knowing the situation in these territories, we can say that no efforts can reverse the current trends in these territories. The emigration of part of the population has already cut off a large part of the potentially reproductive population, and this 'hole' will become even deeper due to the long-term low fertility rate. The age structure is unfavourable for reproduction, as Lithuania is the most rapidly ageing and depopulating country in the EU. There will be an increasing number of people of retirement age, and they will live longer. This is the most serious social and economic challenge for the country.

We can expect re-emigration and immigration, especially if the living standards reach the western European standards. Lithuania is suitable for habitation. We believe that eventually SPTs will be highly valued – and they already are. Often, SPTs are located in or very close to protected areas of Lithuania. Therefore, these territories are characterised by high forest cover and beautiful landscapes, and they are full of lakes and have special historical value. Additionally, SPTs are very calm and beautifully maintained. The environment was improved using mostly EU funds; thus, in the municipalities of SPTs, we find renovated schools and cultural centres. The residents of these settlements are gathering into communities

and working for their homeland. SPTs provide excellent conditions for living and for recreation and tourism.

We should look ahead and continue to develop infrastructure and improve living conditions in rural territories and small cities, but the improvements must be rational. The government's regional strategies (e.g. the most recent 'Lithuanian Regional Policy White Paper', National Regional Development Council [2017]) should be less general and more place-specific. We support the ideas of Dax and Fischer (2018, p. 306.), who state that there is a great need for a regional policy to make a '…shift towards improving well-being and local attractiveness for the remaining population.' However, this does not mean that the improvement should occur by investing EU funds in rural institutions that will shortly be closed just to create a better 'panorama' of the village; we should rather think about improving the legal basis that would become the guidelines for regional policy.

Our research motivates us to think about the (system of) indicators that could best define the quality of life in the Lithuanian territories, especially in the problematic ones (such as SPTs). In general, we can study quality of life via qualitative and quantitative indicators. The qualitative part (completed with semi-structured interviews) in our project is left for sociological research, while we aimed to find the most suitable quantitative indicators to evaluate the topic. The selection of indicators to measure quality of life is a very subjective issue; therefore, the question 'What is the best way to evaluate quality of life quantitatively and underline the increasing territorial exclusion?' is still open for discussion.

Acknowledgement

This article is based on a report presented at the international conference in Poland, 'Warsaw Regional Forum 2017: Space of Flows' (Warsaw, 18–20 October 2017). The research was funded by a grant from the Research Council of Lithuania ('Regional disparities of welfare in Lithuania' Project, No. GER-005/2017). The authors thank Viktorija Baranauskienė and Aušra Baranauskaitė from the Lithuanian Social Research Centre for their help with the graphics.

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New method to support decision making process in the local economic development of Hungary

Melinda Nagy-Molnár
Szent István University,
Hungary
E-mail:
melindamolnar@yahoo.com

Endre Lendvay
Szent István University,
Hungary
E-mail:
lendvay.endre@responsum.hu

This study provides a method that supports local governments' efforts to develop their economy with a set of instruments built on evidence-based decision making. The authors' first objective is to define the action space and opportunities by examining the relation between environmental factors and internal resources. To achieve this, an analytical tool was designed that discovers – with an indicator system – the network of internal factors of a settlement economy and the external environment affecting it. When studying local economic development, it is important to assess the local economy in situ and its interaction with its surroundings.

The second objective is to discover and show the connection between the available tools and environmental factors, and thereby enable decision makers to take development actions based on evidence. The tools provide a quantified relationship between the possible actions and environmental factors made available by these actions. It is essential to determine which actions affect which environmental factors, and which factor they can help adjust. It is assumed that the development tools used by local governments are not equal in their effectiveness when interacting with the different environmental factors.

The authors' third objective is to discover the relationship between the tools and internal resources, thereby ensuring a base for planning resources necessary for implementing economic development actions. According to their preliminary assumption, the relations between the available resources and local governmental tools are not of the same strength; therefore, it justifies their analysis.

The next assumption is that areas affected by the same environmental factors can be devel-

Regional Statistics, Vol. 8. No. 2. 2018: 69–91; DOI: 10.15196/RS080207

oped to different extents with local governmental tools. However, it is also assumed that a settlement can be developed according to a predefined target by a systematic application of appropriately selected tools; thus, every area can be developed. Economic factors are related to each other; they constitute a living fabric. The authors' objective is to discover the hidden relations in a local economy. According to their assumption, understanding these relations allows indirect influence of economic factors that are more difficult to shape.
The authors' final objective is to provide structured information for economic development actions.

Keywords:
local economic development,
PESTEL-analysis,
scorecard,
benchmarking

Introduction

The trump card of successful settlements: the successful development of local economy. To be successful, settlements should ensure a successful development of their economy. Our research develops a method for local municipalities that supports complex decision making which ensures that the action areas of the local economy are properly designated so that they can be influenced by the local government. First, it is worth clarifying some key concepts.

Local economic development is an emphatic question of the human–environment relations, which has been evaluated differently from time to time (Kőszegi et al. 2015). The concept of local economic development is not unambiguous. According to G. Fekete (2005), local economic development is the conscious intervention in the ongoing changes in a region. According to some, it is a strategy, which effectively unites the local resources for creating workplaces (Čapková 2005). A different approach states that the development of the local economy is a conscious intervention, where the initiator can be external or internal; however, the key figure of the process is a local character (Mezei 2006). According to Lengyel (2013), the development of the local economy is a conscious local community intervention in the economic process to ensure sustainable local development.

Although the development of a local economy is first and foremost an economic question, in reality, it depends on several economic, social, and environmental factors. Every factor that influences the local living conditions and quality of life, affects the development or success of a settlement (Ludescher 2010). Several studies prove that successful settlements have a stable economy and community. One stream of study states that social capital is one of the most important factors determining success (Bodor et al. 2017). Bartik (1995) and Čapkova (2005) state that

besides emphasising the positive quality of life, sustainability is also important. On the other hand, a lack of info-communication tools leads to regional disparities (Páger–Zsibók 2014). It is also important to highlight that since settlements are characterised by different features, they have different methods available to them to achieve their goals.

According to Péteri (1994), although local governments do not have a significant effect on economic processes, they should intervene. Faragó (2004) concludes that since intervention opportunities are limited, they should be used only when the market is not functioning properly. Others say that settlements are capable participants in the economic development process; they are not just drifting with the tide. The key to this is adaptability. Amidst constantly changing conditions, settlements can be successful if they can adapt to their surroundings (Jedynak et al. 2015). Adaptability depends on a combination of natural factors and their effect on their settlements, internal resources, and the tool sets available to settlements. Local economic development requires the determination of tools that can be used for tasks and goals. The settlements, as municipalities, have tools with different characteristics, which can strengthen or weaken each other's effects due to their complex system roles. Some of the tools used by the settlements are unique (e.g. local taxes, local communities, etc.), while others (e.g. administrative and legal regulations) function alike anywhere in the country. The success of a settlement depends on its ability to find effective tools and use them.

The objective of our study is to show, through a domestic example and with the help of methods known and used, the use of a decision-supporting system practically and in a complex way in the future planning of settlements.

The objective of our studies is to show through the domestic example and with the help of methodological footings already known and used, how to use a decision-supporting system usefully and in a complex way in the future planning of settlements.

Methods used for building a regional scorecard

The emphasis is on the method developed; therefore, we discuss this in more detail. To illustrate the workings of our model, we developed the following research.

To achieve the objectives, we used, remodeled, and linked several commonly used, well-established tools in a stricter framework: PESTEL analysis (it is a tool by companies to track the environment they're operating in. PESTEL is an acronym: P means political, E means economic, S means social, T means technological, E means environmental and L means legal aspect.), Balanced Scorecard (BSC), indicator creation, benchmarking, multi-variant analyses, etc.. However, it was necessary to develop customised analytical and decision supporting methods, partly to connect the elements quantitatively, partly to acquire supplementary information, and

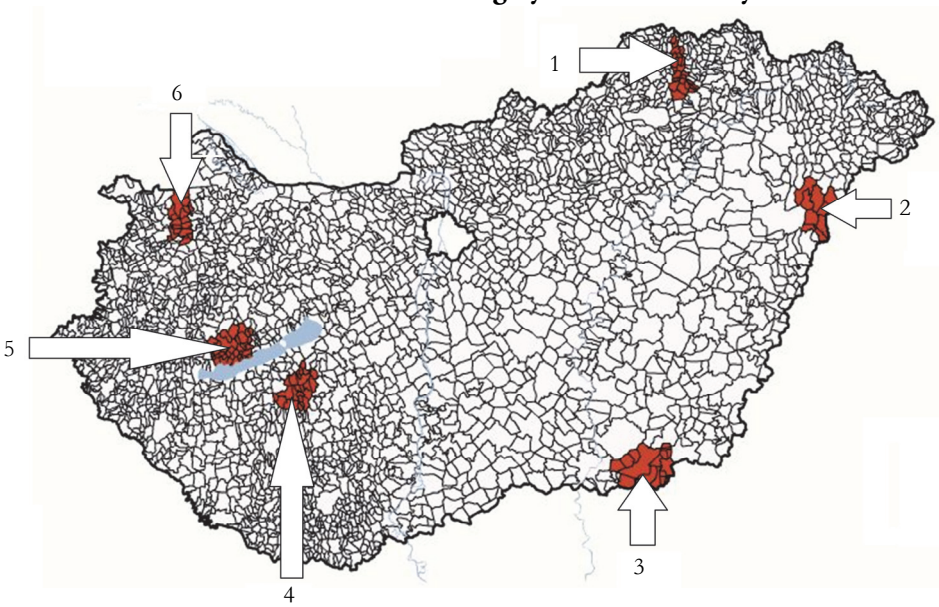
partly to create the tight logical connection between the different work stages (governmental set of instruments, tools–effect matrix, resource matrix, effectiveness matrix, screening prioritisation tools, etc.).

Our starting point is that local governments are active participants in regional processes. We developed a complex method consisting of three matrices to assist government decisions (the *regional scorecard matrix* (*RSC*), *tools effect matrix (TEM),* and *resource matrix (RM)*).

We describe the method below. Except for the region of Central Hungary, we worked with one district in every region, and included data on every settlement in that district. The selection of a district was based on its diverse regional conditions, but the differences were not excessive. The following six districts were examined: Kapuvár (Győr-Moson-Sopron county, Western Transdanubia region), Tapolca (Veszprém county, Central Transdanubia region), Makó (Csongrád county, South Great Plains region), Nyíradony (Hajdú-Bihar county, North Great Plains region), Szikszó (Borsod-Abaúj-Zemplén county, North Hungary), Tab (Somogy county, South Transdanubia). Data were collected from 126 settlements in six districts (Figure 1) and 24 indicators were developed, based on 50 variables. Each indicator is formed from two to five variables (see Table 1). The data were obtained from the following: TeIR, www.valasztas.hu, www.munka.hu, local data services, Hungarian Central Statistical Office, and www.palyazat.gov.hu. Our study is based on 69 case studies on the most successful economic development practices.

Figure 1

The six districts in Hungary used in the study



Note: 1. Szikszó, 2. Nyíradony, 3. Makó, 4. Tab 5. Tapolca, 6. Kapuvár.

RSC as a new method in the strategic planning of local economic development

To identify effective tools, settlements need to determine their action space and opportunities. We used the PESTEL analysis for assessing external factors, and the BSC for assessing the internal factors to create the RSC matrix.

PESTEL: Analysis of external factors

PESTEL analysis assesses the external environment of an enterprise under the following categories: P(olitical), E(conomic), S(ocial), T(echnological), E(nvironmental), and L(egal). This model is flexible; there are several variations depending on the importance of factors as considered by researchers and enterprises. The analysis of settlements is special because while the decision of a company's management (usually) influences the position of the enterprise, a local government's decision not only influences the organisation, but also the quality of life of the whole community. This makes the influence of the local governments on the development of their economy relevant, by improving the quality of life of the locals.

When adapting the model to local governments, we analysed each of the six factors and determined their ability to describe the surroundings in which the local governments make their strategic decisions. The political, economic, social, environmental, and legal factors are as fundamental for a settlement as they are for an enterprise, even if these impacts apply differently. However, when considering technological changes, the differences are apparent; while in the case of an enterprise the available technology is important, in the life of a settlement the infrastructural background is much more determining, since it also covers technological features, hence, this expanded definition was used.

BSC: Analysis of internal factors

The BSC, a strategic framework similar to PESTEL, designed for the business world, is flexible and simple in usage (Kaplan–Norton 1996). It examines four business aspects: financial, customer viewpoint, operational processes, and learning development. Based on these aspects, the strategic goals, the indicators which make them achievable, and the actions necessary for these goals are determined. The tool is thus particularly suitable to measure the achievability and effectiveness of the strategic goals, besides determining these goals. Since the strategic goal of a settlement is to develop its economy, the four aspects were subordinated in our method. Readjusting the four aspects of the model implies the following:

- The financial aspect was extended to *financial-economic aspect*, as it analyses the financial and economic situations of the settlement.
- The customer viewpoint is similar for enterprises and settlements because the service provider and the service user can be identified; however, it is im-

portant not only to measure the effectiveness of the local government as a service provider, but also the opinion of the residents about the settlement, so the *quality of life* definition is more appropriate.

- The interpretation of operational processes varies significantly for enterprises and local governments; an enterprise is much more flexible about its internal processes, while the internal functioning of local governments is determined by various laws, which allow low flexibility. Nevertheless, local governments can make their operations more effective under the legislative framework and distribute the resources available for development more effectively. This factor was termed *organisational efficiency*.
- Learning development is more closely connected to an organisation than a settlement, and is defined less from the aspect of learning, so this category was extended. This factor was termed *innovational capability*.

The synthesis of the external and internal factors: the RSC Matrix

The RSC matrix is used to aggregate the external PESTEL factors and the internal BSC aspects of a settlement in one table (see Table 1). The rows show the aspects of the Balanced Scorecard, while the columns represent the six factors of PESTEL. The cells of the table show indicators, which characterise the local economy based on specific aspects.

Table 1

The logical frame of the RSC matrix (analysing table) and indicator codes

Factors	Political	Economic	Social	Infra-structural	Environ-mental	Legal
Quality of life	IQP	IQE	IQS	IQI	IQEN	IQL
Operational efficiency	IEP	IEE	IES	IEI	IEEN	IEL
Economy and finance	IFP	IFE	IFS	IFI	IFEN	IFL
Innovation	IINP	IINE	IINS	IINI	INEN	IINL

The practical use of the RSC matrix depends on the information provided by the variables that are assigned from the official database to the 24 indicators. The indicators in the table can be formed from primary and secondary data sources.

Application of the RSC matrix

The benchmark data provide several analytical assessments. We compare settlements at the regional and national level, and analyse a settlement's economic character based on size. Below we present the line of research that uses indicators dependent on region or settlement size. For example, we provide an assessment of a settlement's infrastructural environment and internal conditions based on a regional comparison, and also by settlement size (see Tables 2 and 3).

Table 2

Regional comparison of the infrastructural environment and internal conditions of settlements (value/valid element number)

Indicator	Makó (South Great Plain)	Nyíradony (North Great Plain)	Szikszó (North Hungary)	Tab (South Transdanubia)	Tapolca (Central Transdanubia)	Kapuvár (Western Transdanubia)	**Summary**
IQI	17.79	10.00	18.50	14.50	18.10	24.35	**17.80**
	14.00	8.00	2.00	24.00	30.00	20.00	**98.00**
IEI	5.93	–	6.50	4.51	4.88	4.87	**4.99**
	11.00	0.00	2.00	17.00	26.00	20.00	**76.00**
IFI	5.82	5.00	5.02	3.65	4.34	4.75	**4.63**
	15.00	9.00	24.00	24.00	30.00	20.00	**122.00**
IINI	8.21	2.56	7.43	1.32	4.01	10.18	**5.54**
	15.00	9.00	24.00	24.00	33.00	20.00	**125.00**

Table 3

Comparison of the infrastructural environment and internal conditions of settlements based on settlement size (value/valid element number)

Indicator	At most 500	501–1,000	1,001–5,000	Above 5,000	**Summary**
IQI	16.28	21.19	17.68	19.83	**17.89**
	47.00	21.00	25.00	6.00	**99.00**
IEI	4.93	4.57	5.44	6.04	**5.02**
	36.00	19.00	18.00	4.00	**77.00**
IFI	3.12	4.93	6.83	8.59	**4.66**
	62.00	25.00	30.00	6.00	**123.00**
IINI	1.53	5.16	11.23	26.95	**5.85**
	64.00	25.00	31.00	6.00	**126.00**

For public services available in 30 minutes (IQI indicator), the index value is highest for the district of Kapuvár, and least for the district of Nyíradony (see Table 2). This overlaps with the development status of the regions.

If we examine the same indicator based on settlement size (see Table 3), the difference between the smallest (at most 500 people) and the biggest settlements is around 20%. Nevertheless, the concept of a district service organisation is strengthened by the fact that, on average, more than 16 of the basic services can be accessed in 30 minutes by public transport.

The IEI indicator examines the technological state of a local government by measuring the average age of its IT tools; hence, it indirectly assesses the conditions of work efficiency. The variables for the indicator are sourced from local data (see Table 4). Data show that the age of IT tools is high; the collective average is 4.99 years. An average age difference of more than one year is found for the districts of Transdanubia. Based on settlement size (see Table 5), it is surprising that the average age of IT tools in bigger settlements (more than 5,000 people) is 33% higher than that in settlements with 501–1,000 people.

The IFI indicator refers to a settlement's capability of attracting economic activity. It consists of two factors: the number of middle and large companies per 100 inhabitants, and the index based on infrastructural state. The former measures a settlement's ability to attract investors through existing enterprises, while the latter does the same through accessibility of infrastructure. Based on this indicator, the district of Makó has good conditions, whereas the districts of Tab and Tapolca have poor conditions; the remaining districts show average values (see Table 2). Significant deviation was found among settlements in a district based on settlement size (see Table 3). The value of the indicator for the smallest settlement size is 3.12, whereas for the largest, it is 8.59. Hence, larger settlements are significantly more attractive to new enterprises.

The infrastructural environment for economic innovation is assessed through the number of broadband connections per 1,000 inhabitants (IINI indicator). The collective average is 5.54, which deviates positively, as expected, for the district of Kapuvár (10.18), and negatively for the districts of Tab (1.32) and Nyíradony (2.56). On comparing the IINI indicator with the IEI value of the same location, we conclude that the low number of broadband connections is an obstacle to regional development. When we examine the values in Table 3, the indicator increases with settlement size.

In summary, the values of two (IFI, IINI) out of four indicators increased with settlement size; the IEI indicator showed some correlation with the settlement size but it mostly showed regional dependence along the southeast–northwest gradient, along with the IQI indicator.

We assess the connection between quality of life and conditions of economic environment to find indicators that are dependent on region or settlement size. Net annual income per inhabitant (thousand Fts), used to define the relation between quality of life and the economic environment (IQE), shows a prominent regional dependency (see Table 4).

Table 4

A geographical breakdown of the RSC economic indicators (value/valid element number)

Indicator	Makó (South Great Plain)	Nyír-adony (North Great Plain)	Szikszó (North Hungary)	Tab (South Trans-danubia)	Tapolca (Central Trans-danubia)	Kapuvár (Western Trans-danubia)	**Summary**
IQE	472	406	381	473	550	622	**495**
	15	9	24	24	33	20	**125**
IEE	1,527	–126	301	2,063	1,031	2,777	**1,675**
	14	4	2	24	30	20	**94**
IFE	1,326	1,205	2,044	1,947	2,857	3,660	**2,372**
	15	9	16	19	31	19	**109**
IINE	4.66	5.87	2.60	12.07	1.47	2.41	**4.65**
	15	9	24	24	30	20	**122**

The values recorded for the district of Tab, which are the lowest in Transdanubia, coincide with the highest values recorded in the eastern districts of the country. It is worth noting that while the value of IQE decreases in the western parts in a north–south direction, the opposite is observed in the regions east of the Danube.

Table 5

The change in RSC economic indicators with settlement size (value/valid element number)

Indicator	At most 500	501–1,000	1,001–5,000	Above 5,000	**Summary**
IQI	464	527	519	584	**496**
	64	25	31	6	**126**
IEI	1,585	1,938	1,593	1,453	**1,658**
	47	21	22	5	**95**
IFI	2,472	2,547	1,794	3,552	**2,355**
	50	23	31	6	**110**
IINI	6.82	1.69	3.00	2.58	**4.64**
	62	25	30	6	**123**

The district of Kapuvár, with the highest value, positively deviated from the average, whereas the district of Szikszó displayed the highest deviation in a negative direction (see Table 5). The IQE indicator shows dependency on settlement size; a bigger value is seen in bigger settlements. Although marginally, this indicator gives

better results in settlements with 501–1,000 people, and a weaker result for settlements with 1,001–5,000 people.

We face a similar phenomenon in the analysis of the IEE and IFE indicators. The IEE indicator refers to the efficiency and power of the local economy correlated to the economic environment. The indicator shows the change in local taxing power compared to the increase in GDP (%). The difference between the western and eastern parts is more obvious for this indicator than for the IQE indicator analysed above. Only the mean value for the district of Makó is comparable with that of the districts of Transdanubia. The district of Kapuvár, with the best result, shows a ninefold value compared to that of the district of Szikszó. The IEE indicator shows a decrease in taxing power in the district of Nyíradony, which is a serious warning sign about the status of the local economy. The north–south gradient experienced with the IQE indicator can be stated only with strong criticism for the IEE indicator, and it is not true for every relation: the correlation is true both for the eastern and western parts, but only for two thirds of the relations.

The indicators do not seem to depend on settlement size when the population is below 500 or above 1,001. The averages show a less than 10% deviation from each other in these three categories. It is thought-provoking that similar to the IQE benchmark results, the benchmark for settlements with 501–1,001 people is exceptionally high, showing a value more than 16% than the overall average.

The IFE indicator (gross value added per business) provides feedback about the efficiency of the local economy in the specific macroeconomic environment. It can be clearly concluded that similarly to the IQE indicator, the indicator for Transdanubia shows a significantly higher value than in the districts east of the Danube; a north–south decrease can be observed as well, even more firmly than in the case of IQE benchmarks (see Table 4). This complies with the experience model about the economic power of districts. A north–south decrease can be observed in the eastern parts too, although it is covered by the upward distorting effect of Makó. The average value of the IFE indicator increases with settlement size, whereas the tendency, in accordance with the IQE findings, breaks at settlement sizes of 1,001–5,000 people.

The fourth indicator, IINE, shows the innovation potential. The indicator measures the change in the number of registered enterprises per 1,000 inhabitants (units/1,000 people). Our assumption is that entrepreneurship reflects the innovative ability of the population. Significant differences can be found in the values of the indicator both according to settlement size and districts. Neither a region- nor a settlement size-dependent trend was identified.

The assessed indicators provide valuable information about the settlements and their adaptation to the macroeconomic environment. All benchmark values depend on the geographical location, but a trend between the development of the eastern–western part or the north–south gradient could only be found for the IQE, IEE,

and IFE indicators, and the IQE, IFE indicators, respectively. These indicators are also dependent on the settlement size. Furthermore, for the five indicators mentioned above (IQE-IEE-IFE, IQE-IFE), settlements between 501 and 1,000 people performed better than the expected value, whereas the settlements with 1,001–5,000 people performed lower than the expected value. We could not identify a geographical or settlement size dependency for the IINE indicator.

TEM as a new method in the strategic planning of local economic development

The TEM is closely related to the RSC matrix introduced earlier, both in structure and functionality, and to the benchmark database built on the RSC matrix. However, its purpose is not only to explore the external or internal circumstances of settlements as in the case of RSC, but also to provide possible solutions to overcome difficulties encountered in the analysis of the situation.

Like the RSC matrix, the TEM examines external factors based on the PESTEL analysis. The components of the RSC matrix and the TEM are the same (political, economic, social, infrastructural, environmental, and legal factors). External factors represent the target areas that can be influenced by the local government's tool set. The tool sets of local governments can influence development beyond laws. This method integrates the following six tools:

- *Political:* This includes the lobby and relationship building activities and strategy creation of local governments.
- *Communicator:* The local government has communication responsibilities toward the population and the narrower or wider environment of the settlement, including marketing of the settlement to the outside world (separated from the representation of interest, which belongs to the political tool set) and influencing the settlement attitude.
- *Norm setter:* Various laws authorise and oblige local governments to create local regulations and decrees, through which they can influence the life of settlements.
- *Authoritative:* Local governments act in specific cases and usually indirectly as the local authority, and they implement the interests of the local community and check compliance with rules.
- *Owner:* The local government, depending on the available finances, can exercise their owner rights and continue asset management (e.g. utilisation, estrangement, etc.).
- *Occupational:* The local government is a significant employer. Therefore, it has influence through increasing (or reducing) the number of available jobs in the settlement.

The tools, as internal factors, provide the columns of the matrix, whereas the external factors of PESTEL provide the rows of the matrix. This presumes that local governments use such tools for their actions and decision making, which affect the external factors related to the settlement. A '0' signifies no correlation, '1' signifies correlation, and '2' shows that a tool has more effects.

This matrix is built by collecting information at the specific spot using the 'soft' method. In the practice of the TEM, the data were based on case studies. Data from each identified best practice on economic development are recorded in a unified Excel sheet; this includes data on the settlements (name, county, region), the literary source, title, short description of the best practice, and the TEM set-up for the specific case, which specifies the municipality roles and the economic factor interaction for which they are used. If a tool had an effect in more areas, we marked the relation in every affected field, whereas if one specific tool had an effect on the same economic factor in a number of ways, we included the number of identified actions in the related field. The values of identical fields in each datasheet are added together in a summary table. This table gives the TEM, which displays the strengths of interactions between the local government tools and the specific economic factors.

A two-step method is used to process the matrices which quantify the information from the case studies. First, the database, which serves as the basis of the analysis, is completed by recreating the matrices. The case studies are displayed in the rows of the database with line numbers, while the columns provide the 36 indicators.

In the second step, the values of the database are summed. Summing the values of the columns by each tool helps measure the strength of the correlation between the tools and their impacts (e.g. the relation between the political tool and the economic environment), and the relative values of the indicators (e.g. what factor was influenced the most by the political tool). The former can help filter the stronger and weaker relations, and the latter can be used to rank the tools based on their effectiveness. Besides this, the effectiveness of indicators within the whole tool spectrum can be measured.

TEM in practice

To analyse the TEM, we examined publicly accessible case studies. A minimum requirement for a case study to be included in our analysis was that it described at least one economic development measure that enabled the identification of the mean(s) applied and their effects. Thus, when creating the matrix, first, the case studies are examined for the tools used by the local governments; then, the external factors influenced by tools are determined. Below we present the process of gathering data through an example.

Project:
Designing a remote heating system depending on geothermic power

County:

Settlement:
Bóly

Type of project administrator:
Local government

Source:
https://www.nth.gov.hu/hu/tevekenysegek/gazdasagfejlesztes/helyi-gazdasagfejlesztes/otletado-megoldasok-es-jo-gyakorlatok/geotermikus-energiara-alapozott-tavfuto-rendszer-kialakitasa-boly (Date of download: 07.08.2015.)

Description:
The goal of the investment is to decrease and finally cease fossil energy use by the local government and other public institutions, satisfy heat demand through renewable and/or geothermic energy, thereby significantly reduce public expenses, improve the status of the environment, and moderate harmful atmospheric emissions.

During the planning and implementation of the project, the local government continuously cooperated with the municipality of Baranya county, and heat sources were established at its institution in Bóly. The local government allowed the public to get to know the system, its advantages, and the experience with it. In cooperating with the local county, the local government used the political tool to influence the external political environment, through which it secured economic, social, and environmental benefits for the settlement. The project aimed to improve the energy efficiency of public institutions (owner role). Intervention improved the financial-economic situation of the settlement (economic effect), and by developing the public institution infrastructure (infrastructural environment) and reducing emissions, it improved the state of the environment (environmental effect); by raising the standard of public services it raised the commitment of the population to the settlement (social effect).

Additionally, the management consciously used up-to-date communication tools with which it improved the sensitivity of the settlement population toward environmental protection and cost-effective farming (social and environmental effect), and provided an example for the actors of the local economy to implement similar efficiency-enhancing measures (economic effect). The local government was the owner of the project; thus, it became the owner of the investment, and its property was expanded. Table 6 contains this information.

Data on actions similarly analysed are collected in one database. As a result, on one hand, a case collection is created that contains the best practices and could be used as a sample for planning settlement development actions; on the other, the TEM, showing the efficiency of the local government's tools, becomes visible by summarising the numerical results. Every record in the database contains the processed data of specific case studies. Table 7 is the summary of 69 case studies in the districts examined. In Table 7, highlighted fields contain the occurrence of each indicator reflected in every case study. The summary row shows the influence of the local government on external factors, while the summary column provides information on the efficiency of the tools in developing the economy. Table 7 shows a 'heat map' of the TEM. The most prominent interaction areas between the means and the environment can be identified with the heat map (marked with warmer colours). Warmer colours imply higher values, and vice versa. It might be surprising, but the results of the assessment show that the strongest tools are related to political and communication roles.

Table 6

TEM data for the energetics project of Bóly

Area of effect/ Tools	Political	Economic	Social	Infra-structural	Environ-mental	Legal
Political	1	1	1		1	
Communicator		1	1		1	
Norm setter						
Authoritative						
Owner		1	1	1	1	
Market						

Table 7

TEM results depicted on a heatmap (based on the 69 case studies examined)

Area of effect/ Tools	Political	Econo-mic	Social	Infra-structural	Environ-mental	Legal	Σ (Tools)	Applica-tion rate, %
Political	15	40	45	17	12	0	129	30
Communicator	3	46	50	15	18	0	132	30
Norm setter	0	8	8	6	1	0	23	4
Authoritative	0	4	4	1	0	1	10	2
Owner	0	32	32	19	8	3	94	22
Market	0	23	24	3	1	0	51	12
Altogether	18	153	163	61	40	4	439	100

If we examine the areas to be influenced, we find that local governments can influence the economic and social relations to a significantly lesser extent, but the influence is strong in the fields of infrastructure and environment. The other end of the scale is provided by relations with a '0' value, that is, a correlation could not be created between, for example, the employer function and the legal environment, or between the authoritative tool and the political environment. This does not mean that effective actions cannot be planned with these, but in the case studies, they did not have importance.

RM as a new method in the strategic planning of local economic development

The RM shows the internal factors affected by government tools. The basis of the RM is provided by the case studies processed in the TEM; internal factors (BSC aspects), which were discussed in the section on the RSC matrix (Analysing table), are assigned to local government tools already identified. By identifying this connection, it can be determined which internal factors are affected by the tools. The relation is indicated in the fields of the matrix by a '1', or by a '2' in case of multiple connections (that is, one tool can affect the same internal factor in many ways).

The rows of the RM denote the case studies, whereas the columns contain the indicators that describe the relation between local government tools and internal factors.

The data summary contained in the rows is constructed according to categories (quality of life, organisational effectiveness, and innovation). The summary and ratio measure the frequency of application of local government tools within the specific internal factors. An example is illustrated here: the six local government tools, which influence quality of life, are measured to compare the extent to which they correlate with the internal factors; among 70 case studies, the political tool was used ten times, while the communicator tool was used seven times to impact quality of life; these occurrences can then be compared with the aggregate within the category, as well as the occurrences within the entire internal factors spectrum.

RM in practice

Below we present the data-processing method used to build the RM through a specific example, the project of Bóly, described earlier.

In this case study, the local government cooperated with the municipality of Baranya county during the planning and implementation of the project, and heat sources were established at the institution in Bóly.

The columns in the RM contain local government tools identified by creating the TEM, and the rows contain the BSC viewpoints modified according to a sector's features. To create the TEM, we identified the usage of political, communicator, and

owner tools in the case study; therefore, in the working phase, internal factors must be identified that are affected by this action.

As a first step, we examine the political tools based on new aspects. In this case study, the use of political tools included external networking activities and cooperation (with the municipality of Baranya). Cooperation is an example of political innovation, which could not have been made possible without involving local financial resources. In this stage of the project, the policy's social capital was measured by the difference between the current and expected quality of life, which leads to the relation between communicator functions and quality of life. Enough means were needed to ensure proper project communication and to build an innovative communication solution based on local conditions. The local government won the support of the locals by communicating and popularising the benefits and novelty of the investment (see Table 8).

Table 8

Enumerator resource matrix (RM) for the energy project of Bóly

Tools/Internal factors	Political	Communicator	Norm setter	Authoritative	Owner	Market
Quality of Life	1	1			1	
Operational Efficiency						
Economy and Finance	1	1			1	
Innovation	1	1			1	

It is vital that invested resources are rewarded; the Bóly project received a positive feedback. Innovation potential increased in the settlement, economic-financial resources grew due to savings, and the policy's social credit was strengthened due to improvement in the quality of life as an effect of the project.

Table 11 shows the results based on the 69 case studies in the six districts. By summarising the columns, we get an image of the occurrence of relations, whereas the summary column provides information on the frequency of resource use and the effectiveness of the resources available for the different tools. The summarised data of specific relations from the database (QP, IP, etc.) are provided in the highlighted areas. Instances of local government tools are shown in the summary row, whereas the summary column contains the application rate of specific internal factors.

Table 9 shows a heat map of the TEM. The heat map differentiates the relations between the local government tools and internal factors with a three-colour scale. Bright red denotes a strong relation, and grayscale colours denote weaker relations.

The closest correlation was between the communicator tool and quality of life as an internal factor. This supports the theory by communication professionals that

perception is as important as objective facts. Medium to strong relations are observed in significant numbers (13–21%), marked with a light purple. The results show that local governments used the authoritative and norm setter tools in few cases, although these had the lowest resource requirements.

Table 9

TEM results depicted on a heatmap (based on the 69 case studies examined)

Tools/ Internal factors	Political	Communicator	Norm setter	Authoritative	Owner	Market	∑Internal factors	Application rate, %
Quality of life	38	45	1	4	21	21	130	38
Organizational effectiveness	16	8	5	0	13	2	44	13
Economy-finance	31	34	4	4	32	21	126	37
Innovation	13	21	2	2	5	0	43	13
Altogether	98	108	12	10	71	44	343	100

Among the internal factors, quality of life and economy-finance stand out; this implies that a prerequisite of successful local government actions is securing social support for local quality of life and the required financial resources. However, it is surprising that organisational effectiveness and innovation appear at a low rate.

Analysis of the main components of indicators

In the earlier sections we showed that some indicators are correlated to settlement size, while others are correlated to regional location; however, some indicators correlate with neither.

In the following paragraphs we analyse the relations between different indicators and identify indicator groups whose elements are not entirely independent of each other. The practical significance of this analysis is that the identified correlations might enable the indirect development of areas which cannot be influenced as much, by using interventions aimed at areas characterised by the related indicators. Six main components were identified by reducing data.

Component F_1 contains indicators on development management (see Table 10). The IEEN characterises investments on environmental protection; the IFP provides information on a settlement's ability to exercise resources; IEP characterises the operational efficiency of the management through the financial planning accuracy of the local government. An assessment of the dimensions of the component indicators shows that two indexes portray the political environment, and two contain

aspects of organisational effectiveness. The factors are: efficiency of environmental management (IEEN), ability to create resources (IFP), and efficiency of resource utilisation (IEP).

Component F_2 includes local livelihood opportunities. According to this, two indicators refer to the quality of life, and three relate to the social environment (see Table 10).

Component F_3 contains three infrastructure related indicators (IQI, IEI, IINI); therefore, this component became the factor's dominant feature. It covers a wide spectrum: from the accessibility of public services to the quality of IT tools of the local government, that ensure environmental support of the economy, to the broadband access available in the settlement (see Table 10).

Table 10

Characteristics of the components F_1, F_2, and F_3 (N=132)

Variables in the components	Communalities	Retained information (%)	Min./Max.
F1: Development management			
IEEN	0.399		–5.21781
IFP	0.258	36.983	
IEP	0.453		4.61286
F2: Livelihood opportunities			
IQE	0.827		–2.95699
IQS	0.681	62.167	
IES	0.249		1.99226
IFS	0.730		
F3: Infrastructure			
IQI	0.553		–2.72704
IEI	0.444	47.078	
IINI	0.416		2.74847

Component F_4 denotes entrepreneurial activity (see Table 11). The component indicators provide information about the relationship between innovativeness and the economic-financial characteristics. These indicators represent local entrepreneurship: the number of new and middle-sized enterprises, and the value added by enterprises show the functioning of the local business sphere from multiple views.

Table 11

Components F_4, F_5, and F_6 (N=132)

Variables in the components	Communalities	Retained information (%)	Min./Max.
F4: Entrepreneurial activity			
IFE	0.521		–4.48234
IFI	0.282	36.142	
IINE	0.281		6.24101
F5: Settlement management			
IQE	0.642		–1.92999
IQS	0.386	47.041	
IES	0.383		1.99226
F6: Social activity			
IQI	0.374		–3.49769
IEI	0.608	41.094	
IINI	0.251		2.69848

Indicator group, F_5, refers to settlement management. The two efficiency and two legal dimensions relate to the security and flexibility of the regulator environment.

Component F_6 contains indicators characterising local social activity. Political activity, lobbying power, stability of the local management, and civilian courage are included in this factor.

The question of whether we reached the original goal with the component analysis arises, that is, finding a way to shape areas that are difficult to influence. We thus compare the values of the Effect matrix with the position of the factors (see Table 12).

Table 12

Position of factor-forming indicators in the analysis table

Effects » Internal factors	Political	Economic	Social	Infra-structural	Environ-mental	Legal
Quality of Life	705	4,769	5,160	1,793	1,456	67
Operational Efficiency	264	1,510	1,624	675	447	39
Economy and Finance	567	4,359	4,671	1,736	1,265	100
Innovation	258	1,670	1,819	645	576	17

Three factors are included in component F_1: one is difficult to influence, while the other two can be influenced somewhat easily; here we can hope for a real added option only by the synergy of factor-forming indicators. In groups F_2 and F_4, the situation is the opposite: local governments have good tools for developing almost

all relations. Therefore, the factor effect is not relevant, although because of a contrary reason. The situation is different for components F_3, F_5, and F_6. In these groups, both areas that cannot be developed easily are connected to one that can be influenced somewhat easily, which, if needed, can enable the indirect development of the two weaker relations.

To summarise, the main component analysis provides adequate tools for indirectly developing six areas that can be influenced only slightly. We could not find direct development tools for three factor-forming areas, while another three areas can be influenced only slightly and they are not a part of the main component analysis.

Forming settlement clusters based on main components

In the following paragraphs we examine the creation of settlement clusters based on the main components built from the indicators of the 132 settlements examined (see Table 13).

We identified four clusters in our analysis. Settlements in category 1 have good infrastructural characteristics. Settlement development takes place with serious fundraising, which is based on prominent management. Quality of life is better than the average; however, entrepreneurship is average. Social activity is strikingly modest, as if the locals would turn their awakening initiative for the time being toward economic activities. We named this cluster '*Emerging',* based on the good/improving conditions and strong control. 8% (N=11) of the assessed settlements belonged to this group. The cities of Tapolca, Balatonfűzfő, Makó, Csongrád, Szikszó, and some smaller settlements such as Alsóvadász and Halmaj, belong to this group.

Table 13

Forming settlement clusters based on main components

	Cluster			
	Emerging N=11	Endangered N=10	Opportunist N=101	Fortunates N=10
Development-management	0.78156	–1.95610	0.11981	–0.11370
Livelihood opportunities	0.21461	0.21539	–0.13685	0.93077
Infrastructure	1.59322	–0.23201	–0.17123	0.20891
Entrepreneurial activity	0.02899	–0.27404	–0.20314	2.29383
Settlement management	0.97450	0.35377	–0.14447	0.03337
Social activity	–1.58204	0.43286	0.09033	0.39501

The second cluster is similar in size but has a significantly different character. The livelihood characteristics, similarly to the first cluster, are favourable, with a

weaker but still an imaginative management. However, management efficiency is much weaker and perhaps partly as a result of this, underdevelopment is grave due to the infrastructural conditions. It is interesting that social activity is the biggest here, while entrepreneurship is the weakest among all clusters. We found the '*Endangered*' attribute the most fitting for this cluster (e.g. Nyírábrány, Hövej, and Kövegy).

Most of the settlements (N=101, 76%) belong to the third cluster. Modest development and livelihood opportunities below the total settlement average characterise this group. Underdeveloped infrastructure, insignificant entrepreneurship, and average social activity are the norm. Settlement management is the weakest for this group. Stagnation or slow deterioration characterises these settlements. This cluster was titled '*Opportunists'*.

The fourth cluster is a not too large group (N=10, 8%) of settlements enjoying prosperity. The outstanding livelihood is based on a strong and broadening entrepreneur stratum and the best infrastructural conditions among all clusters. Relative welfare allows a more spirited social life; however, management and development works are neglected to some extent. It is interesting that we find smaller settlements in this cluster, which explains the few but successful enterprises, but when taking the settlement size into consideration, a significant workplace number, just like it explains the modest ratio of liable sources, because the current rural development policy does not favour smaller settlements. The cluster received the name '*fortunates*' (representatives of this cluster are Kékkút, Kapoly, Kára (sic.), and Veszkény).

Conclusions

We described a method (RSC matrix) that combines the PESTEL and the BSC systems, that not only displays the external environmental factors and the internal resources at the same time, but also illustrates the network between them. We assigned variables to the indicators in the RSC matrix, which we used to study six Hungarian districts. We found that some factors were dependent on settlement size, while others were dependent on location, and some factors did not depend on either. We paid special attention to those indicator groups wherein the change in elements was not independent from each other. We conducted a main component analysis to examine the possibility of indirectly developing factors that can be influenced with difficulty. We found adequate tools with the main component analysis for indirectly developing six areas that can be influenced only slightly. We could identify four clusters by using the main components created by the indicators of the 132 settlements examined. Settlements in category I, the 'emerging' group, have good infrastructure and development takes place with serious fundraising, which is based on prominent settlement management. Only a few settlements belong here (N=8). The second cluster, 'endangered', is characterised by low management performance, and weak entrepreneurial activity, but strong social activity. Majority of

the settlements (N=101, 76%) belong to cluster 3, the 'opportunists'. This cluster is characterised by underdeveloped infrastructure and insignificant entrepreneurship; average social activity can be observed from the numbers. The fourth cluster, the 'fortunate' category, is characterised by a broadening entrepreneurial layer and excellent infrastructural conditions with strong civilian activity, although with a less active management. There are ten settlements in this cluster.

Our novel results are methodological adaptations and analytical and evaluation techniques for optimising decision-making objectives. Our new adaptation is the indicator matrix (RSC matrix). The model shows the relation between external factors affecting settlements and internal factors characterising the settlement with quantitative tools. The logical system of the reference database needed for additional analyses is novel since it enabled comparative work based on many aspects. From a comparative analysis of benchmark tables, we deduced that some of the indicators are dependent on region and/or settlement size. We identified six characteristic municipal roles based on regulation features of the municipal sphere; to each role we matched the set of instruments that can be attached by the legislator, which enabled the assessment of the relation between the set of instruments and the environmental factors, as well as the resources of the settlement. We summarised the relations in the TEM and the RM. The two matrices can support the planning of economic development actions. The effect matrix is used in a novel way regarding its methodology; it helps in revealing the influencability of economic areas characterised by different indicators. The matrix created and the heat map built on the values of the specific fields gives a plastic image about the extent of the direct influencability by local governments.

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Preliminary results of a farmstead survey of the Great Hungarian Plain

Mátyás Szabó
Corvinus University of Budapest
Institute of Geography, Geoeconomy and Sustainable Development,
Hungary
E-mail: matyas.szabo@uni-corvinus.hu

Orsolya Pap-Szuromi
GreenDependent Institute,
Hungary
E-mail: szuromi.orsi@gmail.com

Róbert Romvári
Szent István University
Enyedi György Doctoral School of Regional Sciences,
Hungary
E-mail: romvarirobi@gmail.com

Keywords:
rural development, scattered farmsteads, infrastructural features, Great Hungarian Plain, Farmstead Development Programme

A common problem with research into farmsteads is that, at present, there is no universally-accepted definition of a farmstead. Another problem specific to the Hungarian context is that no exact data are available for the number of farmsteads on the Great Hungarian Plain in recent decades. Recognizing this problem, a farmstead survey targeting the delineation of the Farmstead Development Programme was carried out in 2016. The authors of the study attempted to collect the data and databases currently available about farmsteads and peripheral residential areas and present a background to the survey carried out in 2016. The results of the survey allow to identify new trends, such as farmsteads becoming territorially more fragmented and the transformation of farms away from their traditional functions.

Introduction

The quality and historical continuity of the data available on farmsteads, as well as the comparability of the data measured during each period, primarily depend on the criteria that different surveys and databases use to define a farmstead.

Data on farmsteads, including on the people living in farmsteads, are available in the time series taken mainly from the population censuses of the Hungarian Central Statistical Office (HCSO). The problem with these data is that, since the population census of 1990, the HCSO has not separated out data collected on the number of people living in farmsteads, instead of publishing data showing the number of people living in peripheral residential areas[1] (Font 2006). A peripheral residential area includes parts of inhabited local administrative units located on the outskirts of municipalities - such as a watch-house, a forester's lodge, a village-like settlement with a street, a garden plot, a single farmstead or a group of farmsteads, or a factory housing estate - meaning that the HCSO data are representative of several types of residential areas combined, and not just farmsteads (HCSO 2018). Thus, at present, no single database provides data on the current state of Hungarian farmsteads or their demographic, economic, and environmental characteristics.

In connection with the definition of the farmstead, it is also important to note that legislative and other development policy documents and databases sometimes use different definitions and stress different aspects of the farmstead lifestyle.

For example, in 2009, the Hungarian Parliament passed the 49/2009 (V. 27.) resolution, referred to by Becsei (2016) as the farmstead law, which aims to preserve and develop farmsteads and farming areas. This piece of legislation refers to a farmstead *as a traditional type of agriculture, settlement, and lifestyle that is part of the Hungarian social, settlement pattern, and economic history heritage going back hundreds of years. Due to its unique socio-geographical, architectural, linguistic, ethnographic, and landscape features, the farmstead settlement system forms part of the Hungarian national heritage and, thus, of the European heritage.*

The above resolution was the basis for the delineation adopted by the Farmstead Development Programme ('the Programme'), announced every year since 2011. Furthermore, the Programme used the farmstead definition outlined in Section 5(25) of Act CXXII of 2013 on agricultural and forestry land trade for determining the entitlement of farmers applying for grants. Pursuant to this law, a farmstead refers to: *a plot of land not larger than one hectare located on the outskirts of a settlement to which – apart from the land – belongs a residential and farmstead building or group of such buildings erected for the purpose of plant and livestock production and product processing and storage related thereto, or a plot of land registered in the land registry as a farmstead.* The Pro-

[1] Inhabitant of the outskirts is a broader category than number of people living in farmsteads. An inhabited area of outskirts is - according to the practice of population census - an inhabited area where at least one person was enumerated or lives and at least one unoccupied but usable dwelling can be found (HCSO 2019).

gramme considers the whole of the Great Hungarian Plain as the recipient region (an area spanning six Great Hungarian Plain counties and nine southern districts of Pest county and currently consisting of 724 settlements).

However, according to the National Spatial Development Concept (NSDC) of 2005, farming areas are not restricted solely to the Great Hungarian Plain, as they can also include settlements where the population on the outskirts is at least 200, with a minimum of 2% of the population belonging to farming areas. Based on this definition, 280 settlements are considered parts of farming areas.

Contrary to the NSDC, the farmstead definition used by the National Development and Territorial Development Concept is better suited for potential applicants to the Farmstead Development Programme: *Scarcely inhabited outskirts of settlements typical for the areas of the Great Hungarian Plain with a dwelling function, a traditionally important agricultural role, and an increased touristic and recreational function.*

However, it is worth noting that the Rural Development Programme (RDP), corresponding to the seven-year-long programming period between 2014-2020, uses the aforementioned definition of Act CXXII of 2013 for identifying farmsteads (Rural Development Programme 2014–2020) and, thus, it is not surprising that the delineation of the RDP grant announcements for developing farming areas corresponds to those indicated in the Programme.

The delineation of farming areas can also provide an anchor for specific land coverage databases. The CORINE database CLC50 (1:50,000 scale) initiated by the European Union (EU) and, in Hungary, managed by the Government Office of the Capital City Budapest, Department of Geodesy, Remote Sensing and Land Offices (DGRSLO), uses the following delineation for farming areas: *typically, especially for the Great Hungarian Plain, a complex agricultural environment with scattered buildings.* In the CLC50 database, the smallest charted unit is four hectares; thus, farmsteads situated close to each other (not further than 200 meters), none smaller than four hectares (buildings with vegetable gardens and trees), are measured together, but farmsteads situated more than 200 meters from each other and smaller than four hectares are not shown (Szabó 2010). In contrast, under the definition outlined in the Land Trade Act, a plot of land situated on the outskirts of a settlement and smaller than one hectare can be considered a farmstead, which shows that the number of farmsteads and the location of farming areas vary in each database.

Previous survey and background

According to Székely and Kotosz (2018), although farmsteads have been examined by researchers for a long time, these analyses are not systematic, but rather specific. The authors of this study agree with this assessment, as following political change, only minor territorial units (not larger than a county) has been involved into farmstead researches.

From these works, we would like to highlight the research carried out in 2002–2003 by the professors and students of Szent István University, Corvinus University of Budapest, Eszterházy Károly University (formerly Károly Róbert College), and John Von Neumann University (formerly Kecskeméti College) under the control of the Centre of Regional Studies of Hungarian Academy of Sciences, Great Plain Research Institute; this study involved 825 farmsteads in 24 settlements in the area of Kiskunság. The primary objective of the research was '*to shed light on the farmsteads and the people living in these farmsteads, the reasons, circumstance and consequences of the positive and negative changes*' (Csatári–Kiss 2004).

The fieldwork carried out by the Centre of Regional Studies of Hungarian Academy of Sciences, Great Plain Research Institute in 2005 across 104 settlements in Homokhátság is also noteworthy. In this survey, the researchers examined and analyzed farmsteads based on five thematic units (society, built environment, type of farmstead, and certain progressive elements). In the course of the study, 39,251 farmsteads were surveyed (Czene–Jávor 2006).

It is important to ascertain the objectives of the Farmstead Development Programme, initiated in 2011 and financed entirely by the Hungarian government, which supports area and county surveys of farmsteads. Under the objectives above, five organizations in 2011, four in 2012, and three in 2013 received financial aid. Among the projects that received aid, a farmstead survey covering 200 settlements (nearly 34,000 farms) was carried out with the use of a uniform and centrally-approved questionnaire.

Here, we would like to stress one of the conclusions on the farmsteads of the Kiskunfélegyháza area from the 2012 survey: '*Unfortunately, there are several farmstead numbers in the databases, under which the farmstead has already disappeared. This is also due to the failure of the owner to report that the farmstead has ceased to operate, they plough the area*' (Farmstead Development Programme of the Kiskunmajsa area 2012).

We should also point out that research was conducted in the neighboring countries and financed by the Hungarian Ministry of Agriculture. In 2016, there were surveys in the scattered farmsteads of Partium (RO) and Székelyföld (RO), where thousands of responses were recorded (Geréb 2017, Szilágyi 2017).

Based on the objectives of the Hungarian government, according to which, by 2020 every farmstead in Hungary should have electricity and should be accessible by road, a comprehensive survey of farmsteads was undertaken in 2016. The survey, reflecting the delineation of the Farmstead Development Programme, that is, covering 724 settlements on the Great Hungarian Plain, was induced by the fact that Hungary has no accurate and up-to-date information about the geographical location of farmsteads, the population living in farmsteads, or the demographic and economic situation of the farmstead population (Dobai et al. 2018).

2016 survey objectives and methodology

The primary objective of the 2016 survey was to compile a database in which geographical coordinates can be used to identify the farmsteads on the Great Hungarian Plain. Another important objective was the preparation of a study presenting the situation of those farmsteads that are still without electricity and highlighting possibilities and proposals in connection with lack of access to electricity.

Based on the decision made during the cabinet meeting on 18th August 2015, the field work for the survey was carried out between March and April 2016 by the Government Offices. The work of the Government Offices was partly assisted by farmstead caretakers (a type of public service), family support workers, and field watchmen with appropriate local knowledge. The Ministry of Agriculture drafted the questionnaire used during the fieldwork and the related explanatory notes. The materials were drafted based on previous survey documents and the practical experiences of several farmstead researchers. The questions included in the questionnaire can be classified into eight thematic groups:

1. Locations of farmsteads
2. State of natural environment around farmsteads
3. Population
4. State of farmstead buildings
5. Infrastructure situation
6. Wired electricity supply
7. Farming
8. Farmstead Development Programme and other grants

The Ministry of Agriculture consulted several other ministries before compiling the questionnaire used during the fieldwork to more precisely define the range of farmsteads to be included in the survey. As a result of these consultations, a background table was compiled with the help of the DGRSLO, which included the land registry database (LRD), vector topographic map database (VTMD), and the data of the Land Parcel Identification System (LPIS) related to farmsteads. DGRSLO used the following queries during data sorting:

- an analysis focusing only on outlying plots and garden-plots;
- plots that were shown to be a farmstead, school, farmhouse, and so on were sorted from the land registry database;
- plots overlapping with the one-meter zone of farmstead objects sorted from the 10v.1 database of DITAB (Digital Topographic Database) were sorted from the topographic database of the land registry;
- plots overlapping with the one-meter zone of farmstead objects of the Cover Database of the LPIS were sorted from the topographic database of the land registry.

Table 1 includes the county-level summaries of the mentioned data sources.

Table 1

Farmstead-related county-level summaries of the databases

County	Settlement with farmsteads based on LRD (number)	Farmsteads based on LRD (number)	Settlements with farmsteads based on the VTMD (number)	Farmsteads based on the VTMD (number)	Settlements with farmsteads based on the LPIS (number)	Farmsteads based on the LPIS (number)
Bács-Kiskun	119	18,809	116	68,160	108	22,479
Békés	75	6,568	73	20,944	71	12,136
Csongrád	66	9,050	65	45,429	61	27,319
Hajdú-Bihar	85	18,733	72	9,718	70	4,852
Jász-Nagykun-Szolnok	77	6,551	72	9,826	65	4,181
Pest	80	11,021	74	15,310	60	5,289
Szabolcs-Szatmár-Bereg	218	20,126	186	5,935	108	1,847
Total	**720**	**90,858**	**658**	**175,322**	**543**	**78,103**

Source: Own elaboration based on DGRSLO data.

Table 1 demonstrates that the databases registering farmsteads are not uniform. The number of settlements with farmsteads belonging to the counties of the Great Hungarian Plain (see Table 2) and the total number of farmsteads varies significantly.

It must be emphasized that the data presented in Tables 1 and 2 (for the year 2015) come from public databases. The data are handled and recorded by the Government Office of the Capital City Budapest.

Table 2

Settlements with the highest number of farmsteads based on different databases

Serial number	LRD	Farmsteads (number)	VTMD	Farmsteads (number)	LPIS	Farmsteads (number)
1.	Kecskemét	3,882	Kecskemét	6,680	Kiskunfélegyháza	2,284
2.	Nyíregyháza	2,786	Kiskunfélegyháza	4,287	Hódmezővásárhely	1,974
3.	Kiskunfélegyháza	2,023	Kiskunmajsa	3,586	Békéscsaba	1,949
4.	Lajosmizse	1,568	Debrecen	3,574	Debrecen	1,913
5.	Kiskunmajsa	1,564	Kiskunhalas	3,517	Balástya	1,885

Source: Own elaboration based on DGRSLO data.

Besides the numerical data presented above, the 40 cm/px georeferenced orthophotographs prepared in 2015 regarding the research observation area were received from Government Office of the Capital City Budapest, the Department of Geodesy Remote Sensing, and Land Offices. These orthophotographs have been developed. The orthophotographs are used for the validation of the GPS coordinates registered during the survey and to check the state of the farmsteads.

Preliminary results of the 2016 survey on the farmsteads of the Great Hungarian Plain

During the fieldwork, the interviewers recorded 94,644 data sheets. Following the recording, the Herman Otto Institute built an SQL-based database with the assistance of the Ministry of Agriculture and carried out a preliminary feasibility study, in which the authors presented the situation of farmsteads without electricity and formulated possibilities and proposals for how to solve the problem of electricity supply.

Guided by the original purpose of the survey, we subsequently sorted those farmsteads with residential and economic functions but no electricity - that is, no connection to the power grid or no isolated power system - from the total sample. This search shows that 4,779 farmsteads have no electricity, and it can also be said that no data related to this question are available in the case of nearly 41% of the surveyed farmsteads.

It should also be mentioned here that, in the course of preparing the present study, we had access to the background materials jointly prepared by the Ministry of Agriculture and the Herman Otto Institute, which already analyzed some questions from the 2016 survey on the Great Hungarian Plain concerning access to electricity. In the material above, the authors stated under the question concerning distance from the nearest power grid connection that the owners of the farmsteads could answer the question with relative accuracy. To record the accurate distances, the authors of the background material contacted the Lechner Nonprofit Ltd., the operator of the E-utility system (unified electronic register of public utilities). Table 3 contains the information obtained from the respondents, supplemented with the data received from the operator.

Table 3

The distances between farmsteads and the nearest power grid connection

No.	Distance from the grid (m)	Based on the questionnaire		Based on the data collected by Lechner Nonprofit Ltd.	
		Number of responses	Percentage of responses	Number of responses	Percentage of responses
1.	< 50	1,032	35.2	968	21.0
2.	50 – 1000	390	13.3	3,110	67.4
3.	1000 – 2000	111	3.8	436	9.4
4.	2000 <	1,398	47.7	102	2.2
Total		**2,931**	**100**	**4,616**	**100**

Source: Own elaboration based on information from the Ministry of Agriculture, Herman Otto Institute, and Lechner Nonprofit Ltd.

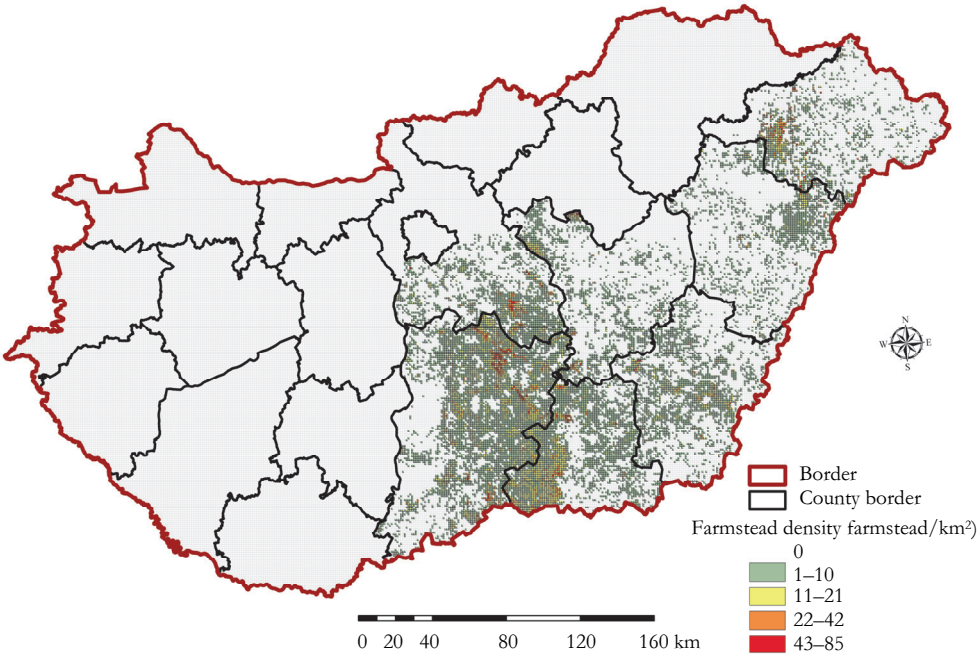
Table 3 shows that, according to the questionnaire, 61.5% of the owners of the farmsteads without electricity (4,779) responded to the question concerning the

distance from the power grid. In contrast, the data of the Lechner Knowledge Centre relate to 96.2% of the total sample.

Cleansing and organizing the inventoried data are part of the process of building the involved database. As a result of this process, it is considered that the GPS coordinates of nearly 3,000 farmsteads from the full sample could not be analyzed, as either the latitudinal or longitudinal coordinates were missing. There were cases in which, according to the coordinates, the farmstead was not situated within the boundaries of the analyzed area (in extreme cases, it was located outside Hungary). At the end of the data cleansing and organization, data were available for 91,806 farmsteads. With the use of these data and the ArcGIS 10.4.1 software, we drew up a density map dividing the territory of Hungary into a grid of squares of 1x1 km (see Figure 1).

Figure 1

Geographic representation of the surveyed farmsteads



Source: Edited by Róbert Romvári.

Figure 1 shows that the areas of the Great Hungarian Plain with the highest number of farmsteads are the environs of Homokhátság, Nyíregyháza, and Békéscsaba. These three hubs correspond to the three typical types of areas with farmsteads: the dispersed settlements around Kecskemét, the so-called 'sortanya' (a number of farmsteads along dirt roads) typical of Békés county, and the so-called

'bokortanya' (farmsteads scattered across arable land) in the area of Nyíregyháza (Romvári 2017).

In recent years a remarkable increase of territorial population disparities can be seen within the Great Plain (Obádovics 2013). According to the projections prepared by Hablicsek (2007), the Southern and the Northern Great Plain population will decrease by 340,960 between 1980 and 2021. In terms of population loss, the Great Plain as a whole was ranked second behind Northern Hungary. However, comparing the real and the projected population an underestimation of an approximate 1-1.5 percentage can be detected in 2011 within the Great Plain region.

Using the principal component analysis Kulcsár et al. (2011) classified micro-regions by age structure and regional development. According to the result, the Southern Great Plain can be characterized by aging micro-regions and average development indicators. In contrast, young age structure and economic underdevelopment are characteristic within a remarkable part of the Northern Great Plain.

Using vector maps and a GIS program, we examined the number of farmsteads – from the 91,806 (see Figure 1) – located in the inner belt area or other central parts of the 724 settlements. As a result of this sorting, we found that 1,674 farms are located in such zone.

Subsequently, we carried out a preliminary analysis of each question concerning the total sample (94,644). It should be noted before the presentation of the results that the poor quality of survey data did not allow to conduct a deeper examination. In general, the responses to the questions included in each of the thematic groups show substantial lack of data. A recurring problem throughout the processing of the data sheets was that the respondent did not use the unit of measurement defined in advance, meaning that the results were largely distorted and not representative of reality. Based on these, we analyzed only those answers where the responses were relatable to the whole sample. However, when smaller geographic units are examined (case studies), other variables that are not handled by this study may be subject to substantive analysis. Such indicators may include: the distance of surveyed farmsteads from the settlement; the distance from the nearest solid paved road; the type of agricultural activity; whether farmsteads engage in tourism, organic farming, or food processing; and the use of renewable energy sources.

For cases in which we analyzed the number of farmsteads belonging to a settlement, it can be established that the highest number of dispersed settlements were registered in Kecskemét (4,765), Nyíregyháza (2,965), Kiskunfélegyháza (2,259), Lajosmizse (1,697), and Cegléd (1,450). However, we found that, contrary to the size of the surveyed area (724 settlements), in the framework of the Great Hungarian Plain survey of 2016, farmsteads were registered in the outskirts of 'only' 675 settlements.

As we have already mentioned in the methodological part of the paper, the survey included questions concerning the relations between the farmsteads and the natural environment. In what follows, we would like to present some of these ques-

tions. The presentation of the protected natural features of the farmstead areas of the Great Hungarian Plain shows that some national parks and areas protected at the national level and Natura 2000 areas enrich the lowland landscape, making it valuable and interesting. Based on the data published by the Ministry of Agriculture in December 2017, there are 10 national parks, 171 conservation areas, 39 landscape parks, and 88 nature value sites in Hungary (Ministry of Agriculture 2018). Each of the categories above can also be found within the boundaries of the research sample area. The survey analyzed whether each farmstead is part of the Natura 2000 area. Based on the responses, only 1.1% of the total sample is situated in Natura 2000 areas; however, according to the vector topographic map data available to us, three times more farmsteads can be found in the Natura 2000 areas. Based on the responses given to the question on whether the farmstead is part of any of area marked for conservation, 597 farmsteads are situated in national parks, 459 farmsteads in conservation areas, and 393 farmsteads in landscape parks, and we do not have adequate data regarding 13,502 farmsteads. According to the topographic data, the correct number for the above information are 941, 85, and 368, respectively. Based on the responses, it appears that many of the owners do not know the conservation status of his or her farmstead.

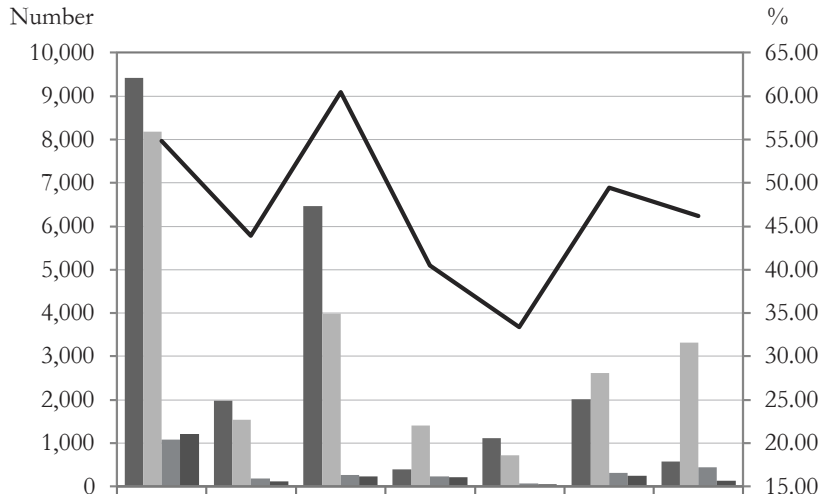
Regarding the environmental status of the surveyed farmsteads, based on nearly 80,000 responses, we can state that a significant portion of the farmsteads in the Great Hungarian Plain, i.e. 80.5%, has preserved its traditional architectural nature up to the present date. A further 10.3% of the farmsteads have a combination of modern and old-style buildings, and 9.2% have new and modern buildings.

A subsequently processed question concerns the year of construction of the residential building of the surveyed farmstead. The questionnaire defined ex-ante four possible responses: the residential building was constructed before 1945, between 1945 and 1989, between 1990 and 2000, or after 2000. Figure 2 shows the county distribution of the farmsteads for which we had adequate data (48,491).

Figure 2 shows that the vast majority of the surveyed farmsteads (90%) were built before the regime change of 1989. It is interesting to note that the number of farmsteads built between 1945 and 1989 (21,764) is almost the same as the number of buildings constructed before the end of the Second World War (21,936). These data are especially interesting since, in the 1950s, a moratorium on buildings was introduced in peripheral areas, which was only lifted in 1986 (Csatári–Kiss 2004). According to Duró (1990), this regulation deprived the population of the peripheral areas of even the possibility of constructing buildings from their resources. According to Dövényi (2003), the peripheral population of the Great Hungarian Plain fell by one-fifth between 1949 and 1960. However, the demographic decline of the peripheral areas showed significant territorial differences (Beluszky 1983). The greatest 'losers' during this period were farmsteads in Tiszántúl, while the farmsteads of Homokhátság were least affected.

Figure 2

Distribution of surveyed farmsteads by year of construction of their residential buildings



	Bács-Kiskun	Békés	Csongrád	Hajdú-Bihar	Jász-Nagykun-Szolnok	Pest	Szabolcs-Szatmár-Bereg
Before 1945	9,422	1,972	6,459	393	1,118	2,003	569
1945–1989	8,185	1,539	3,976	1,401	731	2,617	3,315
1990–2000	1,077	184	269	226	66	309	445
After 2000	1,216	123	226	213	52	243	142
Response rate (%)	54.84	43.84	60.44	40.44	33.37	49.41	46.17

Source: Own elaboration based on the survey.

The traditional functions of farmsteads have undergone significant changes during recent decades. The literature indicates that traditional farming has been in retreat and that the role of farmsteads has become more diverse, with an increasing number of farmsteads becoming active in catering and tourism, and the number of hobby farmsteads has been increasing over recent decades (Csatári–Kiss 2004, Kozma 2011, Székely–Kotosz 2018). When looking at the distribution of farmsteads according to their dwelling function, based on 49,488 responses, 79% of the farmsteads are permanently inhabited. The proportion of uninhabited farmsteads is around 12%. However, a considerable portion of these dispersed settlements has some economic function. A total of 8.5% of the analyzed farmsteads function as hobby farmsteads.

Regarding the farming function the majority (58%) of the surveyed farmsteads (based on 24,000 responses), produce for their own consumption, that is, their products are not sold. A total of 23% of the farms sell any surplus not meant for own consumption (not more than 50% of the produced goods), while 19% of the respondents produce mainly for the purpose of selling (at least 51% of the produced goods are sold).

In the case of farmsteads used for farming, based on 38,425 responses, in more than 80% of the farmsteads, the size of the plot directly belonging to the farmstead is one hectare or less. These farms, based on their size, meet the following part of the definition of a farmstead used in the Farmstead Development Programme: '*a plot of land not larger than 1 hectare located in the outskirts of a settlement to which – apart from the land – belongs a residential and farm building or group of such buildings erected for plant and livestock production and product processing and storage related thereto'*. Farms with a plot larger than one hectare (8,000) are considered farmsteads according to the following part of the definition: *'a plot of land registered in the land registry as farmstead'*.

The 2016 survey analyzed the proportion of the agricultural areas around the farmsteads. Based on nearly 61,000 responses, in the case of half of the farmsteads, this proportion is more than 80%, while in the case of 27% of the farmsteads, less than one-fifth of the area of the farmstead is used for arable farming.

This survey did not investigate whether the farmstead infrastructure involved an appropriate road network or not. Among others, the transport situation can be characterized by the so-called accessibility index which is based on time, not distance. Within the Great Plain, the average micro-level accessibility time (10.0–29.9 minutes) of the central town from a given settlement is around the country average. However, Békés county has the slowest nationwide approach (up to 90 minutes) from the express road junctions (Novák–Varsányi 2011).

In the framework of the survey, the experts analyzed the infrastructural situation of the given farmstead. They asked about the electricity, gas, and drinking water supply of the property. In the course of processing the data, we produced an index value from the responses given to the questions mentioned above. We included only those farmsteads in the comparison, whose owners provided valid responses to all the questions, a total of 43,016 farmsteads. We followed the below logic when producing the index value:

Electricity supply:

- the farmstead has electricity and is connected to the power grid – 2 points
- the farmstead uses an isolated power system – 1 point
- the farmstead has no electricity – 0 point

Gas supply:

- the farmstead has a gas connection – 2 points
- the farmstead uses liquid petroleum gas – 1 point
- the farmstead has no gas connection – 0 point

Drinking water supply:

- the farmstead is connected to the drinking water distribution network – 2 points
- the farmstead solves the question of drinking water with a driven well – 1 point
- the farmstead has water quality problems – 0 point

After we arranged the farmsteads in order, according to the mentioned logic, we defined three categories: 1. Farmsteads with an unfavorable infrastructural situation (0–1 point); 2. Farmsteads with an average infrastructural situation (2–4 points); 3. Farmsteads with a favorable infrastructural situation (5–6 points). We derived the results shown in Table 4, broken down by county.

Table 4

Infrastructure features of the surveyed farmsteads

County	Number of surveyed farmsteads	Unfavorable state		Average state		Favorable state	
		Number	%	Number	%	Number	%
Bács-Kiskun	17,943	432	2.41	12,977	72.32	4,534	25.27
Békés	3,497	37	1.06	2,172	62.11	1,288	36.83
Csongrád	8,443	1,349	15.98	5,215	61.77	1,879	22.26
Hajdú-Bihar	2,323	61	2.63	1,626	70.00	636	27.38
Jász-Nagykun-Szolnok	1,526	59	3.87	1,066	69.86	401	26.28
Pest	4,900	65	1.33	3,751	76.55	1,084	22.12
Szabolcs-Szatmár-Bereg	4,384	23	0.52	1,269	28.95	3,092	70.53
Total	**43,016**	**2,026**	**4.71**	**28,076**	**65.27**	**12,914**	**30.02**

Source: Own elaboration based on the survey.

Table 4 shows that 4.7% of the farmsteads are in unfavorable state, 65.3% in average state and 30% in favorable infrastructural state. However, there are significant differences in the distribution of each category by county (written in Table 4 in bold type):

- While the proportion of properties in unfavorable situations varied, on average, between 0.5% and 4%, in Csongrád county this value was 16%;
- The average value of the average farmstead by county varied between 61% and 76%; however, in Szabolcs-Szatmár-Bereg county this value was 29%;
- The average value of the favorable situation category varied between 22% and 37%. From this value, the farmsteads of Szabolcs-Szatmár-Bereg county showed a different result, measuring 70.5%.

Overall, 93% of the surveyed respondents had wired electricity, 22% piped gas and 26% piped drinking water. A total of 22% of the analyzed farmsteads had a gas connection, while 26% of them had a connection to the drinking water distribution system.

Analysis of the phone connections of the farmsteads, based on 41,048 responses, showed that 5% of the farmsteads have a fixed telephone and 69% of the population has a mobile phone connection. A total of 17% of the population has a fixed or mobile phone connection. Analyzing access to the internet, the results show significant differences compared to the national average. Based on HCSO 2016 data, nearly 80% of the households in Hungary had access to the internet; in the case of the farmsteads, based on 36,666 responses, this rate is 38%. According to the HCSO data, the internet penetration rate of the total population in the Northern Great Plain and the Southern Great Plain was lower than the national average (in 2016 this value was 72% in the regions of the Great Plain) (HCSO 2017b).

In the survey under review, the data show that the highest internet penetration is in the counties of Pest and Békés (47.8% and 44.0%, respectively), and the lowest rate of penetration can be found in Csongrád county (29.8%). Based on the data, the farmsteads of Csongrád were the least developed. However, the internet penetration rate of the total population of Csongrád county was above the national average (this difference could be affected by the lower response rate of Csongrád, which was under 40%).

Conclusions

Over the last two decades, farmsteads have become territorially more fragmented. No accurate information existed about the geographic location and general state of Hungarian farmsteads. Acknowledging this gap, a survey of the farmsteads of the Great Hungarian Plain was carried out in 2016. By using the GPS coordinates recorded during the fieldwork, a map of the whole territory of the Great Hungarian Plain showing the farmsteads was drawn up.

The number of farmsteads and their population has diminished over recent decades. Alongside others, this survey gave us a fresh territorial picture of the 'living' farmsteads, so we can now prove that the areas of the Great Hungarian Plain with the highest number of active farmsteads are the environs of Homokhátság, Nyíregyháza, and Békéscsaba, with three typical types of settlements: scattered farmsteads, the 'sortanya', and the 'bokortanya'.

In parallel with these processes, the traditional functions have also transformed: a total of 79% of the farmsteads are permanently inhabited; uninhabited farmsteads make up around 12% of the total; however, a considerable part of these dispersed settlements has some kind of economic function. Hobby farmsteads, purchased only for recreational purposes, have appeared, and in the context of being multifaceted and diverse, more and more farmsteads have become active in catering, tourism, and artisanal activity. In the field of environment, a large number of the owners do not know the exact conservation status of his or her farmstead, and a significant portion of the farmsteads, i.e. 80.5%, has preserved its traditional architectural nature up to the present date.

From a development policy and planning point-of-view, we were able to identify at least 4,779 farmsteads with residential and economic functions, but with no electricity, i.e. no connection to the power grid or an isolated power system, from the total sample. This is a definite point to target, for example, in the next development period of the EU. It is also important to highlight the relevance of agricultural policy, as, for half of the farmsteads, the proportion of the agricultural area around them is more than 80%, while in the case of 27% of the farmsteads, less than one-fifth of the area of the farmstead is used for arable farming.

In light of the preliminary research results presented in our study, it is considered that they did not fully meet the objective of the questionnaire survey. However, the data collected in the field and the database built from these data could be used as the basis of further analysis focusing on similar topics. We think that a more thorough and detailed analysis of the data could enable the development of dedicated funding for the different types of the farmsteads.

Possible further research

The authors believe that the data included in the database built during the survey should be clarified and supplemented in the future. We consider the field research worthy of being organized as a model programme, and within the framework of this field research, the general data concerning the farmsteads could be verified in the field. With the processing of the orthophotographs by the geographic information system provided by the Government Office of the Capital City Budapest, the maps showing the geographic location of the farmsteads can be more accurate. In case of the availability of a complete database, we think that, based on the general features of the farmsteads, the current farmstead typing can be renewed.

For this work, further useful data could be delivered by the HCSO Inspire database, which maps the resident population and dwelling stock of Hungary on a 1 x 1 km square grid. By comparing the data sets listed above and the state land cover and land use map files, the environmental changes of the scattered farmsteads can also be described.

In addition, the results of the 2016 survey could provide a basis for a GIS system that would include the location of surveyed farmsteads (based on GPS coordinates), public utilities, basic data of people living on the farm, and information on accessibility of farms (e.g. photographs showing the quality of farm roads). In the region of Gyula (a settlement in Békés county), there has been a similar system since 2013 (with an underlying database of about 700 farms), which greatly facilitates the work of local ambulances, firefighters, police, family support workers, farmstead caretakers, and social workers.

Finally, we believe it would be worthwhile to, once more, include farmstead surveys at regional and county levels into the grant announcements of the Farmstead

Development Programme for upcoming years, as a grant objective would be useful. With the latter step, the changes of the farmstead areas could be checked and monitored.

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Spatial differences regarding the chance to leave supported public employment in Hungary's rural periphery

Tibor Kóti
University of Debrecen, Hungary
E-mail: tiborkoti7@gmail.com

Time has passed since unified supported public employment was introduced in Hungary in 2011, thus enabling an analysis of the efficiency of the programme, using exact quantitative and qualitative methods. The present paper aims to comprehensively study the most significant employment policy measure in Hungary (supported public employment) with special regard to its efficiency. The paper studies the chances of integration with the open labour market, which is the open aim of supported public employment, in well-defined periphery areas. Based on qualitative analyses, the spatial structure of supported public employment, or the supported public employment rate, is presented with a situation in which public employees are supported in the labour market. This includes regional development's effects on peripheral areas and the budget's appropriateness. Based on quantitative analyses, it is discovered that one critical factor impeding integration into the open (alternative) labour market is atypical employment and its obstacles. Analysing the supported public employment programme's efficiency reveals a major issue in the high number of people in supported public employment, as the value of the lock-in indicator was higher than 80% in the 603 settlements studied in 2017. The present paper discusses the possible exposition of factors behind this lock-in, and its special cases have also been studied, (including age, gender, and qualifications). Supported public employment currently provides an opportunity to improve disadvantaged people's policy-related employment conditions by increasing employment. This also includes strategic rural, socio political, and regional development aspects. The study's national strategic role is reflected in that the conclusions drawn from the data may illustrate a way to develop strategies to support public employment programmes with appropriate quality.

Keywords:
lock-in
rural areas,
integration,
regional differences,
periphery areas,
disadvantaged

Regional Statistics, Vol. 8. No. 2. 2018: 109–134; DOI: 10.15196/RS080210

Introduction

Supported public employment is a social and economic phenomenon first detected in ancient times, and can be defined as performing activities in the interest of the public, but with different contents in both space and time. Supported public employment was emphasized at times when labour market inequalities such as increasing unemployment, increasing poverty, and extended declassification, among others increased, and these could not be handled by active labour market mechanisms, such as enhancing the integration of disadvantaged groups unemployed through no fault of their own in the open labour market.

Marked regional differences exist in Hungary regarding employment (a west-east slope and core-periphery dichotomy) generating significant tensions, especially in marginalised areas. Studying labour market mechanisms in recent decades reveals that supported public employment is one of the most significant employment policies. Consequently, numerous works have been published in recent years on supported public employment, including its social and economic effects, primarily due to resolutions to improve employment (Csoba 2010a, Csoba 2010b, Messing 2012, Cseres-Gergely–Molnár 2014, Tésits–Alpek 2014a, Váradi 2016, Cirfusz 2015) However, most papers do not attempt to qualitatively and objectively expose and analyse the factors significantly hindering the programme's efficiency, which is an innovative element in the present research. The present paper's novelty is that it studies the open aim of supported public employment by analysing spatial processes, thus exposing the programme's most important inequalities.

Studying these processes on a spatial basis is relevant, as indicated by the fact that supported public employment as with labour market situations has changed significantly over the past decades. Employment policy trusts that a proportion of supported public employees will be employed in the competitive sector, however, companies have complained during labour shortages that relatively rigid supported public employment programmes have retained their potential labour force. This perspective reveals that increasing the minimum wage, especially compared to wages in supported public employment, may attract supported public employees to leave supported programmes. Unfortunately, supported public employment varies spatially. It is difficult to imagine that local economies in disadvantaged regions could generate jobs, especially when transitioning supported public employees into the labour market. In contrast, prosperous counties have few supported public employees, which is problematic given the employment capacity of the competitive sector in these areas.

The 2008 global economic crisis had a cumulative effect in Hungary, especially in its peripheral areas, due to disadvantages caused by marked differences in regional development. Previous empirical research has considered the exponentially disadvantageous situation in rural areas, in that the agricultural basis such as the reduction

of processing plants or privatisation among other situations cannot be incorporated into long-term strategies. Thus, employees could not be mobilised towards other sectors (increasing their long-term unemployment) and supported public employment programmes, even if only theoretically, could contribute to the sustainability and diversification of the rural lifestyle (Farkas–Kovács 2018, Shucksmith 2010). The disadvantages of rural life are not the result of the crisis, but manifest as problems that have gone unsolved for decades due to uncertain working conditions, insufficient infrastructure and narrowing labour market mobilisation (Pospech–Kulcsár 2016, Pospech et al. 2009).

The economic recession following the crisis substantially affected Hungary's labour market especially in rural areas. Many economic organisations became unstable; most could not manage the negative consequences of the crisis and they got out of records. Hungary had 477,351 registered job-seekers in 2008, which increased markedly and continuously to 604,576 in 2009. At a macro level, this increase caused economic deprivation. Consequently, the Hungarian employment policy aimed to reduce the high unemployment ratio with an open employment policy measure to escape the crisis namely supported public employment. The role of supported public employment became a field of improvement and as a result of this employment policy over the past 20 years ('Public Works': from 2000, 'Road to Work': from 2008 program, 'Unified Supported Public Employment': from 2011), the state's role has reduced. The priority has been to surmount the unemployment crisis by achieving a higher employment ratio, and to minimise passive state support by increasing jobs instead of aid.

Studying labour market tendencies in Hungary reveals the special role of supported public employment in employment growth as a whole, especially among disadvantaged groups and regions (Váradi 2016, Alpek et al. 2016). Currently supported public employment can be regarded as an important and innovative tool of regional development, as well as social and employment policies. Employment policy aims to improve labour market parameters and establish economic stability, thus improving Hungary's competitiveness. Regional development's role in realising supported public employment is reflected in its focus on regions suffering from depressed employment; it aims to reduce regional inequalities by focusing on deprivation in rural areas. An important aspect of the social policy involves eliminating poverty (pauperisation), and supported public employment seems to be an appropriate tool to realise this aim.

When supported public employment was first developed, its most important aim was to integrate or re-integrate participants into the open labour market as soon as possible. Certain studies indicate that both employers and supported public employees perceived potential re-integration rather pessimistically (Tésits–Alpek 2015, Tésits–Alpek 2017). Numerous government initiatives have been launched in recent years to aid integration or re-integration, although these risk disadvantage due to

regional anomalies, such as the core periphery dichotomy which significantly affect open labour market conditions. This paper seeks answers by studying unified supported public employment to determine the actual probability of integrating supported public employment participants into the open labour market. The paper discusses the factors that impact supported public employment's efficiency, and outlines the probability that periphery areas will reach settlement levels by exposing regional differences. Further this paper aims to focus on the most underdeveloped regions in Hungary using an area delineation adjusted to a complex programme best conveying underdevelopment from a supported public employment perspective. Another aim involves studying the spatial structure of supported public employment, such as determining which regions are overrepresented in programme participation. Another noteworthy issue is the coherence of the support for settlements overrepresented in supported public employment given the particular region's unemployment rate. The present paper also describes the factors hindering integration into the open labour market by studying regional processes. Critical notes and complex recommendations are then provided after each factor has been discussed.

Material and methods

This paper's results are based on both primary and secondary methods. The research's primary aspect involves a complex visualisation of regional relations among the studied factors, with a special focus on inequalities. When analysing the regional aspects of supported public employment, the research highlighted Hungary's peripheral regions, especially from a supported public employment perspective, as well as such regions' chances of development. Settlement-level data were used, where available, for a more detailed analysis. However, regarding certain factors analysing supported public employment's efficiency, such as a study monitoring supported public employees, county- and country-level analyses were also important.

The present paper is based on the criteria widely used in international literature (Perger et al. 2016, Ray 1998, Dax 1996, Mardsen 1998). Thus, it grouped all settlements with population densities less than 120 people/km^2 based on 2011 census data into rural regions. Previously defined rural areas were also used as a basis for further delineation, with two additional categories: areas with population densities less than 60 people/km^2 are regarded as 'fundamentally rural' (2,145 settlements), while those with lower population density are regarded as 'mostly rural' (659 settlements). This further categorisation of already delineated rural areas was justified by the fact that supported public employment's efficiency, which is important relative to this paper, indicated clear differences in fundamentally and mostly rural areas. The present paper classified regions with population densities greater than 120 people/km^2 as 'urban' (350 settlements). Mapping urban and rural regions exposed Hungary's spatial inequalities regarding its core-periphery dichotomy.

As these peripheral areas were delineated, factors could then be selected that characterise the most disadvantaged regions regarding supported public employment. Regions can then be identified based on the factors applied in the study in which the chances of leaving supported public employment have been minimised due to the regions' social and economic vulnerability. The factors' final selection was significantly influenced by the need for data sets that are reliable; controlled; easy to localise spatially; and complete, with data available for each settlement (Nemes Nagy 2009). In studying the relationships among these factors, Pearson's rank correlation justified including both factors, as they do not influence either each other or the current delineation. The following factors were used when peripheral regions were defined:

- The value of domestic migration per 1,000 inhabitants, 2016 (%),
- A lock-in indicator of supported public employment[1], 2016 (%),
- The average ratio of supported public employees among average working aged people, 2016 (%),
- The ratio of people with a maximum of eight classes of primary school qualification among supported public employees, 2016 (%),
- The ratio of people aged 24 or younger among supported public employees, 2016 (%).

Data were then operationalised based on the supported public employees' place of residence and not their workplace location for each research factor. As the factors involved in the study were selected for the year 2016, this research did not aim to dynamically study these factors. It was important that certain factors be transformed into specific parameters, except for the lock-in indicator, to perform complex comparisons. Peripheral regions' supported public employment were identified using a normalisation method relative to the minimum-maximum interval:

$$Z_i = \frac{X_i - X_{min}}{X_{max} - X_{min}}$$

where Z_i is the normalised variable; X_{max} is the maximum value; X_i is the studied data series; X_{min} is the minimum value.

The complex factor's value was determined by the arithmetic average of the normalised data series; values greater than the average (0.27) were categorised as peripheric. Moreover peripheric regions were further delineated to identify the most disadvantaged areas regarding supported public employment in the already identified rural areas. Strongly peripheric (494 settlements), fundamentally peripheric

[1] The Ministry of Interior constantly examines persons who entered some supported public employment programmes by considering whether the employee spent at least one year in supported public employment in the three years preceding their entry into the programme (continuity is not a condition). The calculation method used in the records from the National Tax and Customs Administration (tax return) determines the person's labour market status for several years. The lock-in indicator's value for settlements is the value compared to the average number of people and the number of supported public employees.

(495 settlements) and mostly peripheric areas (510 settlements) were delineated using a one-to-three ratio. In studying supported public employment's efficiency, such as the factors impeding integration into the open labour market, fundamentally rural areas were regarded as standard and were grouped with various peripheral clusters; the present paper did not map characteristically rural areas due to previously mentioned reasons. A focus on fundamentally rural areas aims to highlight the chance disadvantages of rural regions, which contain mostly tiny villages with more marked labour market problems, even compared to characteristically rural areas, and with incredibly small chances of integrating into the competitive labour market (Bódi–Obádovics 2000).

The present paper primarily studies the specifics of changes following the introduction of unified, supported public employment (2011) to the current period (2017). This time period enables an adequate analysis of the experiences obtained from supported public employment and to draw conclusions regarding its efficiency and target orientation.

Secondary research primarily focuses on analysing and interpreting former scientists' works. In contrast, the primary research in this paper was based on comprehensive interviews conducted at the Ministry of Interior, Deputy State Secretary for Public Employment and Water Management over several time periods. This process obtained the actualities of supported public employment and experiences since its introduction, and future plans were discussed. The data used in this paper were requested from the Ministry of Interior's Strategy and Monitoring Department, and were analysed based on statistics from the Regional Development Information System (TeIR, http//www.teir.hu), the National Employment Service (NES, http//www.nfsz.munka.hu) and the Hungarian Central Statistical Office (HCSO, http//www.ksh.hu). Geoinformatic software, including Microsoft Excel and Quantum GIS Lisboa 2.18, were applied for data processing.

Peripheral rural areas and supported public employment

This study directly aimed to select indicators that delineate the most peripheric regions of supported public employment, and therefore, the social and economic backward indicators applied in former studies (Pénzes 2014, 2015; Faluvégi–Tipold 2012, Tóth–Nagy 2014, 105/2015. (IV.23.) Government Decree) were not used. Alternatively, periphery regions as delineated in the present paper strongly correlate with 'favoured regions'[2] as classified by the government.

Domestic migration per 1,000 people, whether temporary or permanent, suggests numerous factors, such as an insufficient infrastructure, slight labour market

[2] 105/2015. (IV. 23.) Government Decree: on the classification of beneficiary settlements and the criteria for classification.

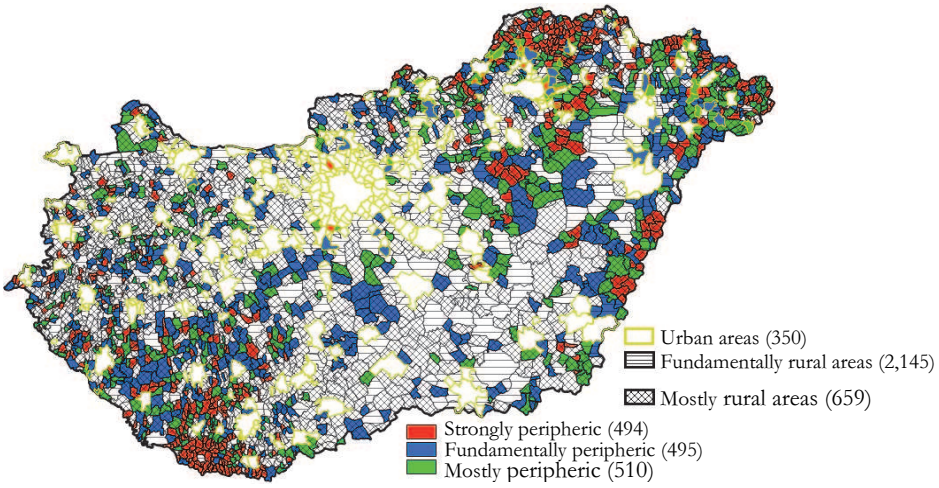
demand offers, and low-level education, among others. Therefore, this was selected as an important indicator of backwardness. According to our hypothesis, the higher the migration from a given settlement, the more significant the backwardness. The lock-in indicator, which will be discussed in further detail later, indicates certain regions' gradually increasing tendencies to integrate and re-integrate multiple disadvantaged supported public employees into the open labour market. As this parallels the primary aim of supported public employment in many cases, its incorporation among the indicators is justified. The high ratio of supported public employees among the working-age population suggests that regions' labour market inequalities are higher than average. Although supported labour market participation is overrepresented, stable participation in the open labour market is less likely, which can be explained by the disharmony between the labour market's demand and employment offering, in considering a lack of jobs to the high ratio of low- educated jobseekers that have been registered in the programme for a long time.

Indicators also include the ratio of supported public employees with a qualification of eight primary school classes. The act of leaving supported public employment is problematic in regions where this indicator is overrepresented, as low levels of education can possibly prevent employees from meeting the open labour market's demands, and employers typically do not rely on less-qualified supported public employees. Supported public employment is especially marginalised in regions where even young people or those under 24 years of age who are generally more mobile permanently participate in the programme. According to our hypothesis, the higher the number of supported public employees aged 24 or younger in a given settlement, the smaller the chance they will transition to the open labour market.

The long-term labour market recession in rural areas is proven by the fact that peripheral areas' supported public employment strongly correlates to fundamentally rural areas (see Figure 1); specifically, marginalised supported public employment is due to multiple factors in settlements with population densities of less than 60 people/km^2. Rural areas in the Southern Great Plains Region differ where periphery areas are scattered, such as Kecskemét and the agglomeration around Szeged.

Figure 1

Hungary's rural periphery regarding supported public employment, 2016



Source: Own elaboration based on data from TeIR, HCSO and the Ministry of Interior.

Strongly peripheric regions are found in two continuous zones: Baranya County, with its tiny villages, and in the micro-environment of Cserehát, in northeast Hungary. However, the outer peripheries of Szabolcs-Szatmár-Bereg and Hajdú Bihar in the southeast counties can also be classified here[3]. In contrast, fundamentally peripheric and mostly peripheric regions exhibit much greater spatial scattering, and mostly inner peripheral areas[4] belong to these groups. While mostly eastern Hungarian counties can be highlighted in the former cluster, areas of backwardness can be found in the case of the latter, in several greater continuous zones in the Southern Transdanubian region, especially Somogy County, and scattered in Fejér County. Across the country, 430 settlements with approximately 192,000 inhabitants can be classified as strongly peripheric and fundamentally rural; 363 settlements with approximately 300,000 inhabitants are classified as fundamentally peripheric and fundamentally rural; and 395 settlements with approximately 400,000 inhabitants are grouped into the mostly peripheric and fundamentally rural regions.

In summary, it can be stated that peripheries identified from supported public employment point of view are regions with the most intensely depressive labour market where leaving the supported public employment programme is multiple problematic.

[3] 'Outer periphery regions' are areas along the border involving the country's most sensitive regions with multiple disadvantaged conditions, and even more backward places than in the inner peripheral regions (Baranyi 2004, Süli-Zakar 2009).

[4] The 'inner periphery regions' are extensive areas in the inside regions of the country's interior, in which the consequences of the disadvantaged state occur in a higher than average concentration (Baranyi 2004, pp. 7).

The employment improving role of unified supported public employment

Supported public employment has substantially changed since it gained importance around three decades ago to progressively influence labour market conditions over time. As a result of the significant economic recession from the 2008 economic crisis, the introduction of the 'Road to Work' programme was regarded novel, as it involved numerous innovations over former programmes.[5] Its long-term measures and impact assessment aimed to improve employment, but could not be carried out, as the 2011 introduction of unified, supported public employment restructured the supported public employment system. This introduction can be regarded as one of the most significant employment policy decisions due to the change of government in 2010.

The factors shaping the unified, supported public employment include the demotivating effects of passive state support[6], short-term employment in supported public employment programmes, and a high level of unemployment[7]. Therefore, it was necessary to establish a complex system to reform all these factors. According to Kálmán (2015), such elements manifest as the macro-economic aims of supported public employment programmes, such as increased employment, direct job creation, fighting poverty, and a stimulation for the economy to create new jobs.

Hungarian employment policy had to transform to help integrate[8] those people who lack the qualifications demanded by the private sector and who have had no employment activity for quite some time (Belügyminisztérium 2017). One important aspect of establishing unified, supported public employment involved identifying supporters. The programme offers those in backward situations, who have been unemployed for a long time, the chance to compete in the open domestic labour market; they can also return to this market to gain work competencies and experience job returns.

One key element of unified supported public employment is its value-creating supported public employment[9], carried out in its framework of start-work programmes. According to Váradi (2010, 2016), these start-work programmes are currently critical employers in small, rural settlements, and are their only income source

[5] The present paper does not aim for a detailed analysis, but Csoba (2010b) provides further detail.

[6] The state's welfare role prevented some people from entering the labour market.

[7] The system was criticised because the typical three-to six month duration of public employment is insufficient to establish the 'existence' of employment for inactive people.

[8] A primary aim involved helping those participating in public employment to succeed in the open labour market by developing their work routines, abilities and competencies (Public Employment Almanac 2011–2016).

[9] Value-creating employment can be regarded as a programme type that employs the most people in both short- and long-term public employment. On average, 46,177 workers were employed in this programme in 2012, which increased to 84,953 workers in 2016 based on data from the Home Office.

in numerous cases[10]; these programmes aim to establish value-creating supported public employment based on local conditions, which can then contribute to local economies and to possibly establishing local self-sufficiency. However, a different issue involves its sustainability, which creates dilemmas for local governments regarding cost efficiency, uncertain buyers, weather conditions, and seasonality, among other issues. Moreover, the goods production under the start-work framework provides only a temporary solution for most local governments, with slim chances of establishing permanent employment (Tésits–Alpek 2014b).

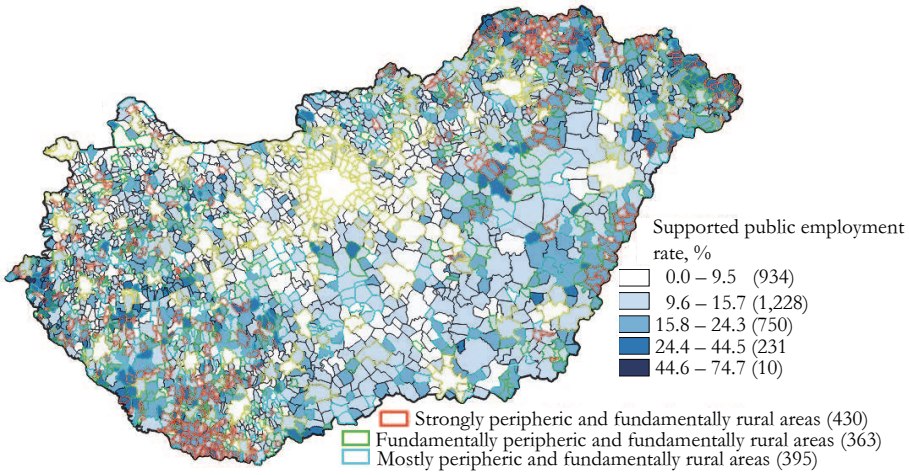
Significant unemployment has been successfully eliminated, as Hungary's unemployment rate was previously near the highest within the European Union according to Eurostat data (11.2%). Currently (2017), Hungary has significantly decreased its level of unemployment (4.2%). However, the reasons behind this higher employment reveal that supported public employment has played an extremely substantial role. Work conducted in the course of supported public employment would not be problematic on its own, but employment is only superficial in many programmes organised by most local governments. In the case of locally governed settlements with few inhabitants, the financial resources obtained through supported public employment are the most important sources of income, and therefore these settlements are not interested in eliminating this programme to integrate workers back into the labour market (László 2016). Further, supported public employment resources are unequally distributed in many cases, and do not parallel the unemployment rate (Cirfusz 2015). This indicates significant dilemmas regarding workers' integration into the open labour market, including the gradual reduction of those leaving the programme versus an increasing lock-in rate. Supported public employment has become an open tool for employment in peripheral regions, especially in areas comprised of smaller villages.

The ratio of supported public employment (see Figure 2) at the time unified, supported public employment was introduced in 2011 reveals a greater continuous zone of supported public employment dominance. This is especially notable from Vas-Hegyhát to Ormánság (Alsószenterzsébet – 74.7%, Főnyed – 71.7%) as well as in the Eastern Hungary border zone, especially in the regions of Cserehát (Regéc – 40.9%) and Szatmár-Tiszahát (Szatmárcseke – 34.5%).

[10] Local governments primarily use goods produced in the start-work programme (such as public catering). Local governments also commonly give away these goods to indigent people as social benefits (Váradi 2016). The programme undoubtedly has the effect of extending employment.

Figure 2

Regional inequalities in Hungary's supported public employment rate*, 2011

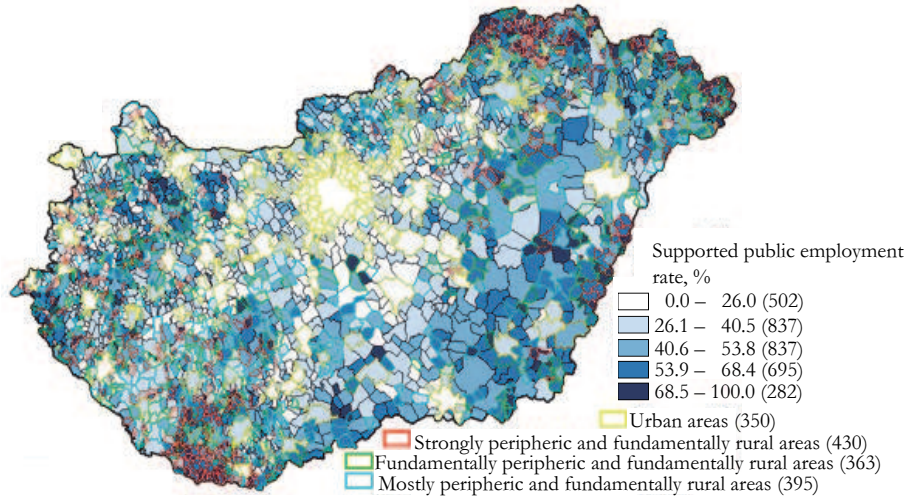


* The closing day number of supported public employees is compared to the closing day number of registered job-seekers.

Source: Own elaboration based on data from the Ministry of Interior.

Figure 3

Regional inequalities of Hungary's ratio of supported public employment, January–November, 2017



Source: Own elaboration based on data from the Ministry of Interior.

Compared to conditions in 2011, the number of supported public employees significantly increased by 2017 (see Figure 3), partially as a result of the fact that the programme's financial resources had multiplied to achieve a greater volume of employment. The fact that supported public employment increases overall employment is indicated by the number of registered jobseekers in Hungary, or 582,900 people in 2011; this decreased to 285,500 people by 2017. The spatial differences are significant at the macro-level, and were accumulated based on data from the National Employment Service. The 2017 supported public employment ratio was highest in Baranya (Ormánság), which has abundant rural areas, as well as Borsod-Abaúj-Zemplén County (in the Cserehát region) and the outer peripheral regions of Szabolcs-Szatmár-Bereg County from Rétköz to Szatmár Plain.

The values among certain settlements further increased compared to 2011, including Regéc (75.7%), Szatmárcseke (72.8%), Tiszacsécse (75.6%) and, Almáskeresztúr (92%). Outer peripheral regions along the borders in Hungary especially along the border between Hungary and Ukraine, Hungary, and Croatia, and north-eastern Hungary and Slovakia are characterised by a lack of jobs. These regions' supported public employment includes any employment possibility and income source. The supported public employment programme's aim to increase employment there is reasonable, as these areas include an abundance of strongly peripheric and fundamentally rural regions.

However, one question involves how long supported public employment can decrease high unemployment in disadvantaged social groups living in rural areas. Clearly, if Hungary is to increase its competitiveness the labour market must be significantly restructured towards developing fields with high added value. Thus, support for training and job creation are essential due to their high lock-in ratios, to be discussed later. Although secondary employment undoubtedly and significantly improves employment figures, its sustainability and producing of value are not as obvious. If a greater volume of human resources are activated, for example, then employment restructuring can occur to shift employment from the supported labour market to the open labour market. Subsequently higher-quality individual lifestyles and a significant economic upswing could then be predicted, even in the rural periphery.

Factors hindering integration into the open labour market

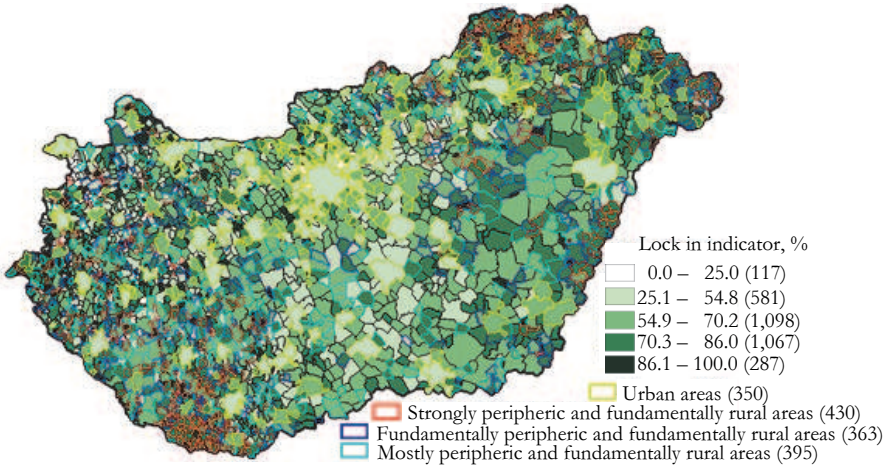
This chapter discusses the factors that could significantly transition employment to the open labour market, although these factors are commonly characterised by their tendency to obstruct this transition. It is important to note that the factors to be discussed cannot independently solve the problems in this transition, as a qualified, skilled labour force is also required, which must be suitable for and motivated to enter competitive sectors throughout the labour market.

The lock-in indicator- and monitoring supported public employees

The lock-in indicator is suitable to measure the probability workers will leave supported public employment. This measures whether an employee has spent more than one year in the programme over three years prior to entering supported public employment, and this time need not be continuous.

Figure 4

Regional lock-in indicator inequalities in supported public employment, January–October 2017



Source: Own elaboration based on data from the Ministry of Interior.

In supported public employment, the lock-in indicator is a specific, sensitive issue occurring at the macro-level; lock-in increased from 39.4% in 2014 to 55.1% in 2016, and is still increasing. The indicator's heterogeneity is further demonstrated, in that no significant regional inequality can be observed (see Figure 4), and its spatial distribution is very even and does not only occur in typically strong peripheral regions. The highest values are found scattered in Western Transdanubia, and typically in its villages. A significant block of efficient supported public employment displays the value of the lock-in indicator as 100% at 151 settlements especially in fundamentally rural regions with low populations 80% at 603 settlements, and 60% at 2,196 settlements.

Gradually increasing the lock-in indicator is further amplified by the uncertainty factors of offers among the open labour market, as these incite supported public employees to remain in supported public employment. Uncertain downtime, possible commuting costs and time factors, higher expectations, minimal salary differences, most employers' prejudices and an individual lack of motivation do not compel employees to transition from supported public employment to the open labour market. The complex problems of a high lock-in ratio in the case of supported public em-

ployment are explained by workers' probability of leaving the programme, which further decreases when considering the labour market's different spatial characteristics. These include: advancing atypical modes of employment in both settlements and regions, a lack of local supported public employment programmes, job-seekers' deficiencies included in these programmes, the programme organisers' personal and professional qualities and economic or political opposition among operators.

In the course of their study, Cseres-Gergely–Molnár (2014) concluded that the more time is spent in supported public employment the smaller the likelihood workers will leave the programme. This practically means that supported public employment traps most unemployed people and provides them no encouragement to leave (Váradi 2016). Further, Calmfors et al. (2002) consider that the lock-in in supported public employment can successfully decrease if job-creating programmes sufficiently imitate the real employment situation.

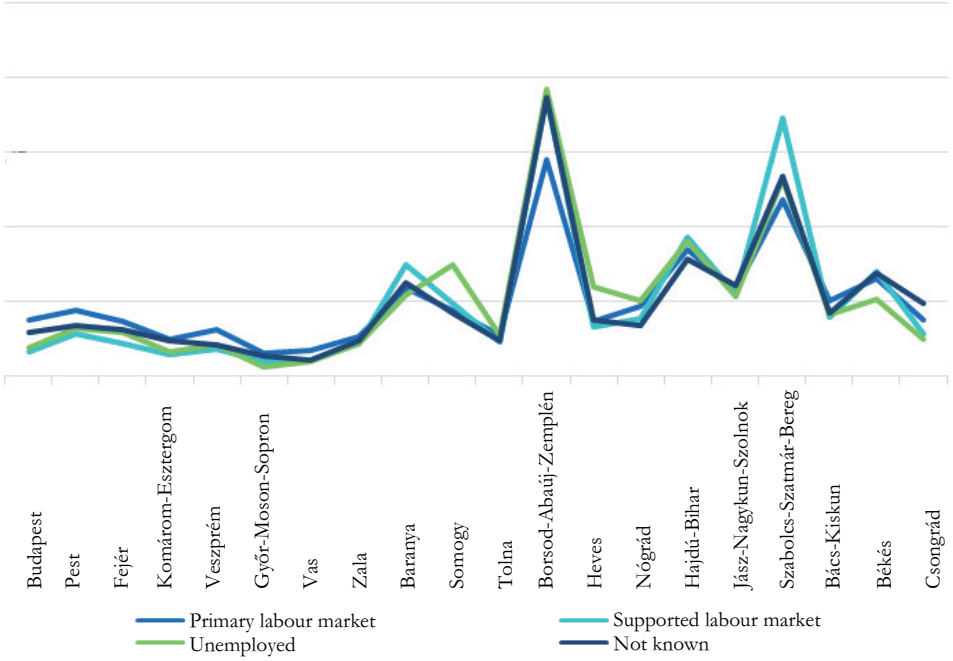
Quality professions obtained through certain supported public employment training programs – such as computer data recorder, security guard, electrician, or cook – may provide adequate work competencies that may also contribute to reducing employers' strong prejudice, and thus reducing the thus 'locking-in' of supported public employment in peripheral areas.

Another indicator suitable for determining the probability employees will leave public employment involves a study to monitor supported public employees after they have left supported public employment[11] (see Figure 5). Tracking data reveals significant cumulative regional differences in this respect. Borsod-Abaúj-Zemplén County, Szabolcs-Szatmár Bereg County and third-ranked Hajdú-Bihar County are typical crisis areas. While 27% of those released from supported public employment returned to the former supported labour market during the studied period (2016), this ratio was 29% in Szabolcs-Szatmár-Bereg County. The transition to the open labour market is relatively more positive for Borsod-Abaúj-Zemplén County (14.5%), as this 2% higher than in Szabolcs-Szatmár-Bereg County (11.8%). However, the ratio of those registered as unemployed is simultaneously much higher in Borsod-Abaúj-Zemplén County (19.2%) than in Szabolcs-Szatmár-Bereg County (13.2%). If the ratio is taken of those unsuccessful in the open labour market, the situation is problematic, as a high percentage of people leaving supported public employment did not appear on the open labour market at the time of the analysis. This includes 89.1%, 89.4%, and 87.9% in Borsod-Abaúj-Zemplén, Szabolcs-Szatmár-Bereg and Hajdú-Bihar Counties, respectively, which includes those of unknown. In summary, the ratio of those appearing on the open labour market is very small in all studied counties, and even outside the highlighted regions.

[11] This method essentially operationalises the individual's labour market status on the 180th day after leaving public employment. This tracking analysis reveals whether the previously supported public employee appears on the open labour market, or again on the supported labour market, or possibly among those who are registered as unemployed.

Figure 5

Ratio of people leaving supported public employment programmes according to their labour market status on the 180th day from their release from the programme in different counties, 2016



Source: Own calculation based on data from the Ministry of Interior.

It is noteworthy that some special cases include people who also 'stick to' supported public employment based on their gender, age, or other qualification. Further, no significant difference can be observed regarding the gender distribution of those reappearing in the supported labour market (women: 58.8%, men: 54.5%). The same applies to those appearing as unemployed status, in which the difference is only 0.9% for men.

The labour market situation for people younger than 25 years of age – an indicator of which is also used in delineating peripheral regions – reveals a much more concerning image. In the studied time period, 63.7% of supported public employees in the given age group did not appear on the open labour market, which can also explained by major social (negative examples from parents) and economic (a lack of jobs or employers' prejudice) problems.

Thus, and as anticipated, the highest lock-in ratios are found among those supported public employees with primary school as their highest education; of this group, 56.6% reappeared on the supported labour market. It is further unanticipated

that 57.2% and 43% of those with secondary education or higher, and typically education from nationally supported public employment programmes, respectively, also reappeared on the supported labour market in the studied period.

It is noteworthy that the present study includes only one year (2016) in which no dynamic data series are analysed. However, the above macro-level lock-in values are of concern, as the dynamic data (2014–2017) of certain rural peripheral areas (specifically, the Baktalórántháza district) exhibit a significant increase from 44.7% to 65.3% (Jász et al. 2018). Nevertheless, the success of supported public employment is measured not only by workers' integration and reintegration into the open labour market. Significant results, especially in rural peripheral areas, include: improving potential employees' suitability for competitive sectors throughout the labour market, parallel training for supported public employees; producing values targeting settlements' development; and providing temporary support to these workers.

Regional development's effects on the labour market in rural peripheral areas

Hungary's labour market cannot be handled as a homogeneous 'mass' at either the macro- or micro-levels. Joining the European Union (2004) has extended its regional development possibilities, although regional development differences are still significant, regarding in our case of the labour market. Moreover, regional development primarily aims to impede backward regions' fragility and falling further behind while eliminating chance social and economic disadvantages. Significant effort has been made across numerous regions in Hungary to fight the labour market's depression, including north-eastern Hungary, southern Transdanubia, and, especially, Baranya County. Thus, labour market anomalies are especially important in shaping core and periphery regions (Government Decree 105, 2015). Despite this, hardly any significant social and economic development can be detected outside regional and county centres, which delineates insignificant job-creation investments. To study the development and backward state of Hungary's labour market, it is noteworthy to analyse the number of vacant jobs (see the Table), which is the most suitable indicator to predict the development potential in a given region's labour market.

The number of vacant jobs in the studied periods was smallest during the 2011 labour market recession in almost all counties, which can be explained by the effects of the economic crisis. It is noteworthy that the highest number of vacant jobs was found in Borsod-Abaúj-Zemplén County, which has been marginalised from several perspectives; it has an abundance of tiny villages and a high Roma population ratio, among other factors. Further, the county has the highest number of registered jobseekers, suggesting that a significant amount of human capital either cannot meet or only barely meets the labour market's requirements. As a result of the economic development in recent years, in which job offers have been increasingly extended, the number of vacant jobs increased in 2017 (13,764 people), but significant inactiv-

ity still exists (37,420 people). Similar tendencies are also found in both Szabolcs-Szatmár-Bereg and Hajdú-Bihar County compared to the total population. A question has also arisen regarding the high number of vacant jobs, in that so many people remain in supported public employment despite jobs' availability. The highly incongruent relationship between vacant jobs and registered job-seekers suggests that no long-term strategies are based on the human capital in such regions as they either pertain to foreign investments or involve high risk especially in Borsod-Abaúj-Zemplén, Szabolcs-Szatmár-Bereg, Hajdú-Bihar, and Baranya counties, and most strikingly in Jász-Nagykun-Szolnok County. Balcsók (2000) conducted similar research along Hungary's north-eastern border to conclude that a high proportion of unemployed people in the region are associated with the Roma ethnic group, the economically active aged members of which are mostly undereducated. Unfortunately, the saying that 'who wants to work will find a job' is not always true (Balcsók 2000). This is a social feature that can also be detected in the present day. In summary, although many vacant jobs exist, the skilled labour they require is missing.

Number of vacant jobs in Hungarian counties and in Budapest, considering the vacant jobs getting out of registration and the number of registered jobseekers, 1,000 pc

County	2011			2014			2017		
	A[a)]	B[b)]	C[c)]	A	B	C	A	B	C
Budapest	6,993	3,344	48,750	23,854	7,499	3,6078	30,738	6,284	19,755
Pest	4,096	1,836	41,719	10,251	2,775	3,4328	8,542	2,321	22,941
Fejér	2,562	1,274	22,903	5,523	2,194	1,4598	4,128	1,455	8,977
Komárom-Esztergom	2,686	1,278	13,920	4,046	2,121	,8,962	3,311	1,495	5,303
Veszprém	2,270	1,396	17,472	4,065	2,144	1,0890	3,508	1,372	6,420
Győr- Moson-Sopron	3,325	1,835	11,957	4,606	2,188	5,859	5,868	2,100	3,410
Vas	2,082	1,019	8,903	3,671	1,387	6,021	3,135	1,035	4,339
Zala	3,599	2,051	15,772	4,647	2,183	1,2262	4,877	1,755	7,371
Baranya	3,112	1,780	29,213	5,555	3,340	2,0358	5,601	3,176	14,296
Somogy	2,846	1,646	25,452	3,729	2,461	2,0165	3,350	1,815	14,838
Tolna	1,849	1,084	14,470	2,013	1,270	1,0423	1,880	,914	6,853
Borsod-Abaúj-Zemplén	10,890	5,369	69,393	15,623	9,259	5,1430	13,764	7,120	37,420
Heves	2,520	1,632	21,361	3,944	2,545	1,4816	3,940	1,759	11,739
Nógrád	2,829	1,416	19,945	3,446	1,923	1,4841	4,514	1,641	11,534
Hajdú-Bihar	7,008	3,210	47,151	12,874	5,652	3,6917	10,450	4,042	25,305
Jász-Nagykun-Szolnok	4,697	2,259	30,294	9,288	5,149	2,1618	12,402	5,991	15,693
Szabolcs-Szatmár-Bereg	9,710	4,890	61,010	13,765	7,290	4,5840	7,051	2,553	31,287
Bács-Kiskun	4,675	2,690	33,639	5,281	3,440	2,4551	6,068	2,936	15,011
Békés	4,576	2,653	27,782	6,130	4,258	1,7574	5,997	2,963	11,727
Csongrád	3,411	1,948	21,766	5,155	2,944	1,4915	4,104	2,256	8,751
Total	***85,736***	***44,610***	***582,872***	***147,466***	***72,022***	***422,446***	***143,228***	***54,983***	***282,970***

a) A Monthly average number of registered vacant jobs. b) B Monthly average number of vacant jobs getting out of registration. c) C Monthly average number of registered jobseekers.

Source: Own editing based on data from NES (2018).

Pénzes (2011) also explains rural areas' backwardness, with a complex, problematic group of low-income earners that foreshadows the given area's marginalised economic potential, as consumption is also low in these regions and supports a smaller number of companies. This also results in increasing social costs and permanently low-level labour market offers (Pénzes 2011).

The lack of jobs also means that the transition from supported public employment to the open labour market will create dilemmas. The passivity of economically active disadvantaged people beyond their own fault is explained by the highest number of vacant jobs and vacant jobs getting out of registration are the lowest in the peripheral regions hit by the labour market depression, with the present case focusing on north-eastern Hungary. Thus, the chance of leaving supported public employment is minimal, especially for people with a non-skilled education. Future regional development must prioritise the creation of jobs in peripheral regions. Until this tendency changes, restructuring the population's employment will be an 'unfamiliar' definition among settlements further away from the nation's centre. To realise abundant job creation the development of human resources to determine present competitiveness is inevitable, especially in the highlighted 'backwards' regions. A high number of successful local developments are required to create labour market momentum among Hungary's peripheral areas, which will provide long-term, sustainable living for those in rural areas.

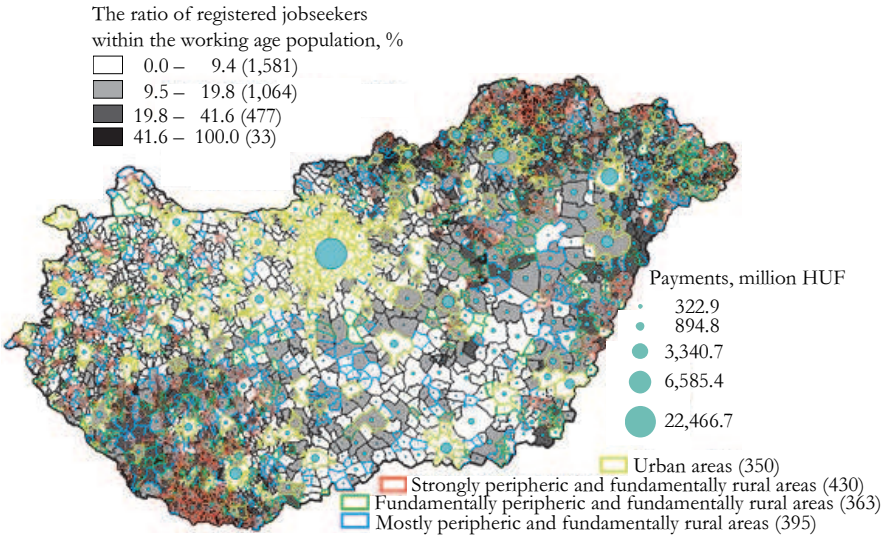
Spatial allocation of the budget aimed for supported public employment

The following section considers regional inequalities in the budget aiming to support public employment as well as the ratio of registered job-seekers. The programme's budget indicates a significant time dynamism – as previously mentioned – as payments have multiplied since unified supported public employment was introduced (2011: 72.5 billion forints). In 2016, 267.63 billion forints were allocated for various supported public employment programmes, including national, long-term, and district start-work programmes).

As anticipated, the spatial distribution of most registered job-seekers (see Figure 6) indicates a significant synergy with strongly peripheric and fundamentally rural regions, and particularly in Southern Transdanubia, located in northern Hungary. An exception is the Central Tisza region, where many economically inactive people were registered, but this region cannot be classified as strongly peripheric in its supported public employment. Numerous settlements have critical values: 'full' unemployment (100%) can be observed only in Tornakápolna, although several other settlements exhibit significantly depressed labour markets: Csenyéte (90.9%), Lasztonya (81.8%), Endrefalva (76.7%), Rinyabesenyő (62.6%), Abaújszolnok (61.7%), and Tiszabura (55.5%). A common characteristic among the affected regions is that working-aged people are permanently missing from the open labour market.

Figure 6

Regional inequalities of payments for supported public employment and the ratio of registered job-seekers within the working-age population, 2016



Source: Own editing based on data from the Ministry of Interior and TeIR.

Regarding supported public employment, a significant eastern Hungarian dominance can be observed. Settlements receiving high support separate from county centres – as this support in such a volume is causeless (more favourable settlement geographical features) in many cases – include: Gyula (1.95 billion HUF), Ózd (1.85 billion HUF), Hajdúböszörmény (1.61 billion HUF), Baja (1.51 billion HUF), Püspökladány (1 billion HUF), Hajdúhadház and Hajdúnánás (895 million HUF), Kisvárda (882.6 million HUF), and Hódmezővásárhely (823.3 million HUF), Western Hungary's county centres are mostly supported in greater volume; this contrasts Eastern Hungary, where greater support exists for both the inner and outer peripheral regions.

This work then studies inequalities among registered job-seekers and supported public employment assistance (Hoover index). Regarding the distribution of financial resources when comparing registered job-seekers and the working-age population, significant regional differences can be detected in the strongly peripheric and fundamentally rural (42.2%), the fundamentally peripheric and fundamentally rural (44.3%) and the mostly peripheric and fundamentally rural (41.4%) regions. Significant anomalies can be found in all the studied clusters, as it would be necessary to re-allocate more than 40% of financial resources to balance the previously men-

tioned differences[12]. Aside from the studied clusters, significant differences can also be observed at macro level, as the Hoover index's value is 54.7%. This is concerning when regarding target orientation; if a majority of the resources are not concentrated in regions with the highest unemployment rates, then this decreases workers' chance of leaving supported public employment. Subsequently, employees from social groups living at the given settlement will be permanently barred from real work. Chance disadvantages multiply in regions with smaller villages, or those with populations of less than 200 people, in which the Hoover index is 42.5%. As a result of an underdeveloped infrastructure and a lack of economic institutions, supported public employment is presented as a primary priority, although this cannot be provided for every inactive person. The situation is slightly better for settlements with populations of 200 to 500 and 500 to 2,000 people. Re-allocations of 35.5% and 34.6% would be required in the former and the latter, respectively, to reduce differences and improve employment.

Hungary's social and economic isolation would greatly improve if an open labour market integration was more successful; thus, financial resources from the must decrease to achieve this, as these resources would also contribute to dissolving the country's 'rigid' spatial structure.

Alternative labour market – atypical employment

One of the most significant factors hindering employment strategies' success involves the advance of alternative labour market norms, especially among those living in small, disadvantaged settlements. Currently, the number of companies conducting illegal employment practices – or simplified employment, in a better case – is growing. Finding such (illegal) employment creates major dilemmas, as even local governments in many cases are not interested in blocking such habits. 'Day labouring' is one of the most widespread alternative jobs for disadvantaged, inactive jobseekers, and is considered even traditional. If this were eliminated, it would contribute to the spreading of pauperisation and extreme poverty, and thus, local governments have attempted to compromise with different economic organisations. The following portion of this work analyses the effects of supported public employment and atypical employment synergies blocking integration to the open labour market.

It is widely known that supported public employees, and typically those in rural regions, take 'second jobs' to increase their income. Most of these second jobs are illegal, which opposes the entire system and aims of supported public employment. In such cases, supported public employees augment their salaries from supported public employment with income obtained through atypical employment, or typically

[12] Such re-allocation of support for public employment would be required for equalisation, and to allocate support to the levels of registered job-seekers.

day-labouring, which includes simplified employment and hired labour. This alone would not be such a substantial problem, as this is the only way to fight poverty. The problem is that supported public employment and atypical employment do not collectively motivate workers' appearance in the open labour market; this is partially because their joint income is greater than the income from one proper job.

The Roma people primarily conduct seasonal work in their supported public employment. For a long time, the law blocked jointly supported public and seasonal employment, resulting in significant tensions as seasonal employment during times of congested agricultural tasks has provided a source of income for centuries to (mostly Roma) people living in rural areas. Current laws provide opportunities for those involved in supported public employment to also take on seasonal employment, although such workers sometimes rush from one 'workplace' to the other by frequently cutting off the first occupation's work hours (Kóti 2016).

According to Messing (2012), in the case of greater settlements with more complicated demand-offer relationships, organising institutes do not adjust to the seasonal labour market. Employees must then choose between seasonal work, which provides higher income but high uncertainty and seasonality, and supported public employment, which provides a more secure source of income for most of the year, but is also unpredictable at times. Unfortunately, this presents problems that have remained unsolved for decades among smaller settlements; its primary consequence is that it absorbs labourers from the open labour market (Messing 2012). However, Váradi's (2016) research results prove that supported public employment organisers attempt to meet the labour demands of numerous settlements' economic organisations while adjusting to the requirements of the alternative labour market, even by completely ignoring the bureaucracy: 'Law has changed so that if the farmer requests it, the labour office sends supported public employees for him for "day labour" upon his recommendation. The labour office practically said that this should not be made complex administratively. Consequently, I invited the farmers for a talk and told them that it is better for all of us if we handle things [internally].' (Váradi 2016, pp. 47). Local government leaders have multiple underlying reasons keep workers in the supported public employment system, as it is impossible to live on benefits alone. Thus, the local government's burden would be eased if people took on 'second jobs' even informally, as fewer benefits would then have to be paid. Companies in the affected regions are also interested in sustaining atypical employment in an informal framework to avoid their tax load, and they have made no efforts to widen such employment (Vida–Virág 2010).

In summary, it can be stated that the alternative labour market and atypical employment act in opposition to the aims of the system. Its elimination and hindrance, however, are not even in the government's interests; for example, one of the most important elements in the European Union's 2020 professional strategy involves fighting to decrease the number of people living in poverty. This is because atypical

employment, on the one hand, seems to be one of the most important perspectives in fighting poverty in rural marginalised regions. On the other hand, we must recognise that the issue a critical factor hindering the appearance of supported public employees in the open labour market.

Conclusions

This paper primarily aimed to outline the efficiency of supported public employment in Hungary's rural peripheral regions and the programme's compliance with its primary objectives. Supported public employment is frequently the only labour market option for social groups living in rural areas, especially those that are disadvantaged, and it is Hungary's most significant employment policy tool. Therefore, an important question remains regarding how this programme can be sustainable in rural peripheral regions in the long term, although this the most important aims of the programme itself.

Based on the research results from analysing the efficiency of supported public employment, the following conclusions can be drawn:

- A strong labour market recession occurred due to the economic crisis, with the number of registered job-seekers in Hungary (477,351 in 2008) gradually declining to the current number (243,498 in 2016). The supported labour market has undoubtedly created positive employment effects, as the number of registered job-seekers decreased to a minimum and several thousands of people became active again.
- In studying supported public employment's efficiency, it is important to mention that many supported public employees cannot or can hardly integrate into the open labour market due to changed work abilities or illiteracy, among other factors.
- Strongly peripheric and fundamentally rural regions identified relative to their supported public employment (430 settlements in Hungary nationwide) are the most sensitive areas, with a depressed labour market in which workers' transition to the open labour market is the most fragile. Regions classified under this cluster exist at the utmost reaches of the periphery – especially Ormánság, Cserehát, the Rétköz- Szatmár Plain, and their micro-environments – and contribute significantly to high lock-in indicator values in supported public employment.
- The lock-in regarding the supported public employment programme is problematic at macro levels as the lock-in indicator's value is greater than 80% in 603 studied settlements. Greater regional differences cannot be detected (i.e. scattered areas in the Western and Central Transdanubia regions have smaller villages that exhibit incredibly high ratios). Further, strongly peripheric regions are overrepresented in their lock-in indicator values.

- Lock-in indicators for supported public employees (monitoring analysis) demonstrated a significant deprivation in three counties, in which the efficiency of the transition from supported public employment is a major hindrance to supported public employees appearing on the open labour market. In Borsod-Abaúj-Zemplén, Szabolcs-Szatmár-Bereg, and Hajdú-Bihar counties, 89.1%, 89.4%, and 87% of supported public employees leaving supported public employment did not appear on the open labour market in the studied period, respectively.
- The incongruent relationship between the number of vacancies and registered job-seekers can be interpreted as an exogenous factor slightly reducing the lock-in. The lack of jobs foreshadows the fact that the transition from supported public employment to the open labour market raises significant dilemmas, especially in the previously discussed regions. Thus, regional policy must pay greater attention to creating jobs in peripheral regions.
- The vast majority of financial resources for supported public employment are concentrated in eastern Hungary, which is remarkable given the reduced regional differences, such as along the west-east slope. However, its relationship with the number of registered job-seekers indicates significant regional inequalities based on the Hoover index, which scored 54.7% on the macro level. Therefore, re-allocating this financial resources ratio nationwide would be necessary to balance regional differences and allocate resources that more closely parallel the number of registered job-seekers within the working-age population.
- Taking on supported public and atypical employment also does not seem to encourage employees to leave the programme, as the higher income obtained in this way discourages them from appearing in the open labour market.

Thus, the programme has achieved partial success and target orientation in accordance with its primary objectives. It could be interesting to investigate the role of the open labour market's willingness towards employment as a factor contributing to the growing lock-in ratio for supported public employment, a topic not among the present paper's goals. Our basic hypothesis is that lock-in for supported public employment especially in strongly peripheric, fundamentally rural regions is increases the most because of the prejudiced attitudes of employers, which hinders workers' natural transition. However, this can generate positive effects, such as long-term strategies to integrate the open labour market when supported public employment training considers territorial aspects to self-organise to meet employers' expectations and needs (human resource development). Thus, continuous and preventive labour market surveys could enable disadvantaged workers to acquire quality certifications and have an actual opportunity to quit the programme. Incidentally, this process could play a prominent role in reducing labour shortages in each area.

Active labour market instruments have a long history, both internationally and in Hungary. These can be defined as the policy methods often used even today, primarily in liquidating long-term unemployment. Further, they raise an important question regarding how active political interventions can be realised – at different international levels as well as among similar program types – to achieve greater efficiency. This research left this topic to future studies because of the extensive study required, which is outside of the scope of the current work.

Alternatively, it is important to declare that supported public employment as a whole has a critical function in regional and social policy development. Peripheral areas delineated based on supported public employment may provide a tool for specific policies' greater success in their target orientation and efficiency. Supported public employment is a primary tool for multiple disadvantaged social groups living in Hungary's rural regions to fight both marginalisation and poverty.

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Urbanisation in a formal way? The different characteristics of the 'newest towns' in Poland and Hungary

Barbara Konecka-Szydłowska
Institute of Socio-Economic Geography and Spatial Management
Adam Mickiewicz University, Poland
E-mail: bako@amu.edu.pl

András Trócsányi
(corresponding author)
Institute of Geography and Earth Sciences
University of Pécs, Hungary
E-mail: troand@gamma.ttk.pte.hu

Gábor Pirisi
Institute of Geography and Earth Sciences
University of Pécs, Hungary
E-mail: pirisig@gamma.ttk.pte.hu

The recent urbanisation of Poland and Hungary can be characterised by two main processes, urban sprawl, suburbanisation on the one hand, birth of new towns from villages through a legal process on the other hand, that have provided significant changes in the share of urban population. Suburbanisation has been investigated in details throughout the post-socialist region, while formal urbanisation could gain less attention, although in certain cases like in Hungary it has doubled the number of towns and cities within less than three decades. The present study introduces the similarities and differences of the formal urbanisation process in Poland and Hungary, giving an evaluation of the new-born towns. Their size and socio-economic development are measured and contrasted on the basis of statistical indices, furthermore, their geographic location and functions in the settlement network are compared, too.

Keywords:
formal urbanisation,
town rank,
post-socialist urbanisation,
Polish-Hungarian comparison,
socio-economic development

Regional Statistics, Vol. 8. No. 2. 2018: 135–153; DOI: 10.15196/RS080202

Introduction

In many countries of Europe, the difference between towns and villages is not only a question of history, functions, size, demography or morphological character, but also a matter of legal and administrative status. The legal system of both Poland and Hungary distinguishes different types of municipalities, and allows the evolvement from the lower to the higher level through a specific legal procedure. As it has been a popular and desired milestone among developed villages, the number of towns has increased significantly in the past almost three decades. The process is also manifested in the growth of the overall urbanisation rate; however, the pace of functional (classical) urbanisation in fact is rather limited. In other words: recent urbanisation has been decisively characterised by formal urbanisation. If urbanisation is mostly a legal procedure of reclassification, researchers are more and more interested in the professional background of the legislation and also in the discrepancies and conflicts between theory and everyday practices.

The aim of the present paper is to compare the post-socialist formal urbanisation in Poland and in Hungary. With the cooperation of researchers in both countries, it tries to answer the following questions:

– What have been the main characteristics of the formal urbanisation process (conferring municipal rights/gaining town rank) in Poland and Hungary since 1989?
– What are the similarities and differences in the sets of new towns in Poland and Hungary?
– What is the level of socio-economic development of new towns in Poland and in Hungary?

Formal urbanisation, settlement reclassification, and new towns: some hints about the terms and concepts

The term of formal urbanisation is barely used in literature anywhere else but in Hungary. The concept refers to the difference between the most common way of urbanisation (the growing population of towns and cities via natural increase and more often immigration) and the process, when the number of urban population is increasing as the result of via statistical-legislative transformation. The process is either based on both statistical automatism (for example reaching a specified population limit) and individual (political) decisions – the legal background and practice of the latter highly varies throughout Europe (Kocsis 2008). The term of 'urban reclassification' is used more often (Kulcsár–Brown 2011), but it hides the fact that the phenomenon is more than a statistical act. Reclassification today may appear as a difficulty for researchers trying to evaluate urbanisation process in rapidly developing and urbanising countries of Asia and Africa (Goldstein 1990, Obeng-Odoom

2010, Pradhan 2013). However, the question has been frequently appeared in connection of socialist and post-socialist urbanisation (Bujdosó–Kovács 2016, Mladenov et al. 2010, Pirisi–Trócsányi 2009a, Konecka-Szydłowska 2017, Konecka-Szydłowska 2011, Krzysztofik–Dymitrow 2015, Sokołowski 2014, Szymańska–Matczak 2002). During the decades of planned economy, reclassification used to be an effective tool for the centrally forced and administered development of urban network (Kocsis–Lenner 2012), in many cases on pure political-ideological basis (preference of industrial towns). Reclassification somehow reflects the desired modernisation of the society – cities and towns; even the small ones were outpost of modernity in a dominantly rural environment. It was among the aims of (even formal) urbanisation to establish modern infrastructure and institutions to provide higher living standards. However, during the years of socialism the (party-led) state initiated and controlled the overall upside-down process.

After the political transition and during the long, and in many aspects still unclosed economic and social transformation, conditions of urbanisation changed fundamentally. Although the transformation of intra-urban spaces and big cities themselves have become the most important issues of settlement/urban geography, many papers underline the importance of suburbanisation (Andrusz et al. 2008, Hirt 2012, Sailer-Fliege 1999, Stanilov 2007, Szabó–Szabó–Kovács 2014, Timár–Váradi 2001, Tsenkova 2006, Kajdanek 2012), the exhaustion of the sources of urbanisation, the end of urban expansion (Brown–Schafft 2002, Enyedi 1998, Kovács 2004), and even the occurring of shrinking in urban Central Europe (Haase et al. 2013, Stryjakiewicz 2014). Papers regarding the topic of lower-level urbanisation in Central-Europe need to take into consideration that these processes are deeply rooted in some major phenomena of the region: ageing (Kulcsár–Brown 2017), polarisation and marginalisation taking place in rural areas (Nagy et al. 2016).

The conditions of urbanisation with slow natural increase or even relatively intensive decrease of population, the growing percentage of international emigration after the year of 2004, the quick expansion of suburban lifestyle, the collapse of many former industrial centres came to an end of urbanisation in its traditional meaning in several countries of the former Soviet Bloc (Kovács 2010). The population of cities and towns has hardly increased during the last two decades, however, villages – mostly with suburban location – gained population surplus. Under these circumstances, exacerbated with a constant demographic decline, formal urbanisation or reclassification in Hungary became the sole way of urban population growth.

As the number of towns has doubled since 1990 in Hungary, the process is quite spectacular; therefore, urban classification is a matter of widespread discussion not only among geographers (Bujdosó et al. 2014; Pirisi–Trócsányi 2009b, 2012; Szabó 2015; Szigeti 2002; Tóth 2008). Beyond the 'moral' evaluation of the process (whether it is 'good' or 'harmful' for the urban network), questions were raised about the urbanity and about the spatial roles of 'new towns'. Also in Poland since

the start of the socio-economic transformation, the set of Polish towns has kept growing almost from year to year, therefore the issue is widely discussed in the literature (Sokołowski 2014, Zaniewska 2013, Konecka-Szydłowska 2011, Szmytkie–Krzysztofik 2011, Drobek 2002, Szymańska 1996).

This normative approach may deflect attention from some more important questions. The local point of view is not about the fitting into the urban network, but about the utilisation of a possible (small) competitive advantage that a town rank can give. From this approach, reclassification is a locally driven, bottom-up initiative, where the goal is to strengthen local autonomy. This way it could be interpreted as a pursuit for the increase of local resilience (Robinson–Carson 2016).

These newest towns however, are not to be confused with the most common usage of this term, the newly, 'artificially' planned, designed and located settlements, which are so typical for the 20th century urbanisation both in Western and Eastern Europe (Alonso 1970, Osborn–Whittick 1963). The novelty of these settlements roots only in their administrative status, i. e. their town rank, however, there are some settlements throughout the region, which actually are products of former central planning (smaller industrial sites), or just objects of rapid growth during the last decades (suburban places, holiday resorts). Nevertheless, in many cases, 'new towns' are indeed old ones: traditional central places in rural areas, reaching recently the present threshold of modernity and urbanity manifested in the town status. In several instances (in Hungary particularly less than in Poland, but also in the Czech Republic) town ranks were not awarded to settlements for the first time: they just have regained it after decades of 'exile' from the urban community (Kocsis 2008, Krzysztofik–Dymitrow 2015).

Methodological issues

This paper combines both qualitative and quantitative methods. The main goal was the parallel evaluation of the reclassification process, which was based on the thorough analysis of legal documents and governmental decisions. The Hungarian authors have spent almost two decades with the participant observation and even as actors of the reclassification as they assisted dozens of municipalities with their application documents through their consultancy work. The timeframe of the research covers the era of the post-socialist development, with a starting year of 1989 in Poland and 1990 in Hungary. All of the researched settlements have reached the desired town rank within this period.

The comparison of new towns is partially based on simple statistical analysis in the first line. Secondly, authors tried to adopt an index-based statistical method to highlight the differences between Polish and Hungarian new small towns. Indices of socio-economic phenomena are necessary to apply to make a correct assessment of processes taking place in the social and economic spheres (Czyż 2016). In the meth-

odological sense, an index is a feature, occurrence or phenomenon on the basis of which we conclude with certainty (or with a specified degree of probability) that the phenomenon of interest to us is actually present (Nowak 2007). The basic classification indices employed in this study are as follows:

– structural indices which present the ratio of the number of units with the given value of a variable to the size of the sample; structural indices are expressed in per cent, e.g. the proportion of urban population;
– intensity indices which present the number of cases of the phenomenon examined in relation to the total number of units in the statistical population from which the phenomenon derives, e.g. the total number of enterprises per 1,000 inhabitants; and
– growth indices which define the relation between figures characterising some quantity (phenomenon) in two periods or moments of time and are expressed in per cent, e.g. total urban population growth in percent against a reference year (1990–2013).

To evaluate the position of the new towns in Poland and Hungary on the scale of socio-economic development, eight indices were used for four aspects: population, economy, housing infrastructure, and social capital.

Table 1

List of socio-economic indices examined

Aspect	Index
Population	x_1 – Population density in km^2 x_2 – Natural increase in ‰ x_3 – Net migration in ‰
Economy	x_4 – Economic dependency ratio - number of persons of non-working age per 100 persons of working age (destimulant variable) x_5 – Number of employees per 1,000 inhabitants x_6 – Number of enterprises per 1,000 inhabitants
Housing infrastructure	x_7 – Usable floor space in m^2 per 1 inhabitant
Social capital	x_8 – Number of NGOs per 1,000 inhabitants

Note: NGO – non-governmental organisation.
Source: Konecka-Szydłowska (2017).

Mathematical-statistical methods

To obtain a linear arrangement of the new towns in terms of their socio-economic development level, Perkal's synthetic index (z-score index, see Perkal 1953, Kostrubiec 1965, Smith 1972, Runge 2006) was used in the following form:

$$W_s = \frac{\sum_{j=1}^{p} z_{ij}}{p},$$

where W_s denotes the synthetic index, p is the total number of variables considered, j is the number of a variable (1, 2, ..., p), and z_{ij} stands for the standardised value of the j-th variable for the i-th object.

To use the synthetic index, it was necessary to start with standardising the values of indices describing the intensities of individual variables in towns. For variables of a stimulant nature, standardisation was performed on the basis of the following formula:

$$z_{ij} = \frac{x_{ij} - \bar{x}}{S_j},$$

where z_{ij} is the standardised value of the j-th variable for the i-th object, x_{ij} is value of the j-th variable for the i-th object, $\bar{x}$ stands for the arithmetic mean of the values of the j-th variable, and S_j denotes standard deviation of the values of the j-th variable.

For the destimulant type of variables, standardisation followed the formula:

$$z_{ij} = \frac{\bar{x} - x_{ij}}{S_j}.$$

The standardisation of indices resulted a matrix of standardised features, which were then used to calculate the synthetic indices (W_s). Based on the distribution of the synthetic z-score values (W_s), a linear rank of the new towns in Poland and Hungary was constructed, and their classification was carried out. This led to the separation of classes representing the same level of an indicator. In dividing the new towns into relatively homogeneous classes, the standard deviation values of the population were used. The classification allowed the delimitation of three classes in the total set of towns as high, average and low level of socio-economic development in terms of the indices analysed.

To examine the dependence between the size of the new towns in Poland and Hungary and their levels of socio-economic development (based on the synthetic index W_s), Pearson's coefficient of linear correlation was used.

Similarities and differences in the process of both countries

First, we need to underline, that there is no dominant approach related to this question among the European states and their practices. Even the comparison itself is hard, because of the quite different structures of local administrative levels. Most of the European countries experienced a significant territorial administrative reform during the 1970–1980s, which resulted in many cases the reduction of communes in their number, building up larger units of local municipalities. In these reforms, legal differences between villages and towns were usually dissolved, which does not mean, that the distinctions in language, even in formal language have disappeared (Kocsis 2008). Only a few data and papers are available in this topic, therefore, we do not set up models, but we are to define some important motives, which appear in several cases.

– Town-village distinction sometimes has become so meaningless that it is presently an issue of only statistical labelling (see for example Sweden, Switzerland) or, in the case of towns (but not of cities!) it is only based on self-definition.
– Despite all rationalisation efforts of European states, still the historical-legal heritage and traditions highly influence the current reclassification practices. The rank of a 'city' is granted by the crown in the United Kingdom, the Czech regulation gives 'automatism' for settlements reclaiming towns rank lost in 1954, and the list can be continued in details with several other European examples (Kocsis 2008).
– In the less-urbanised Eastern edge of Europe, the reclassification is often used as a tool (or replacement) of regional development (initiatives and resources): settlements gain town rank might generate more dynamism in spatial progresses – this is the main factor in Romania (Veress 2016), but also not unknown in Hungary. In addition, political influence on the process become more and more visible when moving eastwards (Berekméri 2006).

How do Hungary and Poland fit into this colourful European picture of urban reclassification? In the first place, we can underline that with different importance, but both the 'historical' and the 'regional political' approaches have influence on these countries' practices.

While descriptions in native language have been long available about the legal regulation of the reclassification process, there are hardly any papers written in English. Therefore, we find it useful, to describe it shortly.

The application, evaluation and selection procedures implemented in these two countries are very similar. In both cases, the 'story' starts (can only start) with a local initiative. It does not necessary mean that it is done by the citizens: most likely, the local political elite, first of all mayors are the key role players. Public consultations in

Poland are obligatory, in Hungary, they are only recommended, but sometimes it is an issue of the local elections' campaign, when candidates give emphasis to the urbanisation as an important local goal. In other cases, not the mayor, but another 'strong man/woman' of local community or even an NGO is the main promoter of the idea.

Anyway, whether it is one source or another, the initiative usually can gain the support of the majority of citizens and decision makers. This majority does not mean uniformity (there are always opponents), and despite the short-term political goals the argumentation is very similar: people have fears to lose values connected to rural traditions – as they usually think that formal urbanisation will implement decisive transformation in their everyday life, a kind of intensive functional urbanisation. Ironically, sometimes communities in the agglomerations and residents moved out from the capitals have the biggest disapproval. At least in one documented case, in Solymár (that is located northwest from Budapest, Hungary, and its actual population is slightly over 10,000) the resistance of some influencing groups and stakeholders (who may own even a majority among the voters) was able to abort the planned initiation. Further Hungarian speciality is that professional consultants play a key role not even in the creation of the proposal, but in the diffusion of the innovation of formal urbanisation by draw communities' attention to the possibilities and encourage local stakeholders. Without them, the number of new towns in Hungary should be significantly less.

After the initiative is formed at local level, the support of higher political and administrative levels must be gained. In Poland, both powiat (district, LAU 1) and voivodeship (province or region, NUTS 2) need to support the proposal. A formal support is not necessary in Hungary from the megye (county, NUTS 3, the only higher administrative level with an elected body), but usually aspirants try to get the county's official and informal political support.

Proposals are to be addressed to the relevant ministers – during the last decades, there were many transformations in governments' structure, the name and responsibility of ministries were anything but permanent. Nowadays, in Poland the Ministry of Interior and Administration, in Hungary the Minister of Prime Minister's Office governs the process. They are both authorised to make decision, but in Hungary, an advisory board is also involved with various members of politics, science, public administration and associations of local municipalities.

The evaluation process contains in both countries a sort of 'soft' or subjective elements leaving a wide-open space for political deliberation. In Poland, the criteria used are a bit more concrete compared to the Hungarian practice, however, the latter one was significantly modified in 2015 closing the gate for the growing number of applicants. The Polish evaluation tries to be comprehensive with four factors: 1. demography, including a minimum population of 2,000; 2. engineering and 3. morphology, demanding an urban layout and developed infrastructure, and

4. central functions, including the predominance of the non-agricultural employment. The possession of the past town rank could also be an advantage during the evaluation (Sokołowski 2014).

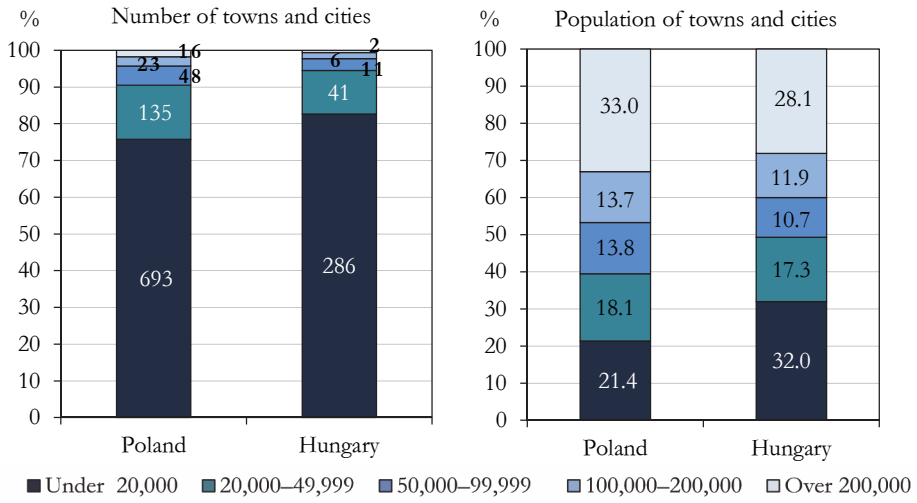
In Hungary, the main theoretical criteria are 1. development level (exceeding the average of small towns) and 2. central functions. Traditionally, a long list of statistical measures was published to be used for the evaluation, but without defining any threshold to be reached for each criteria (Pirisi–Trócsányi 2009). After the latest (or last) massive pool of applicants and successful candidates (in 2009 22, in 2013 18 new towns), a significant restriction was introduced in 2015. A new list of indices was developed, and target values were also added to each criterion. For example, as a main spatial criterion, a ratio of minimum 20% of incoming commuters within the locally employed is required, which is can be fulfilled by majority of the potential new candidates, however, the important local labour centres are already possessing town rank (Pénzes et al. 2015). A constantly growing population and the limit of 10,000 (!) inhabitants were also published, but textually they are rather expectations than requisites (meanwhile the country has an annual population loss of –0.25%, and there are 202 towns with population less than 10,000). Although the new regulation theoretically gives the possibility for a flexible evaluation, the recent practice has become quite rigorous without any settlement reclassified since then. Therefore, reclassification was and remained primarily a political decision.

Effects of reclassification on the urban network

While the procedure is or was very similar in Poland and Hungary, the scale, effects and partly the goals are different. There are important discrepancies between the two countries' urban structure: a highly monocentric Hungary on the one hand, and a polycentric Poland on the other. Polycentricism of Poland is reflected in the higher number of cities over 200,000 people and in the higher ratio of people in these cities (see Figure 1). Despite of this, the smallest towns (with population under 20,000) give not only a larger proportion in Hungary (81% compared to 75% in Poland), but also provide home for 32.0% of the urban population (21.4% in Poland). Thus, somewhat simplified, this is the sign of a lower concentration in urban network – if we do not consider the capital cities.

Figure 1

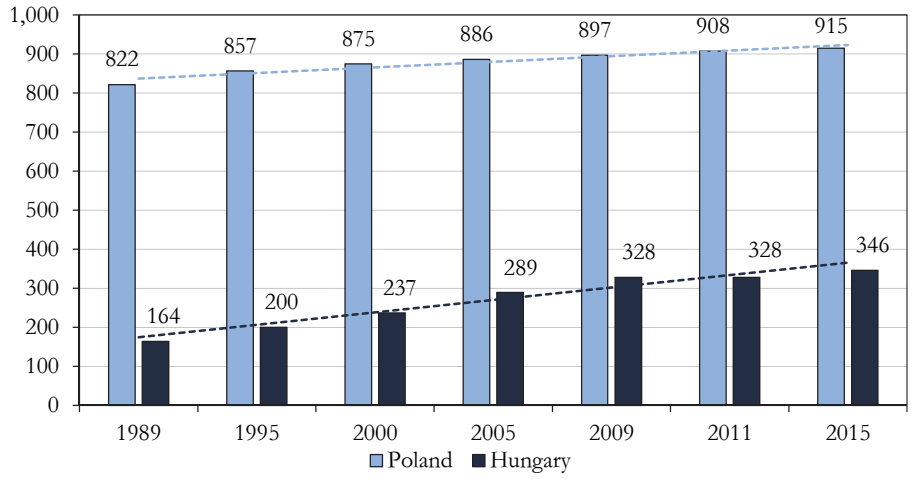
Structure of urban settlements and urban population, 2016



Source: Gábor Pirisi's calculation based on 2011 Census data of Poland and Hungary.

Figure 2

The increasing number of cities and towns in Poland and Hungary



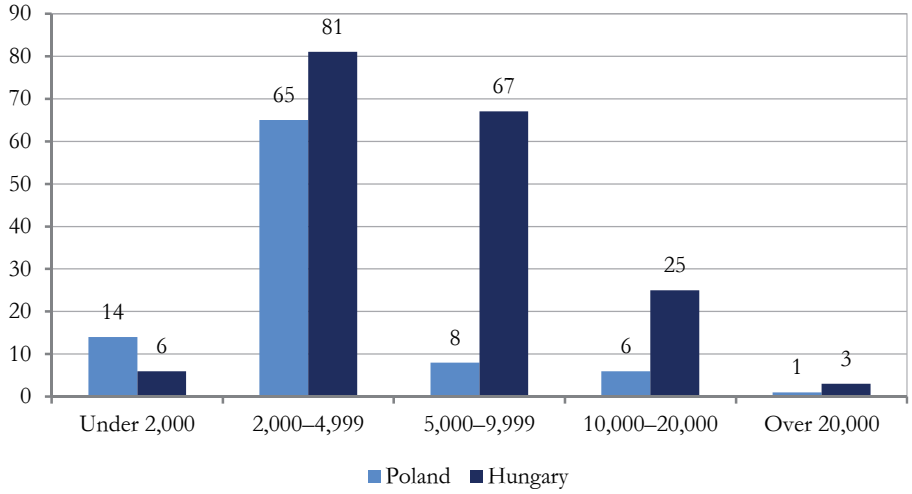
The reclassification process itself was much more intensive and transformed more detectable the structures in Hungary than in Poland. By adding 93 new towns to the network in the latter case, the total number of urban ranked places has grown with 11%. Meanwhile in Hungary, 182 new towns resulted more than the doubling of the starting number. Finally, the 915 Polish cities and towns mean slightly more

than 60.0% rate of urbanisation, and the 346 Hungarian urban unit ends up in 70.5%. It seems that Hungary has become a bit 'over-urbanised' from a formal point of view – which is actually the explicit or somewhat hidden opinion of many authors of published papers in this topic throughout the recent years (Bujdosó et al. 2014, Csapó–Kocsis 2008, Németh 2009).

The label 'over-urbanised' for Hungary may go too far in simplification or in criticism. If we look at the population of new towns, there is a clear difference between the two countries: the majority of new towns in Poland[1] have inhabitants between 2,000 and 5,000. There are only 15 Polish new towns over 5,000 citizens, while 95 Hungarian new towns belong to this populous category (see Figure 3). The latter number could be interpreted also as underlining the (previous) 'under-urbanisation' of Hungary compared to Poland, where the formal urbanisation has only reserves in this lower population class.

Figure 3

Population categories of new towns in Poland and Hungary, 2016



Source: Gábor Pirisi's calculation based on 2011 Census data of Poland and Hungary.

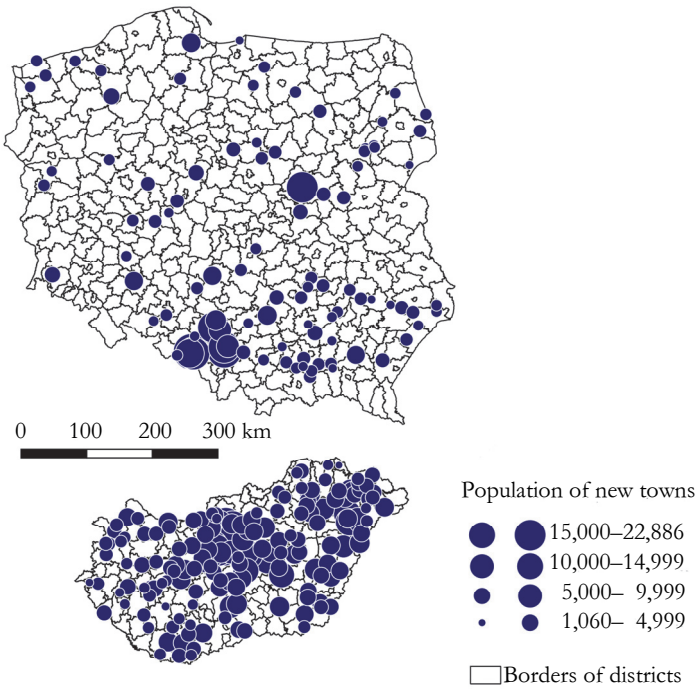
These differences can be explained by the dominant (functional) types of new towns. In Poland, a kind of 'historical restitution' is among the major motivations behind the process. Town rank very often (in 71% of all cases) was given to settlements that had historically owned former privileges. In most of the cases, these are smaller and less dynamic places. Towns with significant urban historical heritage

[1] From an economic point of view, for municipalities with more than 5,000 inhabitants, obtaining the town rank is disadvantageous as they are to receive limited amount of educational subsidy and lose preferential conditions for co-financing investments from EU funds (Konecka-Szydłowska–Perdał 2017).

also exist in Hungary among the reclassified settlements, but in these instances, the rank was lost the latest during the late 19th century, in some cases much earlier. Several of these towns still keep traditional urbanity in character (at least some monuments, heritage elements – see Zsámbék, Csákvár, Lébény, Pécsvárad in Hungary, and Frampol, Tykocin, Nowy Wiśnicz in Poland), but their traditions are often bound to market towns – a 'semi-urban' category, especially in their physical appearance. However, historical values and heritage were arguments in the application process, but almost never decisive, and the majority of new towns in Hungary had hardly any urban past. Some of them have not even existed 100 years ago. Thus, the typical new town in Hungary is located in the agglomeration of Budapest and has a relative high population (8,000-12,000), a dynamic growth through suburban migration. Nevertheless, the typical Polish new town is more traditional, smaller and usually located in rural areas or at least outside large urban agglomerations.

Figure 4

Population of new towns in Poland and Hungary, 2016



Source: Gábor Pirisi's elaboration based on 2011 Census data of Poland and Hungary.

Finally, by taking a short look on the maps of Figure 4, one can identify the difference in the location of new towns between the two countries. While Hungarian new towns spread – with some concentrations around Budapest and the Eastern

peripheries – almost consistently, in Poland extensive regions can be found. However, some focuses could also be observed in Poland: the relatively large new towns of Upper Silesia (Ledziny, Bierun, Rydułtowy, Radlin), a few around the capital, and a disperse network in the Eastern part of Małopolska.

The index of new towns

The index-based comparison of Polish and Hungarian towns is informative. Foremost, there are general differences between the two countries in some basic data used for the indices; however, the overall evaluation shows that Polish towns perform better. There are two reasons for this. First, the overall demographic situation is much more favourable in Poland than in Hungary. With a natural decrease of –3.3‰ in Hungary and 0.0‰ in Poland (Eurostat Demographic Statistics, 2014), the components based on demographic data are definitely higher in Polish towns – without any real significance for the small towns' position in the urban network. Looking at economy-based indicators, the picture is more diverse: Polish towns perform better by the number of enterprises, but are weaker at the employment rate. The numbers of NGOs are quite similar, and Hungarian citizens seem to own somewhat bigger houses in Hungary – although this element of the index is the less reliable.[2] The mean of Polish towns is 0.206 with a standard deviation of 0.39 and a median of 0.130. In Hungary, the mean (–0.105), the standard deviation (0.28), and the median value (–0.131) are definitely lower.

We also investigated the connection between population size and the index score (see Figure 5). The connection is not strong, but the differences of the two samples can be recognised quite easily. Correlation with the population size is a bit higher in Hungary, however, it is only indirectly caused by the size. The bigger new towns in Hungary are actually not better-developed centres with more spatial functions, but parts of the Budapest agglomeration with intensively growing, well-educated and employed population (see Table 2).

[2] Hungarian regional statistics does not publish data on the average size of flats, but only on the number of flats according to floor-size categories. Therefore, this data was created by an estimation using the number of flats in categories and the arithmetic mean of category values.

Figure 5

Synthetic index of new towns in Poland and Hungary, 2016

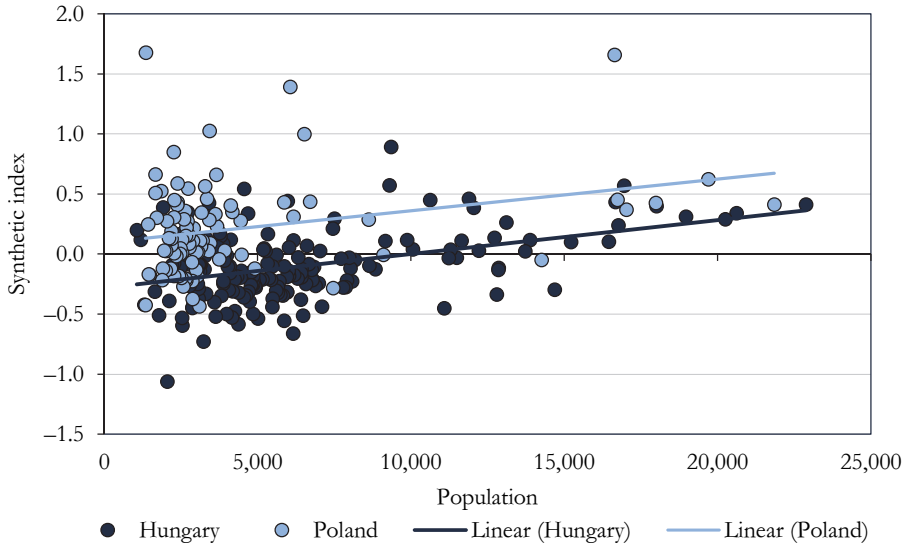


Table 2

The best and the worst performing Polish and Hungarian new towns according to *z*-score values, 2016

Poland			Hungary		
New town	z-score (W_i)	Combined (PL-H) position	New town	z-score (W_i)	Combined (PL–H) position
Krynica Morska	1.68	1	Diósd	0.89	6
Łomianki	1.66	2	Halásztelek	0.57	12
Siechnice	1.39	3	Szigethalom	0.57	13
Rzgów	1.02	4	Rácalmás	0.54	16
Żukowo	1.00	5	Maglód	0.46	20
…	…	…	…	…	…
Koprzywnica	–0.27	219	Tompa	–0.59	269
Miasteczko Śląskie	–0.28	224	Rudabánya	–0.60	270
Ryglice	–0.37	245	Újszász	–0.66	271
Kleszczele	–0.43	252	Borsodnádasd	–0.73	272
Kunów	–0.44	253	Gyönk	–1.06	273

Hungarian towns performing the best in factors of social wellbeing and liveability are not outstanding in this respect (Pirisi 2009). Four among the five highest ranked towns are located not more than 15 km away from the administrative border of Budapest. The fifth one, Rácalmás is a suburb of the former socialist city (a new town of 1951), Dunaújváros, and a location of one of the biggest green field investments of the last decade (a plant of Hankook tyres). In Poland, many of the best performing towns are also parts of various agglomerations; according to the polycentric structure of urban network, it does not mean Warsaw (Łomianki) only, but Łódz (Rzgów) and Wrocław (Siechnice) also appear as centres. The first place (including all towns in both countries) is occupied by Krynica Morska, a touristic resort at the seaside – with only 1,300 inhabitants (Konecka-Szydłowska–Perdał 2017, Konecka-Szydłowska 2018). This type of touristic towns also appears in Hungary. The overall economic performance and life quality in these towns (like Bük, Harkány, Zalakaros) are quite high, but the structure of the population (large proportion of elderly people) is unfavourable as far as the synthetic index is concerned. There are two factors that can be marked as important differences between the two countries: while the best performing Hungarian towns are significantly bigger (their average population is slightly over 10,000 contrasted to 6,800), Polish towns seem to have stronger economic functions. Three among the five best performing Hungarian towns are not really more than large residential suburbs without notable economic importance.

Towns with the lowest index values are heterogeneous and indicate many types of small towns: Rudabánya and Borsodnádasd are former industrial sites, abandoned, and 'covered by rust and social hopelessness'. Újszász (railway junction) located at the inner, Tompa (border crossing point) at the outer peripheries: both of them are traffic nodes. Gyönk is a typical small centre in a remote and fragmented rural area, with strong human, but rather weak economic functions. The latter is the most common type among the weakly performing new towns in Hungary: these towns emerge from their rural environment, but are still determined by the backwardness of the region. In Poland, the worst performing towns are not evidently in remote rural areas: Miasteczko Śląskie is located next to Katowice, Koprzywnica is not far from Tarnobrzeg, on an important traffic axis, and Kunów is near Ostrowiec Świętokrzyski. Only Kleszczele is on the eastern periphery of the country (near the border with Belarus), while Ryglice is also located in a typical rural area.

Conclusions

Although there are not any significant differences for the everyday life of local residents, the town rank itself is still attractive at least for the local decision makers. Therefore, formal urbanisation has been dynamic since the political transformation, and resulted the doubling of towns in Hungary, and becoming the only source and

way of urbanisation. In Poland, the reclassification remained as an additional process, and was less significant both in number and in its spatial effects. New towns in Poland are smaller, 'more historical' and more concentrated geographically to the less developed eastern and south-eastern regions (which results from the fact that the largest number of former towns can be found in this part of the country). In Hungary, the main spatial effect is the urbanisation of the suburban rings, not only around Budapest, but also around regional centres and dynamic cities. The larger average population size of the newest towns in Hungary is mainly connected to the larger proportion of these demographically dynamic places.

From this approach, the reserves of urbanisation in Hungary are still not exhausted, if we consider the Polish example. While the predominant majority of Polish new towns have a population between 2,000 and 5,000 people, there are 375 villages in Hungary in this category, while only 24 is over 5,000 and only one (Solymár) is above 10,000.

Another important conclusion is, that the Hungarian reclassification process, which is often considered as a unique one, shows important similarities to the Polish reclassification in goals, steps and evaluation – virtually everything – except its scale. As a bottom-up initiative, reclassification does not really serve higher-level spatial political goals, but reflects local needs and (urban) value choice.

Acknowledgement

Gábor Pirisi's work was supported by the János Bolyai Research Scholarship of the Hungarian Academy of Sciences.

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Assessment of water resources use efficiency based on the Russian Federation's gross regional product water intensity indicator

Lyudmila Grigorievna Matveeva
Southern Federal University, Russia
E-mail: matveeva_lg@mail.ru

Ol'ga Anatolievna Chernova
Southern Federal University, Russia
E-mail: chernova.olga71@yandex.ru

Natal'ya Alexeevna Kosolapova
Southern Federal University, Russia
E-mail: nakosolapova@sfedu.ru

Alexey Evgenievich Kosolapov
Russian Information-Analytic and Research Water Economy Centre, Russia
E-mail: akosol@mail.ru

The extended representation of the water management problem that is an important component of the supply of resources is vital in an effective regional economy. This article justifies the importance of such a representation through the lens of the paired strategizing of the water resource system and regional economic development. The authors' purpose is to analyse the rationality of the usage of water resources in conjunction with regional socio-economic development indicators, by applying tools that allow grouping based on the existing trends in water consumption. The article studies the importance of the effective management of the allocation of scarce water resources among users. It also examines the rationality of their usage in the context of optimising resource usage, and the high variations across areas based on the potential of the resource components, as well as the dynamic socio-economic indicators. The theoretical framework of the rational water usage paradigm comprises a set of interrelated concepts and theories, such as the theory of economic growth, as well as theories and concepts of regional development, particularly regional resource management, considering the parameters of current and proposed mesoeconomic policies in combination with the basin approach for the allocation of water resources. It has been shown that the gross regional product (GRP) water intensity indicator is one of the important criteria in assessing the rational usage of territorial water resources. The authors' hypothesis is that regional peculiarities in the

Regional Statistics, Vol. 8. No. 2. 2018: 154–169; DOI: 10.15196/RS080201

tendencies of GRP water intensity indicator changes allow not only to define the current situation pertaining to water use, but also to determine the direction of the control actions to increase its efficiency. In the study, this hypothesis is confirmed. Unlike other existing approaches and models which are oriented chiefly towards the identification of scarce water resource allocation options in accordance with the standards of water use, this article implements an approach to the assessment of the efficiency of water usage as a strategic resource for socio-economic development at the regional level. Based on the analysis of the GRP water intensity indicator and the problematic nature of region grouping from the standpoint of rational water usage, regions are identified. The results can serve as a guide for designing regional development strategies.

Keywords:
GRP water intensity indicator,
rational water usage paradigm,
efficient usage of water resources,
socio-economic development

Introduction

Russia continues to face the pressure of sanctions imposed on it by western countries. It also coped with the global economic crisis and overcame its adverse impacts. Against this backdrop, along with a range of externally and internally determined factors, the role of regions in the realisation of state plans and programmes, including the strategic ones, is continuing to expand in the Russian economy. As E. G. Animitsa notes, 'For large Russia that was always notable for significant variation of its subject territories, the regional aspect of economic, social and other reforms has decisive significance' (Silin et al. 2017, p. 684.).

There are a great number of causes for the peculiarities in the economic processes at the regional level. Firstly, the global economic shocks, significantly affecting the state economy, are usually moderated while switching over to mesoeconomic systems. Secondly, in spite of the fact that the regions are also influenced by cyclical factors, they have a larger potential than the state as a whole, for both finding a way out of the crisis and forming prerequisites for sustainable economic growth. Thirdly, at the regional level, which is more mobile than the macro level, there is a possibility for the efficient management of all kinds of resources, including natural ones, where water resources play a specific role as an integrated element in vital activity. Fourthly, a region is the main coordinating aspect in the purposeful allocation of state efforts to organise effectively resource flows. Therefore, mesolevel water economy systems act as the main control object in the national water economy system. 'Meanwhile, numerous strategies

of socio-economic development of the country and its regions that are being designed suffer from fundamental insufficiency – they do not include spatial (3-D) measurements of the productive forces organisation in the foreseeable future' (Silin et al. 2017, p. 684.), the consequence of which is inefficiency of resources supply strategies.

Sufficient and rational water supply to the regional economy promotes adequate functioning of economic processes; realisation of regional plans, programmes, and projects; and stability in the functioning of the regional economic system and its subsystems, both currently and in the future. Rational water supply to the regional economy has a pronounced and purposeful objective. It is an important factor in maintaining the integrity of the system and stability of socio-economic processes. The purpose of this article is to analyse the rationality of the usage of water resources in conjunction with regional socio-economic development indicators, by applying tools that allow grouping according to the existing trends in water consumption.

Efficiency of the usage of regional water resources: problem formulation and research methodology

One of the important characteristics of the historically formed non-uniformity in the Russian Federation's economic territory is the fact that regions are essentially differentiated according to their resource base, as well as the availability of water resources within their boundaries. However, in each of them, sufficient resource security allows for the smooth functioning of the regional economy, and formation of sectoral specialisations as well.

A range of problems in resource security management has the 'special significance of taking into account the country's scales and the high degree of regional distinctions both by resource availability and the level of their economic development in the background of increasing scales for demographic, ecological and social problems in some of them. It causes the necessity to carry out the system research for studying resource security management in the region as the object having the criterion character from the viewpoint of the purposeful orientation for the reproduction processes at the regional level' (Dobrolezha 2011, p. 5.). Moreover, the problems of effective management of water resource allocation (one of its features is scarcity) among consumers, as well as the rationality of their usage, increase the need to optimise resource consumption and examine high area asymmetry for their potential, using indicators of regional socio-economic dynamics. The water strategy of the Russian Federation for the period until 2020 is oriented towards the effective usage of scarce water resources, which is one of the most important tasks and is defined as the 'rationalisation of the water resources usage for different needs'.[1] This

[1] Water Strategy of the Russian Federation for the period until 2020 (approved by the RF Government regulation of 27 August, 2009 № 1235-p)// Ministry Resources and Ecology of the RF/Electronic resource/. http://www.mnr.gov.ru/regulatory/detail.php?ID=128717 (Downloaded: 20.02.2018).

emphasises the actuality of the interconnected nature of the problem of rational water supply for the regional water economy and the dynamics of the regional socio-economic indicators, using tools adaptive to both types of regions and environmental factors.

The theoretical basis of a water user's interest and agreement with the frameworks of the regional water economy system has been formed in the works of many researchers (Stackelberg 1934, Bettrand 1883, Wickham 2005, Szabó 2015, Belyaev et al. 2014, Danilov-Danilyan–Khranovich 2013).

The problems in creating tools to support the decision making process in the water economy of the country and its regions, including strategic decision making, are represented in a great number of works by the experts at the Institute of Water Problems of the Russian Academy of Sciences (Danilov-Danilyan–Khranovich 2013, Levit-Gurevich et al. 2010, Xu–Singh 2004, Loukas et al. 2007, Torregrosa et al. 2010). The models developed by these studies are oriented towards solutions for the task to adjust the society or region that needs the water resources with the possibility of their fulfilment. In a number of studies on this range of problems, including Molina et al. (2009), Chernova et al. (2015), Calizayar et al. (2010), Niua et al. (2016), Zhang–Guo (2016), and Krass (2017), the impact of water resources as a factor of both production and existing practices of their allocation, on the strategic plans of regional development as well as efficiency of water resources used in different sectors (primarily in agribusiness by assessment of the yield) is examined. The tools proposed by the authors do not allow an integrated assessment of the efficiency of regional water resources usage. They also do not allow the integrated assessment of the validity of the degree of the water allocation structure formed as a result of the position of the GRP growth security, based on intensive factors.

Various scientists opine that one of the main criteria for the assessment of the complex functioning of the regional water economy is the GRP water intensity indicator that allows the characterisation of the type and level of the ecological and economic development of the territories involved (Antonova 2013, Fomina 2010). The factors determining the GRP water intensity level, including specific weight of mining and manufacturing industries with high levels of water usage, population, as well as natural and climatic factors, are observed in the works of these economists. However, such substations for the high level of the GRP water intensity in Russia (on an average, 2.4 cubic metres/thousand roubles, but in a number of regions 11–14 cubic metres/thousand roubles) do not explain why this indicator exceeds similar ones in industrially developed countries such as the UK, Denmark, Sweden, and others, by 3 to 5 times.

Thus, the specific characteristics of the regional factors and management conditions explain the distinctions in the character of the regional water resources usage that affect the GRP water intensity indicator, which in turn, is determined by the sectoral structure. Since, as V. V. Gamukin justly notes, 'it is the combination of economies of separate regions that finally makes the main foundation of the nation-

al economy' (Gamukin 2017, p. 411.), it is important to understand the features of water use in regional economies, and to reveal the tendencies of its changes. Regional economies have to adapt to external and internal challenges in order to support definite rates of socio-economic development. This results in the search for new technologies for production and economic activities, in connection with the rational usage of water resources.

In our opinion, the high GRP water intensity level of the regions within the Russian Federation does not testify to the high specific weight for mining and manufacturing industries (i.e. non-rational structure of regional production), but to the insufficient efficiency of applied resource-saving technologies or the lack of innovative ones. GRP growth security is facilitated through extensive factors, and not intensive ones. The modern conditions of neo-industrialisation for the national economy, based on the paradigm of high innovation in production, confirm the conclusion.

One should emphasise the methodological significance and practical importance of the dynamic approach to this problem. Existing publications suggest that the rationality of the usage of water resources is usually carried out through the implementation of statutes, according to the state, for a specific period. The methods applied make it possible to reveal the actually formed degree of adequacy of the existing regional methods for the allocation of water resources and their requirements within a concrete period. However, they do not present the possibility of the interrelated prediction of water supply strategies and socio-economic development of the region. According to this approach, water supply management of the regional economy has an exclusively tactical character, since it covers a short period.

It is supposed that in the process of regional strategizing, it is necessary to reveal tendencies of water supply and water resources use in each concrete constituent territory and federal district of the Russian Federation. This will allow the formation and implementation of strategic plans for rational allocation according to the prospects of the socio-economic development of the territory in question. To solve this problem, it is necessary to carry out an analysis of the dynamics revealing the tendencies of changes in the GRP water intensity level in separate regions and in the macro region. Moreover, it is evident that the management of water supply processes and the regional economic development should be goal-oriented in both current and strategic contexts, and include a set of science-based control actions to achieve the rational allocation and effective usage of scarce water resources in the regions.

The rational allocation and effective usage of regional water resources as a control object require heightened attention from the data monitoring system, characterised by the practice formed, as well as by the dynamics of the water supply process in the regional economy. For the unification and systematisation of approaches on part of the management to the processes of allocation and use of scarce water resources, it is necessary to apply mathematical and strategic methods. These methods should enable granting a scientific basis for the main goal-oriented and programme

guides for all the regions found in the same qualitatively uniform group, from the perspective of tendencies for changes in the GRP water intensity level, not excluding the differentiated approach for each region. Using such an approach, the principle of rational water supply and effective water conservation is observed. This principle conditions the possibility of the successful functioning and stability of economic players; the uninterrupted operation of production processes; the realisation of regional plans, programmes, and designs; the achievement of regional development balance; and the greatest conformity of the GRP structure to the imperatives of modernisation and innovation.

The arguments given here support the propounding of the following tasks:

– to analyse the dynamics of the GRP water intensity indicator for separate federal districts and other entities of the Russian Federation, affiliated to their composition;
– to reveal the factors determining the changes in the GRP water intensity level;
– to reveal regularities in the changes in the GRP water intensity level for separate constituent territories of the Russian Federation;
– to carry out grouping of the constituent territories in the Russian Federation by tendencies of changes in the GRP water intensity level.

The results of carrying out these tasks, besides the assessment of the general dynamics for the changes in the GRP water intensity indicator of the regional economy, can become determinants for the directions to increase the rationality level of water resources usage, and their purposefulness to realise strategic priorities in the development of concrete territories.

Empirical analysis of the rational usage of regional water resources

Although each region pays a great deal of attention to the level of supply of resources (including water), the various ways of water resources usage can either contribute or not contribute to the growth of GRP. In this study, the GRP water intensity indicator, as mentioned above, is determined by the volume of water use and the tendency of GRP changes. When innovative technologies are applied, even intensive development with careful usage of water resources may result in a decreasing GRP water intensity indicator. Besides, a sharp decrease in the GRP water intensity indicator can testify to the implementation of a water saving innovation in the regional economy.

Placing emphasis on the interrelation of the component structure of the regional economy (expressed by the GRP value), and the indicator of the volume of water use allows us the reveal which regions with similar component structures (peculiar macro groups) show comparable and even similar tendencies of changes in the GRP water intensity indicator. It also makes it possible to develop a model that will

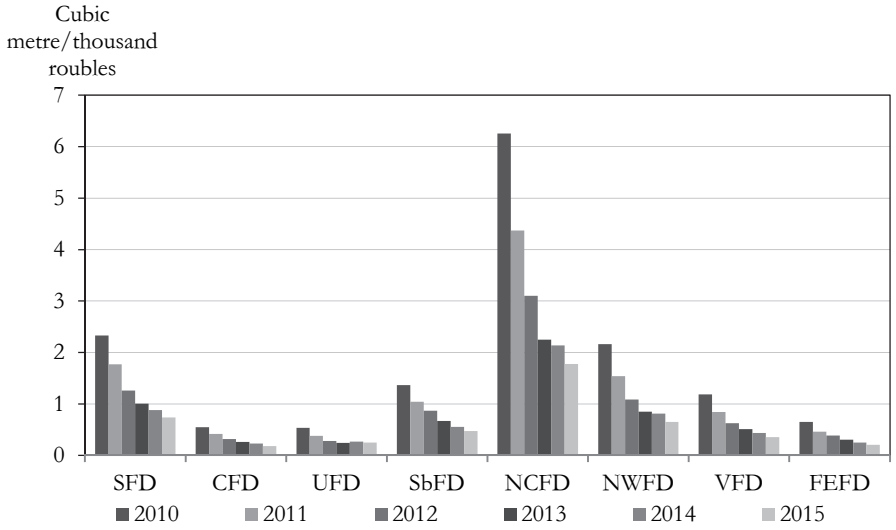
have a great socio-economic effect and thereby create conditions for the modernisation of the regional economy and to make managerial decisions on its application related to the exploitation of water ecosystems.

In the following, the link between the GRP water intensity level and GRP volume dynamics is analysed based on the Russian Federal State Statistics Service's (Rosstat) 2010–2015 data on fresh water use in the Russian Federation's various entities. The indicator of the volume of water consumption by circulating water systems is, however, not taken into account in the computations since the application of such a technology is impossible or limited in some industrial productions (for example, in the food industry). Conclusions of that kind can be only drawn if data on the structure of sectoral water usage are available. However, this is not the focus of this article.

Decrease in the volume of (fresh) water use (with a given GRP growth) indirectly testifies to the application of water saving technologies. In the period from 2010 to 2015, the GRP water intensity indicator decreased in every constituent territory of the Russian Federation. The largest decrease was in the North-Caucasus Federal District (NCFD) (see Figure 1).

Figure 1

Changes in the GRP water intensity indicators of the Russian federal districts



Note: Here and in the following figures, SFD – Southern Federal District, CFD – Central Federal District, UFD – Ural Federal District, SbFD – Siberian Federal District, NCFD – North Caucasus Federal District, NWFD – North-western Federal District, VFD – Volga Federal District, FEFD – Far Eastern Federal District.

Source: Own calculation based on Rosstat (2016).

In 2015 data, the GRP water intensity level was below one cubic metre/thousand roubles in seven of the federal districts. The only exception was the

NCFD, whose GRP water intensity figure – even if it fell to one third between 2010 and 2015 – was more than double of the GRP water intensity indicators of the other federal districts at the end of the period considered.

To analyse the factors affecting changes in the GRP water intensity level, the following model is used:

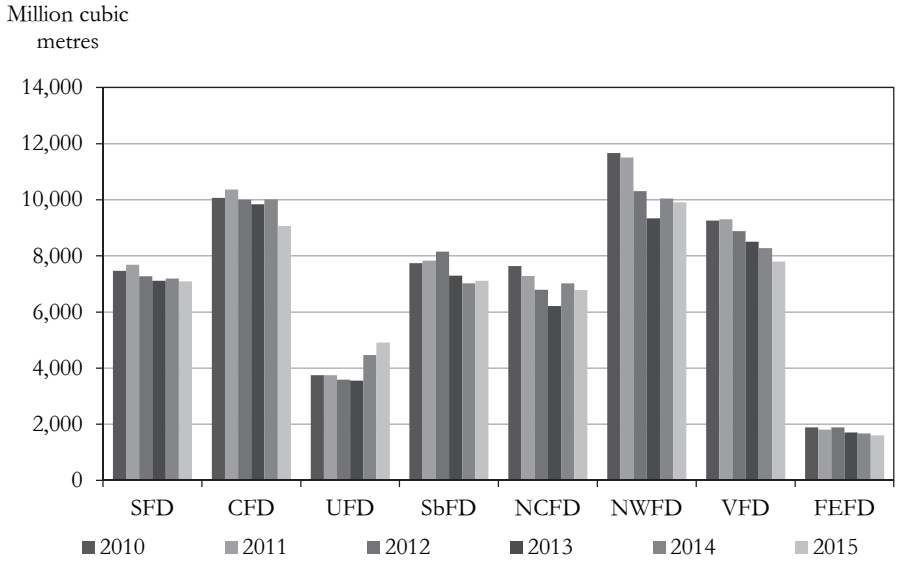
$$W_i = \frac{V_f}{GDP} \ ,$$

where W_i denotes the GRP water intensity level, and V_f stands for the volume of fresh water use.

The analysis has revealed that between 2010 and 2015 the volume of fresh water use was approximately the same, or varied insignificantly in a number of federal districts. They include the Southern Federal District (SFD), the Far Eastern Federal District (FEFD), the Central Federal District (CFD), NCFD, and the Siberian Federal District (SbFD). In the North-western Federal District (NWFD) and the Volga Federal District (VFD), however, this indicator showed a significant decrease (see Figure 2), which, as it was noted above, indirectly testifies to the improvement in the efficiency of fresh water usage, taking these federal districts' GRP growth rates also into account. In the period considered, the volume of fresh water use increased only in the Ural Federal District (UFD), owing to the growing figures of the Tyumen region (the volume of fresh water use has not changed significantly in other constituent territories of the micro region).

Figure 2

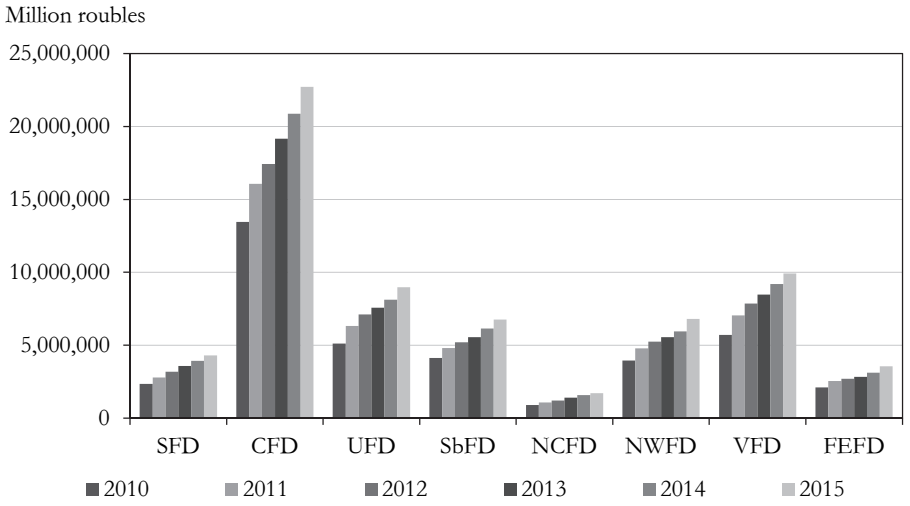
Dynamics of fresh water use in the Russian federal districts



Source: Own calculation based on Rosstat (2016).

Figure 3

Dynamics of GRP changes in the Russian federal districts



Source: Own calculation based on Rosstat (2016).

In the period considered, the GRP growth rates were similar in most of the federal districts, except for CFD whose GRP figures and rates of GRP growth were higher. Besides having the highest GRP water intensity indicator, NCFD does not rank last among the federal districts by the volume of fresh water use, but has the lowest GRP figure. The volume of its fresh water use coincides with that of the SFD and SbFD, but its GRP figures are much lower compared to those of the other federal districts. This testifies to the high water intensity of its regional economy, and possibly, to the irrational management of its water resources.

Our analysis demonstrates that the rates of decline in the fresh water use of the federal districts were significantly lower than their GRP growth rates. In other words, a lower and lower volume of fresh water was needed in each subsequent year for the production of one rouble GRP. Moreover, the GRP water intensity indicator showed a decreasing tendency in the period considered, although the rate of decline became smaller in the last few years. The reasons for this tendency presumably are the following:

– more careful usage of water resources owing to the introduction of new technologies reducing water consumption levels, the introduction of a circulating water supply system, and the decrease in the level of losses;
– expansion of regional production with low water intensity levels.

These reasons, however, can be only proved and concretized by a more detailed analysis of the water consumption levels and GRP water intensity indicators of the regions.

Next, the regions are grouped based on the tendency of their GRP water intensity changes. The results indicate that the GRP water intensity level varies considerably in the regions. Supposing that each group of 'similar' regions forms a separate interval, and the level of GRP water intensity varies evenly within their bounds, Sturges' rule can be used to determine an optimum number of intervals by which the observed range of the random variable is divided when building a histogram. As a great set of indicators are analysed in the present research, and their allocation is close to the standard 1, the reliability of data received is sufficient.

In Table 1, the computation results for the upper bounds of the GRP water intensity intervals are presented that form the basis of a regional grouping. Using Sturges' rule, we could determine seven intervals. As Table 1 shows the boundary values of these intervals were different in the various years and showed a decreasing tendency between 2010 and 2015. The separation of the groups with 'very low', 'low', 'relatively low', 'average', 'relatively high', 'high' and 'very high' levels of GRP water intensity is relative and was performed by taking the maximum and minimum values of the grouping indicators into account in the six years considered.

Table 1

Regional grouping and the upper bounds of the seven GRP water intensity groups (intervals)

Upper bound, cubic metre/thousand roubles						Group (interval)/Level of GRP water intensity
2010	2011	2012	2013	2014	2015	
2.02497182	1.58321951	1.22777915	1.09266440	1.0249131	0.76380529	1/Very low level
3.91970718	3.06065078	2.36348670	2.11253985	1.9856368	1.47679462	2/Low
5.81444254	4.53808206	3.49919424	3.13241529	2.9463605	2.18978395	3/Relatively low
7.70917790	6.01551334	4.63490179	4.15229074	3.9070843	2.90277329	4/Average
9.60391326	7.49294462	5.77060934	5.17216618	4.8678080	3.61576262	5/Relatively high
11.4986486	8.97037590	6.90631689	6.19204162	5.8285317	4.32875195	6/High
13.3933839	10.4478071	8.04202443	7.21191707	6.7892554	5.04174128	7/Very high

Source: Own calculation based on Rosstat (2016).

Table 2 presents the Russian Federation's constituent territories grouped by the tendency of their GRP water intensity indicator changes, and reflects – where it is appropriate – the characteristics of their transition from one group to another.

According to Table 2 and Figure 4, a great part of the Russian Federation's constituent territories was in the same group during the entire research period. However, some constituent territories moved from a group with higher GRP water intensi-

ty level into another group with a comparatively lower GRP water intensity level, or vice versa. Nevertheless, several constituent territories remained in the same group of high water intensity level.

The results of the analysis have revealed the 'problematic' entities of the Russian Federation. Among them, there are constituent territories:

– with growing GRP water intensity level (Leningrad region, Adygeya Republic, and the Republic of Kalmykia);
– with constantly high or average GRP water intensity level (Kostromskaya and Twerkaya regions).

For these constituent territories, further research needs to be conducted to find the reasons for their growing/high GRP water intensity level. In some cases, it can be explained by their broadening regional business activities or some structural changes introduced in the regional economy. However, if this tendency continues in the next few years, the water consumption will be likely irrational in these constituent territories.

Table 2

Grouping of the Russian Federation's constituent territories by the tendency of GRP water intensity indicator changes, 2010–2015

Tendency of changes	Constituent territory	Group of constituent territories/Transition between groups
Relatively constant GRP water intensity level	Amur region, Jewish autonomous region, Kamchatka krai, Magadan region, Seaside krai, Republic of Sakha-Yakutia, Sakhalin region, Khabarovsk krai, Chukotka autonomous okrug, Kirov region, Nizhny Novgorod region, Penza region, Republic of Bashkortostan, Republic of Mari El, Republic of Mordovia, Republic of Tatarstan (Tatarstan), Samara region, Saratov region, Udmurtia Republic, Ulyanovsk region, Chuvash Republic – Chuvashia, Arkhangelsk region, Vologda region, Saint Petersburg city, Kaliningrad region, Novgorod region, Republic of Karelia, Komi Republic, Altai krai, Trans-Baikal krai, Irkutsk region, Krasnoyarsk krai, Novosibirsk region, Omsk region, Altai Republic, Tyva Republic, Khakassia Republic, Tomsk region, and Kurgan region	Group 1 – These constituent territories had the lowest GRP water intensity level in the period considered, which was close to 2.0 cubic metres/thousand roubles in 2010 and decreased to 0.8 cubic metres/thousand roubles by 2015.
Relatively constant GRP water intensity level	Perm' krai, Chechen Republic, Kemerovo region, Republic of Buryatia, and Rostov region	Group 2 – The GRP water intensity level of these constituent territories was sufficiently low in the period considered; it did not exceed 4.0 cubic metres/thousand roubles in 2010 and decreased to 1.5 cubic metres/thousand roubles by 2015.

(Continued on the next page.)

(Continued.)

Tendency of changes	Constituent territory	Group of constituent territories/Transition between groups
Relatively constant GRP water intensity level	Tver' region	Group 3 – The GRP water intensity level of this constituent territory was average in the period considered; it did not exceed 6.0 cubic metres/thousand roubles in 2010 and decreased to 2.2 cubic metres/thousand roubles by 2015.
	Kostroma region	Group 7 – The GRP water intensity level of this constituent territory was very high in the period considered; it almost reached 14.0 cubic metres/thousand roubles in 2010 and decreased to 5.0 cubic metres/thousand roubles by 2015.
Decreasing GRP water intensity level	Orenburg region, Pskov region, Republic of Severnaya Osetia-Alania, Krasnodar krai, Kabardino-Balkar Republic, Republic of Ingushetia, and Astrakhan' region	Transition to 'neighbouring' groups (not more than two transitions in the period considered)
	Stavropol' krai and Republic of Dagestan	Transitions to 'non-neighbouring' groups (not more than two transitions in the period considered)
Growing GRP water intensity level	Republic of Adygeya and Leningrad region	Transition to 'neighbouring' groups (not more than two transitions in the period considered)
	Republic of Kalmykia	Transitions to 'non-neighbouring' groups (not more than two transitions in the period considered)

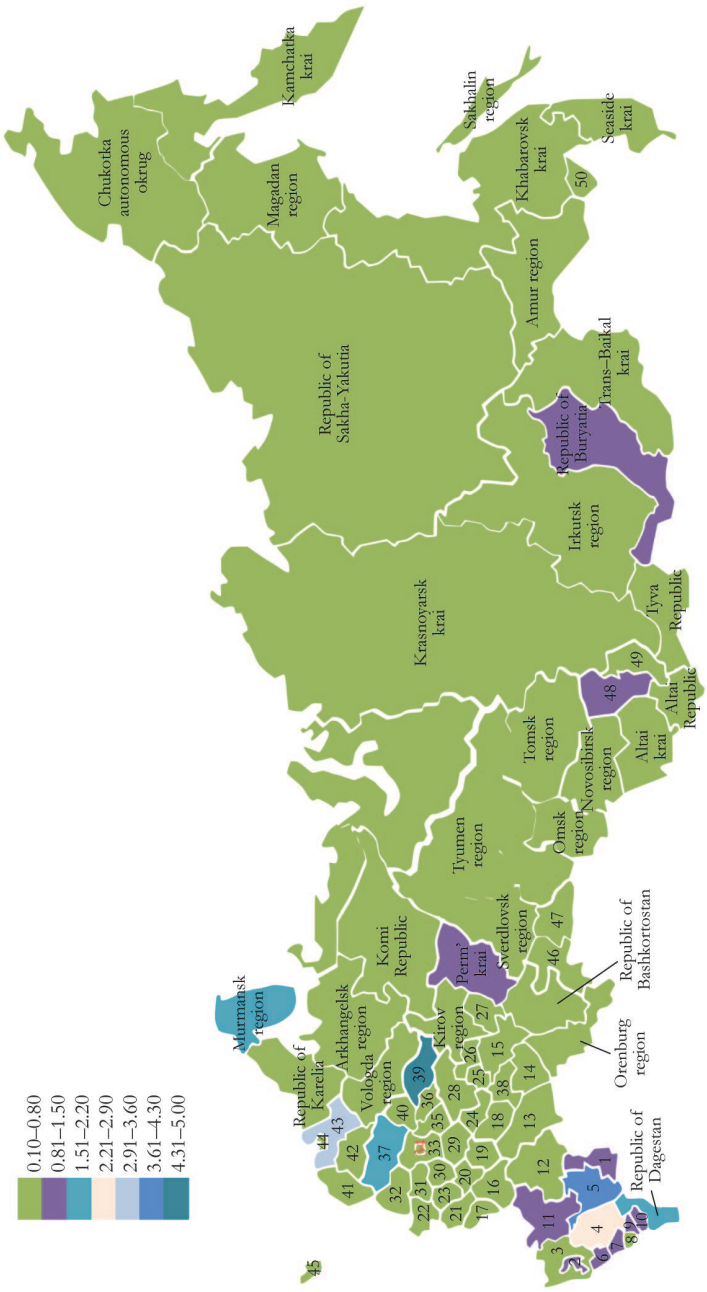
Note: Krai and okrug are two types of administrative divisions in the Russian Federation.

The results demonstrate that the situation in the Republic of Kalmykia (that is characterised by a growing GRP water intensity level and very low indicators of fresh water use) and the Kostroma region (whose volume of fresh water consumption is high, but its GRP figures are low) deserve special attention.

The regional authorities that are responsible for the realisation of water supply policy may consider studying regional experiences with decreasing GRP water intensity levels, particularly those of Stavropol' krai and the Republic of Dagestan, where, against the background of relatively constant water consumption levels, GRP growth is observed.

Figure 4

Map of the Russian Federation's constituent territories grouped by GRP water intensity, 2015



1. Astrakhan' region
2. Republic of Adygeya
3. Krasnodar krai
4. Stavropol' krai
5. Republic of Kalmykia
6. Karachay-Cherkess Republic
7. Kabardino-Balkar Republic
8. Republic of Severnaya Osetia-Alania
9. Republic of Ingushetia
10. Chechen Republic
11. Rostov region
12. Volgograd region
13. Saratov region
14. Samara region
15. Republic of Tatarstan
16. Voronezh region
17. Belgorod region
18. Penza region
19. Tambov region
20. Lipetsk region
21. Kursk region
22. Bryansk region
23. Orel region
24. Republic of Mordovia
25. Chuvash Republic – Chuvashia
26. Republic of Mari El
27. Udmurtia Republic
28. Nizhny Novgorod region
29. Ryazan region
30. Tula region
31. Kaluga region
32. Smolensk region
33. Moscow region
34. Moscow
35. Vladimir region
36. Ivanovo region
37. Tver' region
38. Ulyanovsk region
39. Kostroma region
40. Yaroslavl region
41. Pskov region
42. Novgorod region
43. Leningrad region
44. Saint Petersburg
45. Kaliningrad region
46. Chelyabinsk region
47. Kurgan region
48. Kemerovo region
49. Khakassia Republic
50. Jewish autonomous region

Conclusions

This study of the efficiency problems in the regional economy and its supply of resources, including the support tools for adopting and realising managerial decisions in the field of water usage, has made it possible to draw a reasonable conclusion on the necessity to develop assessment methods to study the rationality of the usage of water resources in conjunction with regional socio-economic development indicators. The verification of the proposed tools showed that in the macro regions of the Russian Federation, a decrease in the GRP water intensity indicators was observed, conditioned by the growth of the volumes of GRP while maintaining fresh water usage volumes. This decrease in the GRP water intensity is due to the introduction of new technologies to secure higher levels of rationality in the usage of water resources based on the circulating water use system and reducing the water losses incurred. One possible reason for the situation is the change in the sectoral GRP structure in favour of lesser water intensity.

To conduct computations of this kind in both current and strategic perspectives, it is necessary to create an effectively functioning system for the steady monitoring of information, to carry out analyses of the situation in the fields of allocation and utilisation of water resources.

A confirmation of the hypothesis on the conjunction of the GRP water intensity indicators and the dynamics of the regional socio-economic development, results in the important conclusion that it is necessary to adjust water resources management tools applied by the basin authorities and the regional management for the development of territories. These conditions are propounding new tasks that determine the directions of the authors' further scientific investigations oriented on research of the sectoral structure for water consumption and the GRP water intensity to reveal and identify factors, as well as to develop mechanisms to adjust the interests of water consumption entities to the position of conjunction for the 'basin' and 'region' approaches.

Acknowledgement

This article was supported by the grant of RFBR No. 18-010-00623 'The intellectual modelling of the organisational economic mechanism of water supply management in regional water management complexes'.

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Generalization of calculation methods for gender indices in demographic and social statistics

Kateryna Serhiivna Akbash
Volodymyr Vynnychenko Central Ukrainian State Pedagogical University, Ukraine
E-mail: kateryna.akbash@gmail.com

Natalia Oleksiivna Pasichnyk
Volodymyr Vynnychenko Central Ukrainian State Pedagogical University, Ukraine
E-mail: pasichnyk1809@gmail.com

Renat Yaroszlavovics Rizhniak
Volodymyr Vynnychenko Central Ukrainian State Pedagogical University, Ukraine
E-mail: rizhniak@gmail.com

Keywords:
gender parity, gender asymmetry, statistical methodology, demographic statistics, social statistics, Erasmus+ Project: Gender Studies Curriculum

Currently, theoretical and practical approaches to gender issues are at a developmental stage. An important issue in gender statistics is the correct application of simple gender indices. This topic should be of interest to scholars and social workers engaged with gender issues. Due to the fact that gender parity/asymmetry indices give different results in different spheres of application, there is a need to develop separate methodological approaches for applying the indices to demographic and social statistics. In the research presented, mathematical methods were used to obtain complete and accurate quantitative characteristics of simple gender indicators. Methods of statistical observations, statistical groupings are used in the process of collecting, systematizing, and processing data. Results are graphically illustrated. It was established that when calculating gender indices for demographic statistics, the use of simple Gender Parity and Gender Asymmetry Indices is correct, and when calculating gender indices for social statistics, specific corresponding modifications should be applied which adjust for general demographic trends when analysing the gender distributions for selected social spheres. In exceptional cases (when demographic indices of the number of men and women are comparable), gender parity indices can be used when calculating the gender indices for social spheres. Therefore the results indicate that the analysis of gender parity/asymmetry requires separate methodological approaches for demographic and social statistics.

Introduction

Currently, theoretical and practical approaches to gender issues are at a developmental stage. The main conceptual idea of gender is that it is a social construct, influenced by the culture and traditions of society, and reflects the society's conception of differences between women and men. The development of the gender approach led to the revision of existing methodologies in social and socio-human sciences and, accordingly, the application of new methods. As a result, the trend of knowledge formation that is up-to-date on gender theory became widespread, applying an integrated approach (gender mainstreaming) to the issue of equality between women and men. Gender mainstreaming has been internationally recognized (Beijing Declaration and Platform for Action, 1995; Gender Mainstreaming Concept of the Economic and Social Council of the UN General Assembly, 1997; Conceptual Framework for Gender Mainstreaming of the Council of Europe, 1998; and the State Programme for the Promotion of Gender Equality, 2006, which was used as the basis of the Ukrainian Gender Policy). At the same time, some scholars point out the existence of significant contradictions between modern gender theory and the concept of gender mainstreaming which may negatively affect the development of mechanisms for the practical implementation of gender equality in society (Herbut 2012). In addition to the integrated approach to gender studies, there are other methods used depending on the objectives and the subject of the research.

One of these alternative methods is the theoretical method, which aims to organize the knowledge of gender on the principles of logical construction of a holistic concept, and to determine the purpose of this knowledge both in the system of social studies and within the framework of separate social sciences or the humanities. The theoretical method in gender studies facilitates the identification of the range of existing problems and the clarification of the subject of study. The method also determines the proper place of gender in modern humanities as a whole. The historical and genetic method in gender studies is characterized as a gender-oriented dimension of the historical process, a two-way approach for assessing historical events, situations and activities, and their consequences in a certain period and society. This method addresses events from the point of view of recognizing the interests and needs of both women and men. Social and psychological methods of studying gender include the study of socially constructed female and male roles and relationships, sexual characteristics, psychological characteristics, identity, etc. The empirical method of gender studies proves the existence and significance of objective facts, events and actions, and the manifestation of quantitative and qualitative parameters. The prognostic method in the study of gender addresses questions regarding gender development in the world (or a defined region) as a whole.

The above methods of gender studies are closely connected with statistical methods featuring numerical indicators which reflect the fairness of distribution and use of national welfare and services among social groups, within a global context or within particular regions, taking into account gender. Gender statistics show social and demographic characteristics of specific groups, with reference to distinctions between women and men. Gender statistics are the key information source for monitoring the circumstances of women and men in the world (or specific regions); they facilitate the development of strategic solutions for social and economic policy to implement social equality. The simplest indices of gender statistics are the gender parity and gender asymmetry indices, which are widely used in the calculation of more complex indicators. Since these indices give differing results for the general population and for particular samples, there is a need to develop separate methodological approaches for using such indices in demographic and social statistics.

Analysis of research and publications

The main simple indices for assessing gender inequality are given in the 1999 UNESCO document. These are the gender parity index, gender gap figures, the gender segregation index, analysis of gender data on the basis of correlation fields, etc. The 2009 UIS document presents the methodology for calculating the Gender Parity Index for specific educational indicators, in particular the analysis of the proportion of girls to boys for particular levels of education and age groups. The method of applying the Gender Parity Index to educational indicators is discussed in the works of Bhattacharya (2013), Jana et al. (2014), and Huebler (2008). Some generalizations of these indices are set out in Akbash et al. (2017a, 2017b, 2017c), but more attention is paid to the qualitative content and analysis of gender indices. In Akbash et al. (2017b), the coefficient of gender asymmetry was introduced, which in our opinion is a convenient measure for graphically interpreting gender parity. The underlying idea: the method of calculating the coefficient of gender asymmetry was borrowed from biology, in particular from Anisimova (2015), where functional asymmetry was demonstrated on the basis of structural and functional differences between the left and right hemispheres of the human brain.

Complex indices are used for gender analysis which cover several fields of human activity simultaneously. Basically, these indices are calculated at country level and are used to rank countries according to their level of human development. The main complex indices for assessing gender equality at the national level are the Gender Development Index, Gender Empowerment Measure, Gender Inequality Index, Gender Equality Index, Global Gender Gap Index, and the Social Institutions and Gender Index. The methodologies for calculating these indices are mathematically complex and they often incorporate the Gender Parity Index in their intermediate calculation formulas. For example, in order to calculate the Global

Gender Gap Index (WEF 2016), the Gender Parity Index is calculated, based on fourteen basic indicators of the country, and then further calculations are applied.

Most international reports that present the analyses of gender differences in countries and regions of the world highlight a number of key areas for gender analysis. For example, to calculate the Gender Equality Index, six main domains (work, money, knowledge, time, power and health) and two additional domains (intersecting inequalities and violence) are distinguished (GEI 2017). The Global Gender Gap Index is calculated using fourteen indicators in four areas: economic participation and career opportunities; education; health; and political rights and opportunities (WEF 2016). This list of indices and of the assessed areas can be extended; gender statistical analysis covers virtually all spheres of human activity and requires a clear methodology for assessing gender parity/asymmetry in each of these areas.

The objective of this study is to assess the peculiarities of application of simple gender indices and to test the theory that the analysis of gender parity/asymmetry requires various methodological approaches to demographic and social statistics.

We used various methods in our research, ensuring the objectivity of our results. Scientific methods of analysis and synthesis were used at different stages according to the subject of the research and the formulation of conclusions. Mathematical methods were used to obtain complete and accurate quantitative characteristics of simple gender indicators. Methods of statistical observation, statistical groupings, and estimation of errors in calculations were included in the statistical methods to collect, systematize, and process data. Simple gender indicators were graphically illustrated.

Main research results

Assessment of gender parity

The following basic terminology has been used. *Demographic statistics* (or population statistics) is a branch of demography which studies statistical patterns of the population. The subject of demographic statistics is the development of methods for statistical observation and measurement of demographic phenomena and processes, and collection and processing of statistical information on the population. *Social statistics* is a branch of statistical science that studies the quantitative aspects of mass social phenomena in order to identify patterns, interconnections, and trends. Social statistics studies the state structure and the political and economic system of a country, the social structure of a society, the standard of living of the population, the consumption of material goods and services, the conditions and nature of labour, social security, trade, housing, communal and transport services of the population, health care, education, culture and art, physical education and sports (Pidhornyi et al. 2016).

Assessment of gender parity. In demographic statistics, the gender ratio is used to analyse the population of the world, global regions, individual countries, and smaller territorial units:

$$GR = \frac{population_m}{population_f} \cdot 100. \quad (1)$$

The ratio shows the number of men for every 100 women in a certain region; $population_m$ is the number of males in the corresponding region, and $population_f$ is the corresponding number of females.

Gender ratios may vary in different subgroups of a population. The gender ratio for new-borns will differ from that for the whole population or the elderly. Biologically, more boys are born than girls (104-107 boys for every 100 girls), but on average, women are more resistant to illnesses and live longer than men. Also, the tendency of men to enter riskier occupations and exhibit aggressive behaviour increases their chances of early death (UNECE 2016). Therefore, whereas the gender ratio of new-borns shows a higher number of boys than girls, the gender ratio for the elderly indicates more women than men (the value of the ratio calculation is less than 100).

In gender-neutral societies where men and women live in the same conditions, the gender ratio is from 98 to 100 (UNECE 2016). In 2015, the gender ratio for the whole world's population was 102, but values varied between different countries, from 274 in the United Arab Emirates to 85 in Latvia and Lithuania (86 in Ukraine). Gender differences are also significant in life expectancy (Uzzoli 2016).

The following indicators and methods are used to perform an analysis of gender parity: the Gender Parity Index, Gender Gap Index, Gender Asymmetry Index and correlation fields. Let us examine the methods for calculating these indices and illustrate the special features of their application.

The *Gender Parity Index (GPI)* is the ratio of the number of women to the number of men in a certain territorial region:

$$GPI = \frac{population_f}{population_m}. \quad (2)$$

This is the generally accepted Gender Parity Index, which was introduced by the UNESCO in 1999. Theoretically, the ratio may vary from 0 (in the absence of any women in the group) to infinity (in the absence of men in the group). In the case of absolute equality in numbers of women and men, the ratio is equal to 1.

The *Absolute Gender Gap (AGG)* is calculated as the difference between the number of men and the number of women in a certain territorial region:

$$AGG = population_m - population_f. \quad (3)$$

Results expressing that there are more women than men are denoted by a negative value.

The *Gender Asymmetry Index (GAI)* is calculated as follows:

$$GAI = \frac{population_f - population_m}{population_f + population_m}, \quad (4)$$

which yields values in the interval [–1; 1]. Where there are equal numbers of men and women in the group studied, GAI=0; where there are more women than men, GAI>0, and the closer the value of GAI is to 1, the bigger the imbalance towards women; where there are more men in the group, GAI<0 (the closer the value of GAI is to –1, the greater the imbalance towards men).

Let us consider the demographic situation in some countries and analyse simple gender indices, in particular: GR, GPI, AGG, and GAI. Demographic indicators in Table 1 were taken from the work (WB 2017).

Table 1

Application of gender indices to the demographic profiles of selected countries, 2016

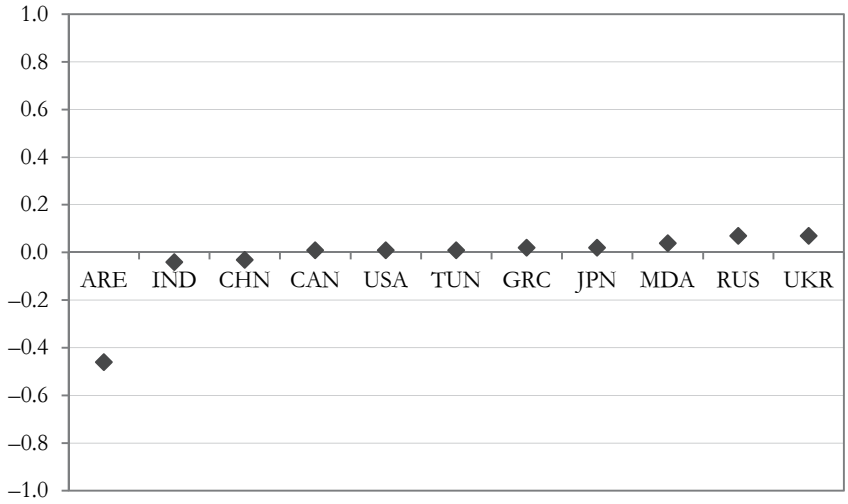
	Country name	Country code	Female population	Male population	GR	GPI	AGG	GAI
1	2	3	4	5	6	7	8	9
1	United Arab Emirates	ARE	2,524,948	6,744,664	267	0.37	4,219,716	–0.46
2	India	IND	637,879,447	686,291,907	108	0.93	48,412,460	–0.04
3	China	CHN	668,291,578	710,373,422	106	0.94	42,081,844	–0.03
4	Canada	CAN	18,285,148	18,001,277	98	1.02	–283,871	0.01
5	United States	USA	163,233,094	159,894,419	98	1.02	–3,338,675	0.01
6	Tunisia	TUN	5,769,883	5,633,365	98	1.02	–136,518	0.01
7	Greece	GRC	5,456,150	5,290,590	97	1.03	–165,560	0.02
8	Japan	JPN	64,962,126	62,032,385	95	1.05	–2,929,741	0.02
9	Moldova	MDA	1,846,518	1,705,482	92	1.08	–141,036	0.04
10	Russian Federation	RUS	77,268,128	67,074,268	87	1.15	–10,193,860	0.07
11	Ukraine	UKR	24,201,697	20,802,948	86	1.16	–3,398,749	0.08

The countries in the table are sorted by the value of their gender ratio. The four indicators (columns 6–9) illustrate each country's demographic situation in different ways.

The most convenient indicator for visual illustration is GAI, since values are restricted to the symmetric deviations from zero to 1 in the case of female predominance, and zero to –1 in the case of male predominance (see Figure 1.).

Figure 1

Visualization of GAI data (per Table 1)



Note: For country codes, see Table 1.

In the first three countries of Table 1, we see a predominance of men in the population. The GPI values illustrate the same, since all are less than 1. AGG shows how many more men than women there are in the country. The minus coefficient of asymmetry also shows the predominance of men.

The mid-ranked countries (Canada, United States, Tunisia, Greece, Japan) are closest to parity in the country's demographic indicators, but there is a slight predominance of females in their populations.

The lowest-ranked countries (all former Soviet states, Moldova, Russian Federation, and Ukraine) are characterized by high gender asymmetry with predominantly female populations.

Assessment of specific gender parity

There are a number of indices for the assessment of gender parity for specific sub-groups of a population.

The calculation of indicators of gender parity for sub-groups is based on the specific values of the structure (SVS) for that sub-group, which characterize the specific weights of the component elements in the sum total. SVS values are determined by the formula:

$$\text{SVS} = \frac{share\ of\ totality\ of\ coverage}{overall\ totality\ of\ coverage}. \quad (5)$$

Thess set of specific values of the structure illustrate the phenomenon being studied (Pidhornyi et al. 2016). We introduce the following ratios based on the SVS:

$$ratio_f = \frac{number\_sph_f}{population_f}; \quad ratio_m = \frac{number\_sph_m}{population_m}, \tag{6}$$

where $number\_sph_f$ is the number of females (males) who have a certain feature chosen for the analysis of a certain social sphere in a certain region (i.e. the sub-group); $population_f$ is the total female (male) population in this region.

Specific Gender Parity Index (GPI_{sph}). The articles (Akbash et al. 2017a, 2017b, 2017c) introduced the specific gender parity index which is calculated in the following way:

$$GPI_{sph} = \frac{ratio_f}{ratio_m}. \tag{7}$$

This index identifies how many times larger/smaller the proportion of women with a certain feature in the social sphere of the study is than the corresponding proportion of men. Thus, GPI_{sph} changes within the limits[0; ∞], and is a qualitative value representing the ratio of the distribution of certain features in gender groups. The cases where GPI_{sph} we will call parity; cases where GPI_{sph} is not equal to 1 we will describe as lacking parity. (If (GPI_{sph}>1 then the ratio for women is greater than the ratio for men; if GPI_{sph}<1 the opposite is true.)

Absolute Specific Gender Gap (AGG_{sph} is calculated as the difference between the proportion of men with a selected trait among the total number of men in the selected demographic group and the equivalent proportion for women (expressed as a percentage):

$$AGG_{sph} = \left(ratio_m - ratio_f\right) \cdot 100\%. \tag{8}$$

This index is meaningful if the number of men and women in the corresponding demographic groups is approximately the same ($population_m \approx population_f$). The index characterizes whether the percentage of men with a certain feature is larger or smaller than the corresponding proportion of women.

Specific Gender Asymmetry Index GAI_{sph} is calculated using the proportion of women with a certain feature from the relevant demographic group, $ratio_f$, and the equivalent proportion of men, $ratio_m$:

$$GAI_{sph} = \frac{ratio_f - ratio_m}{ratio_f + ratio_m}. \tag{9}$$

Thus, GAI_{sph} values will fall between the limits [–1; 1], and yield a qualitative comparison of the distribution of certain features within gender groups. Cases where GAI_{sph}=0 we will describe as exhibiting symmetry between the proportions of men and women, and where the value is different to zero, will be described as asymmetrical. (if GAI_{sph} >0, the proportion for women exceeds that for men, and in the opposite case the proportion for men is greater.)

Having made elementary changes we can see the connection between specific gender parity index GPI_{sph} and specific gender asymmetry index GAI_{sph}. Thus:

$$GAI_{sph} = 1 - \frac{2}{GPI_{sph} + 1} \quad \text{or} \quad GPI_{sph} = \frac{2}{1 - GA_{sph}} - 1. \tag{10}$$

We shall now examine the following questions: 1) how universal is the application of the indices GPI_{sph}, AGG_{sph}, GAI_{sph} and the indices GPI, AGG or GAI; 2) how wide or specific is their scope of application; and 3) how correct will their results be?

To do this, we demonstrate the application of the indices GPI_{sph}, AGG_{sph}, GAI_{sph} and the indices GPI, AGG, GAI to data arrays of different sizes in an arbitrary sphere. The first example relates to the ratio of female to male groups enrolled in primary education in different regions of the world.

Data will be limited to the following regions: the Kirovohrad region of Ukraine, the whole of Ukraine, Europe & North America (UNESCO Region (UNESCO 2017)), and the whole world. Table 2 presents numerical values for the number of persons who were elementary school pupils in 2012 in each of the specified regions, a breakdown of those persons by gender, general demographic indicators and population distributions by gender of the Kirovohrad region of Ukraine, Ukraine, Europe & North America, and the world (2012). (Data on education indicators were taken from (UNECE 2012), demographic indicators were obtained from (WB 2017), all data for the Kirovohrad region were obtained from (DSKR 2016).)

Table 2

Gender indices for enrolment in primary education for arrays of different sizes, 2012

Denomination	Kirovohrad region	Ukraine	Europe & North America	The world
Children in primary school				
$number\_sph_f$	16,932	775,316	35,793,423	339,733,393
$number\_sph_m$	17,456	809,066	40,400,077	371,557,319
General demography				
$population_f$	539,900	24,549,634	620,365,541	3,516,939,678
$population_m$	456,100	21,043,666	588,555,526	3,580,460,987
Simple gender indices				
GPI	0.97	0.96	0.89	0.91
AGG	524	33,750	4,606,654	31,823,926
GAI	–0.02	–0.02	–0.06	–0.04
GPI_{sph}	0.82	0.82	0.84	0.93
AGG_{sph}	0.0069	0.0069	0.0109	0.0072
GAI_{sph}	–0.10	–0.10	–0.09	–0.04

In the mathematical sense of the concept of a multitude, the enumerated regions are consecutive subsets (and related by the inclusion of the sets, when moving from the region with the largest data array to the one with the smallest). Thus, the demographic data array for the population of the Kirovohrad region is a subset of the data array for the population of Ukraine. The data array of the population of Ukraine is included in the data array of Europe & North America, which is in turn included in the data array for the world. (The same is true for the relationship between data arrays for primary school education.)

This example demonstrates the incorrect application of indices GPI, AGG, and GAI as non-demographic indicators. That is, the calculation of parity indices for education indicators was reduced to the following simplified formulas:

$$GPI = \frac{number_{sph_f}}{number_{sph_m}}; \tag{11}$$

$$AGG = number_{sph_m} - number_{sph_f}; \tag{12}$$

$$GAI = \frac{number_{sph_f} - number_{sph_m}}{number_{sph_f} + number_{sph_m}}. \tag{13}$$

From these simple gender indices in Table 2 we see that for the world data array, the coefficients GAI and GPI_{sph} work equally (values for both are –0.04), and the indices for GPI and GPI_{sph} are close (with the values 0.91 and 0.93 respectively). Similarly close results are not observed for the data arrays of smaller regions. In the Kirovohrad region and Ukraine the difference in the indices is: for GPI and GPI_{sph} 0.14–0.15, and for GAI and GAI_{sph} 0.08. Lesser differences are observed in the indices for Europe & North America, 0.05 and 0.03 respectively. In other words, to calculate gender parity and gender asymmetry among primary school children around of the world we may apply both formulas (7) and (9), as well as simplified formulas (11) and (13) (that is, only when $population_m \approx population_f$). To calculate the same indices among primary school children in other regions (with a smaller data array), it is expedient to use formulas (7) and (9), since they give results that correspond to the demographic situation in the corresponding territorial region. Otherwise, we will get results that ignore the distortive influence of underlying demographic gender ratios.

Let us consider another example connected with the identification of ratios between female and male groups, using data for 2016 which represented the subgroup of those individuals who are economically active, and all individuals in the general population who are more than 15 years old. The same territories' data arrays will be used: the Kirovohrad region of Ukraine, all Ukraine, Europe & North America, and the world (Table 3). The data are obtained from (WB 2012).

Table 3

Gender indices for arrays of different sizes (Labour force participation rate 15+), 2016

Denomination	Kirovohrad region	Ukraine	Europe and North America	The world
Economically active population 15+				
$number\_sph_f$	202,700	9,855,331	198,563,366	1,344,090,821
$number\_sph_m$	226,100	10,914,912	240,024,669	2,071,653,076
General demography 15+				
$population_f$	447,189	20,876,809	389,932,647	2,750,154,246
$population_m$	366,546	17,273,031	357,943,440	2,750,152,789
Simple gender indices				
GPI	0.90	0.90	0.83	0.65
AGG	23,400	1,059,581	41,461,303	727,562,255
GAI	–0.05	–0.05	–0.09	–0.21
GPI_{sph}	0.73	0.75	0.76	0.65
AGG_{sph}	0.16	0.16	0.16	0.26
GAI_{sph}	–0.15	–0.14	–0.14	–0.21

From Table 3 we see that, similarly to the previous case, for a large data array (the world) the indices GAI and GPI_{sph} produce the same results, as do the indices GPI and GPI_{sph} (0.65 and –0.21 respectively). Again, this similarity is not observed in the smaller data arrays. In the Kirovohrad region and in Ukraine, the difference between the indices is: for the indices GPI and GPI_{sph}, 0.15–0.17; and for the indices GAI and GPI_{sph}, 0.09–0.10. Slightly lower differences are observed between indices for Europe & North America; 0.07 and 0.05 respectively. In this case, for the whole world data array, the calculation of the gender parity and gender asymmetry indices for economically active individuals within the population aged 15+ can be performed using both formulas (7) and (9) and formulas (11) and (13) (again, it is a requirement that $population_m \approx population_f$). For the calculation of the same indices for economically active individuals within the population aged 15+ in other regions (which have smaller data arrays), it is expedient to use formulas (7) and (9).

In selecting one formula or another to calculate gender parity or gender asymmetry, it is necessary to assess the overall demographic indicators of the region under research. From formulas (7) and (9) it is clear that the closer the general demographic indices of men and women (i.e. $population_m \approx population_f$), the closer the results

of formulas (7) and (9) will be to the results of formulas (11) and (13). Let us analyse the values of the formula

$$GAI = \frac{population_f - population_m}{population_f + population_m} \quad (4)$$

for demographic indicators of both populations (Table 4).

Table 4

Assessment of gender asymmetry in values $population_f$ and $population_m$ calculated on total population and population aged 15+ by region

Denomination	Kirovohrad region	Ukraine	Europe & North America	The world
General demography (example 1)				
$population_f$	539,900	24,549,634	620,365,541	3,516,939,678
$population_m$	456,100	21,043,666	588,555,526	3,580,460,987
General demography 15+ (example 2)				
$population_f$	447,189	20,876,809	389,932,647	2,750,154,246
$population_m$	366,546	17,273,031	357,943,440	2,750,152,789
Ratio value (4)				
Example 1	8.4 E-2	7.7 E-2	2.6 E-2	–8.9 E-3
Example 2	9.9 E-2	9.4 E-2	4. 3 E-2	2.65 E-7

Example 1 tests the entire population of each region and example 2, the population aged 15 or older. For the whole world, in the first and second cases the asymmetry between the values $population_f$ and $population_m$. (i.e. the numbers of men and women in the relevant population) is less than 1% of the total population of the corresponding group. For the other regions, the asymmetry values are significantly higher, ranging from approximately 2% to 10%.

Conclusions and prospects for further research in the field of study

The study of the results of simple gender indices makes it possible to state that the analysis of gender parity/asymmetry requires separate methodological approaches to demographic statistics and social statistics.

1. For the calculation of simple gender indices of demographic statistics, the application of the gender parity index formula (2) and gender asymmetry index formula (4) are correct and universally applicable.

2. For the calculation of simple gender indices of social statistics, the gender parity index formula (11) and gender asymmetry index (13) are not universally applicable. Instead, it is correct to use the formulas for specific gender parity index (7) and

specific gender asymmetry index (9), which take into account demographic indicators $population_f$ and $population_m$.

3. In cases where $population_m \approx population_f$, the necessary accuracy of the calculations can be achieved. See formula (10) and table 4). The application of the formulas for the gender parity index (11) and gender asymmetry index (13) in social statistics can be considered completely correct.

Acknowledgement

The article has been prepared in the framework of the Erasmus+ project "Gender Studies Curriculum: A Step for Democracy and Peace in EU-Neighbouring Countries with Different Traditions", No. 561785-EPP-1-2015-1-LT-EPPKA2-CBHE-JP. This project has been funded with support from the European Commission. This publication reflects the views of the author only, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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VISUALIZATIONS

Visualization of migration using spatial interpolation method in Hungary and Slovakia

Ladislav Novotný
Pavol Jozef Šafárik University in Košice
Faculty of Science
Institute of Geography,
Slovakia
E-mail: ladislav.novotny@upjs.sk

Loránt Pregi
Pavol Jozef Šafárik University in Košice
Faculty of Science
Institute of Geography,
Slovakia
E-mail: lorant.pregi@upjs.sk

Reducing the intensity of natural reproduction of population in the post-socialist central and eastern European countries (CEECs) led to stabilization of natural increase near the equilibrium or even at the negative values by the early 2000s (cf. Berde–Németh 2014, Mládek 2008, Vörös-Torma 2016). At the same time, rise of intensity, effectiveness and substantial changes in spatial patterns of migration (Bezák 2006, Mykhnenko–Turok 2008, Novotný 2016) spurred attention to the research of migration as a phenomenon gaining important role in spatial redistribution of population (Bezák 2006, Kulcsár–Obádovics 2016).

To visualize migration, traditionally choropleth or diagram maps (Pravda 2007) are used. Choropleth maps provide important information for displayed administrative or statistical units, but the various size of these spatial units and the shapes of their boundaries can distort visual perception of migration patterns on large scale maps. This is not the case when diagram maps are used but they fail to display population as a spatially continuous phenomenon. However, the population has a certain impact on every point in the area regardless if people directly reside on it or not, what makes perception of population as a continuous phenomenon relevant.

The aim of this study is to display internal migration as a spatially continuous phenomenon, and so to visualize the impact of migration balance of individual municipalities throughout the whole area of Hungary and Slovakia, which are concerned as a case study. For that purpose, the interpolation cartographic method is employed. The added value of the study lies in the introduction of spatial interpolation method into the research and visualization of migration.

The statistical analysis is based on annual data on migration at the level of individual municipalities (LAU2) in Hungary and Slovakia, provided by the national statistical offices for the period 1996-2017 (KSH 2018a, KSH 2018b, ŠÚSR 1996–2017, ŠÚSR 2017). Although international migration is not negligible regarding changes of spatial distribution of population in CEECs, it is omitted in this paper due to methodological incompatibility of registration of internal and international migration by competent authorities (Novotný 2016). Total change in the number of inhabitants caused by migration in a given area is indicated by net migra-

tion while net migration rate indicates relative impact of net migration referring to the mid-year population of a given LAU2.

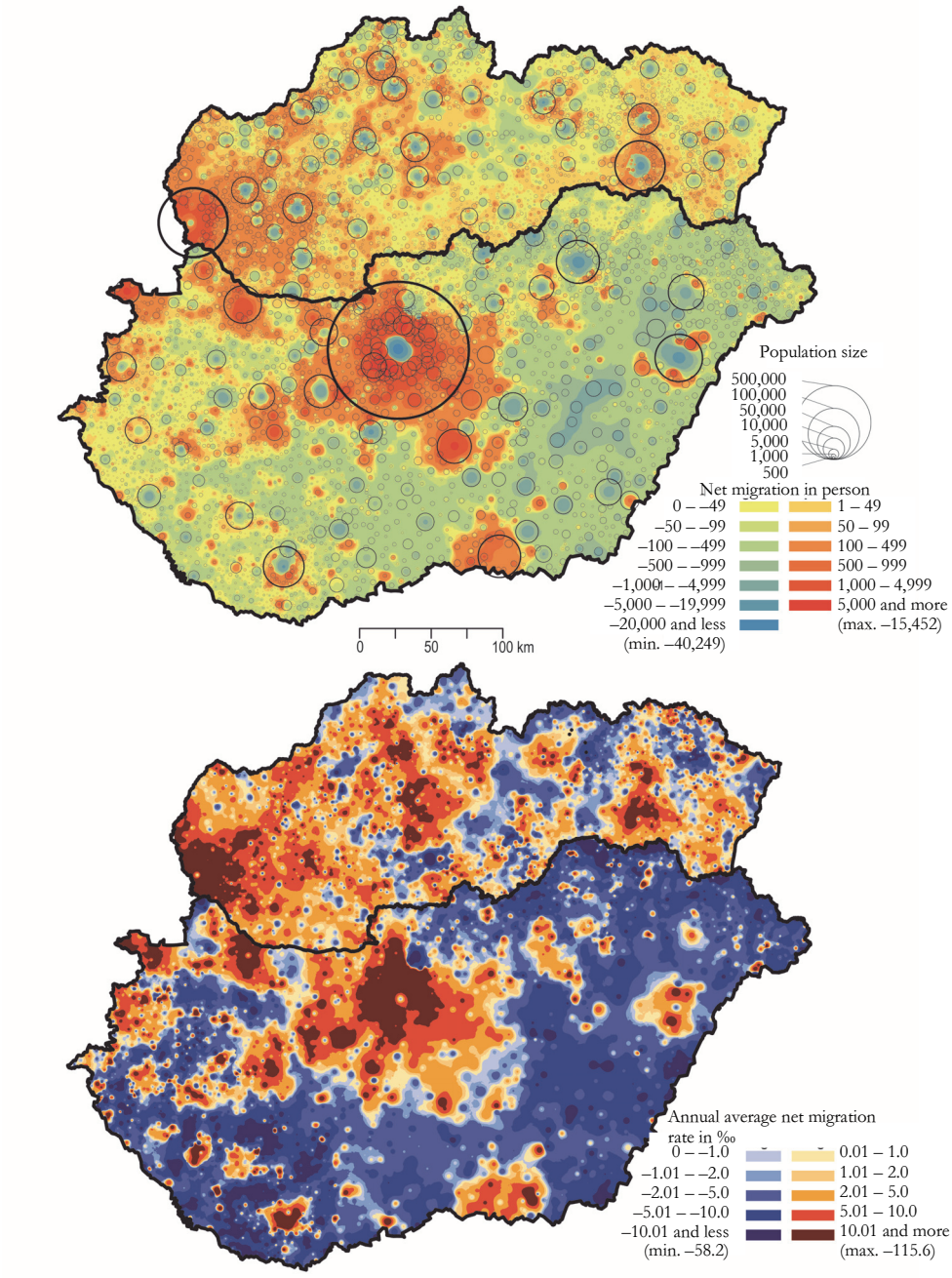
The visualization employs the inverse distance weighting (IDW) method which applies the basic geostatistical principle: phenomena closer to one another are more alike than those farther apart. This leads to the assumption that each point in space with the known value of visualized phenomenon has a local influence which diminishes with distance. In consequence the values for each point on the map are estimated examining all points with known values within given radius (GIS resources 2018).

This method is often used for visualizations of physical-geographic phenomena but has been very rarely employed in population analyses. Mainly because such analyses use data that are available for every chosen statistical unit, and there is no need to estimate them by interpolation. Even in this visualization, the data are available for each municipality. We assume that each point in space is in some relation with the population living in proximity and so, a migration increase can indicate rising intensity of human influence on the area and vice versa. However, statistical data are not available for each point in space but only as values aggregated for statistical units, usually municipalities. Thus, we transformed the principle of IDW into the assumption that the impact of a local population decreases with distance. The values of net migration and net migration rate are considered as values for the central point of each municipality area.

Whether using net migration or annual average net migration rate the visualizations have some common features. They show that the areas in the west tend to reach migration gains while migration losses are more likely in the eastern parts of both countries. The decentralization of population from major cities to their hinterlands is also visible.

When using net migration, migration losses in cities and larger towns are more visible. Achromatic diagrams are depicted in the map to visualize this trend clearly. Budapest, as the largest city recorded the largest loss, followed by Košice – the second largest city in Slovakia and the third in the whole area. Bratislava, the second largest city and the capital of Slovakia recorded only an insignificant loss. This approach shows total changes in spatial redistribution of population by migration but does not necessarily show relative impact of migration to the size of population in given areas. The same value of net migration can have insignificant impact on the population in a large city but a fundamental one in a small rural community. Therefore, the annual average net migration rate was visualized in another map.

Visualization of migration using inverse distance weighted (IDW) interpolation method in Hungary and Slovakia, 1996–2017



It confirms that even large migration losses in the majority of the cities had only modest impact on their population size. However, these cities seem to act as sources of migrants contributing to the rapid population growth of adjacent areas. This trend has the largest extent in the metropolitan areas of Budapest and Bratislava but is seen even around other cities and larger towns. The maps also show migration attractiveness of the areas close to Austria with the exception of a smaller area in Hungary, south of Bratislava. In fact, this is the area where the decentralization of population from Bratislava was recorded (Novotný 2016), but the international migration is not considered in this paper. Generally, the results show that migration contributed to the increase of human impact to the landscape mainly in metropolitan regions and in the proximity of other cities and larger towns, and to its decrease in peripheral regions. The spatial differentiation of the impact of migration is more significant in Hungary.

Software: ArcGIS 10.6.1

Acknowledgement

This work was supported by the Grant VEGA 1/0395/17 and the Grant VVGS-PF 2018/782.

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