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**CONCEPTION OF SPATIAL UNITS APPROPRIATE FOR REGIONAL POPULATION
FORECASTS**

Invited Paper

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Introduction

1. There is no doubt that future population processes and their reflection in number and, above all, structure of the population and consequently censal households, in number of pupils and students and in economic dependency ratio, is a relevant and essential scientific problem. We are convinced that geography (possessing all necessary prerequisites) is a science which should be - together with demography - one of the leaders in the field of creation of analyses and hypotheses of future population processes development in various territorial scale and it should also be able to deal with problems of territorial differences and differentiation or equalization of future processes and subsequently structures, as indicated by Vano (2004), Bleha (2005b). Our conviction can be supported by several arguments, presented in the paper. Except for other reasons, the regional forecasting is a component of scientific subject of demogeography (Bleha 2006).

2. In the paper we intend to pose a question of a set of territorial units appropriate for forecasting. There are two initial facts leading us to the problem stated above.

3. The first of them is an aspect of concordance of regional populations (in purely demographic interpretation) and really forecasted populations, which is rarely satisfied. The main reason is that forecasting within official administrative units is generally accepted. The second aspect is a consequent principal and practical question of decreasing rate of forecasting uncertainty, which could lead to higher accuracy and quality of forecasts. Definition of a projection of a regional population and its territorial delimitation is a highly demanding task,

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different in various geographical conditions. If we are not able to delimit spatially or use (up to a certain scale) demographically homogeneous populations, we can utilize other means, representing a basis for our hypothesis. A potentially high appropriateness of a certain type of functional regions for regional population forecasting represents our primary and key hypothesis that has been selected intuitively and which will be analysed and verified.

Practice in the Czech Republic and Slovakia

4. As noted by various forecasting (or projections²) experts, such as Kucera 1967, Kucera 1998 (in Bleha 2005), forecasts in Czechoslovakia and later in the successive separated republics were created for administrative regions and districts, respectively, effective at the time of the forecasting. The forecasts were subordinated to planning purposes of superior state administration authorities. Recently, several derived forecasts have been done (Vano, in Mládek et al., eds. 2006), such as labour force forecasts (Vano 2006). Based on a population forecast, they have been created for districts (corresponding with NUTS IV). Apart from the evident practical need and utilization of the forecasts in the respective administrative territorial units, their consistency from demographic point of view can be a matter of discussion. Nodality, functionality and aspects of proper territorial delimitation were analysed mainly by Bezák (1996a, b). This author observes several disruptions of basic principles (the ones of territorial effectiveness and territorial fairness) showing multiple districts of Slovakia as examples of these disruptions. Except for official forecasts we have noticed only one projection of future population development for a system of functional urban regions (FURs) by Bezák and Holická (1995).

Overview of some territorial units potentially appropriate for regional forecasts

5. We will show three types of territorial forms which could theoretically be applied in regional analyses, using examples of existing delimited regions in the Slovak Republic. The first framework is represented by regions of (local) migration defined by Bleha and Kurčík (in Mládek et al. 2006). In multiple cases the high rate of territorial concordance of boundaries of these regions with FURs has been confirmed, even if compared with some districts. Thus, the above mentioned facts confirm correctness of delimitation of daily commute regions and in some cases even confirm correctness of delimitation of the FURs and a strong correlation with migration processes. Moreover, this affirms the fact known from Bezák (2006), which could be classified as „high migration power“ for short distances. However, we can find also territories where differences between these two types of regions have been identified. These differences may have different reasons, in any case they imply a need for their close research. We must emphasize that the only criterion for the regional delimitation was migration as a process and a pre-condition of territorial integrity, which could affect the final outcome.

6. Until now, the only framework of territorial forms relevant to the population issues has been presented by Mládek (Mládek, et al. 2006), introducing a demographic regionalization of Slovakia. This author's approach was based on two partial demographic regionalization criteria of dynamics and age structure. Considering utilization of the cohort-component method, the age homogeneity of the delimited regions can be from the aspect of future hypotheses regarded as a certain „superstructure“, being not necessary for the cohort-component method. The main attention will be paid to territorial distribution, size and nature (from the aspect of dynamics) of these regions. From demographic point of view, the above mentioned migration regions can be

² For more details on projection – forecast relationship, see for example Pittenger (1976), Bleha (2006)

classified as semi-complex, while the demographic regions can be theoretically characterized by a higher level of complexity. Natural increase and age structure represent two main attributes that are combined to create types and subtypes of the regionalization described above. However, they lack the absolute complexity due to absence of migration aspect serving as a regionalization criterion. Absence of a detailed look at dynamic indicators seems to be a theoretical problem, too, although this probably was not the aim of the presented regionalization.

7. In the Demographic Research Centre, within the Infostat institute, a typology of Slovakia's districts was published by Jurcová et al. (2006) utilizing the cluster analysis. Inasmuch it brings a typology of existing territorial units, this analysis is different from those mentioned above. In our opinion, the typology of (development of) demographic structures and processes represent the most appropriate way of preparation of future development hypotheses.

The FURs' utilization in forecasting - foreign experience

8. Practice of creation of regional forecasts for official administrative units is typical also for most of west-European countries, but also in the U.S.A and Canada. However, we find differences in the rate of concordance (or identity) between unofficial units (considered as more geographical³ ones) and official units. Moreover, we are interested if there exists a series (optimally continuous and an official one) of regional forecasts. Except for analysing literature and internet sources, a method of direct consultation with experts from relevant institutions (statistical offices, research institutes) was used to find out what is the utility degree and real ways of use of these forms. Apart from others, our analysis was based on a study by Bezák (2000) with a detailed description of formation and utilization of the FUR conceptions in multiple developed countries. However, the study does not show the way how these units are employed for regional forecasts.

9. Conception of daily commute regions first appeared in the United States of America. The idea was based on delimitation of functional regions with a defined relationship between the core and peripheries (although nodality is not the only aspect) bearing features of both metropolitan and non-metropolitan areas⁴. We must abstract from a more detailed description, because the emergence and diffusion of the conception in the United States was thoroughly described by the above mentioned author. In the U. S. A., these regions became officially employed statistical units, for which even population forecasts are created. In order to offer more details, we should mention that the *Metropolitan Statistical Areas (MSAa)* serve as official units at several hierarchical levels. Moreover, the *Metropolitan Labour Areas (MLAa)* were delimited, too, showing a detailed picture of daily commute and being utilized officially. We did not succeed to gain any information on existence of forecasts for these units. The reasons may be very prosaic. First, no data necessary for forecasting (such as tax rates, etc.) are available for these units, and second, borders of these units do not overlap with the statistical units, which makes it difficult to collect data. This is why the official forecasts are made for *municipalities and counties*. On the other hand, (some of) the MSAs can be composed by a mosaic of counties, which enables to create forecasts. In 2004, the U.S. Bureau of Economic Analysis (BEA) redefined so-called spatial economic units – BEA Economic Areas, reflecting shift in economic growth and population development of certain American regions and including recent conception of micropolitan areas (Johnson and Kort 2004). The redefined BEA economic areas (179 in the U.

³ I. e. units which more or less fulfil geographical comprehension of a region

⁴ We must emphasize that it is impossible to describe all attributes of the FURs in this paper, including their complexity as well as their typological differentiation. For more details, see the references.

S. A.) are based on the micropolitan areas (defined first in 2004), CSAs (so-called combined statistical units having been created by clustering the CBSAs – the core units) and MSAs (the Metropolitan Areas). However, a certain instability is typical also for the statistical and scientific units, too, as a consequence of either statistical redefinitions or spontaneous shift of commute inflows and outflows. The territorial instability is not very welcome in terms of evaluation, comparison and practical use of series of regional forecasts.

10. In Japan, demographic databases are available for small statistical units (so-called *mesh*), although these do not represent natural spatial regions. Forecasts are made only for administrative units such as prefectures and municipalities, which cannot be considered as demographically homogeneous regions or functional regions.

11. In Australia, the Statistical Office (ABS) employs statistical *divisions* (or *districts* for cities without administrative function) as one of the statistical units. These are defined as areas being under influence of one or multiple cities and might meet our scheme of functional regions, on the other hand, they were not defined according to principles of the FUR. Besides, they do not cover the whole territory of Australia. This is fulfilled only in case of larger *statistical regions*. Thus we are not convinced about the correctness of the FUR conception's use for regional forecasting in this country.

12. Great Britain was the first country in European territory to receive and develop the American conception of the FURs. The recent elaboration of the FUR was realized by a scientific team of the Centre for Urban and Regional Development Studies (CURDS) in 2005, based on the 2001 census (Coombes et al. 2005). Several analyses using these scientific units are available (for example Rees et al. 1996), but they have never become official statistical or administrative units, which could possibly serve as a framework for continuous series of population forecasts.

13. According to Bezák (2000), the Netherland's territorial units known as COROPs bearing features of functional regions respect borders of the provinces, or – more exactly – the COROPs represent clusters of municipalities within the provinces. In spite of this fact, no official forecasts for these units are available. Nevertheless, a prognosis for municipalities was published in 2006, which allows us to gain a certain picture of recent development in the COROPs.

14. Even if we make a detailed look at the neighbouring countries, no forecasts overlapping the FUR boundaries can be found. The statistical office of Austria employs these regions for data collection, but they have never been used for population forecasts. In Poland, the scheme of FUR was elaborated within a project of the IISA in the 1970s, but no official population forecasts have been presented for these units. In Slovakia, the model of FUR was first implemented by Bezák (1990) using the data from the 1980 census, later modified (e. g. Bezák 2001).

15. To summarize, we can state that the FUR conception has been introduced in multiple scientific fields as well as in practice (such as regional planning and policy, creation of administrative organization of a state's territory), although an attempt to apply series of population forecasts for these regions has not been successful even in countries with highly developed statistics and demographic research.

16. European countries recently intend to work mainly with nomenclatural units of the NUTS system, which enables to make comparisons. A study presented by Kupiszewski and Kupiszewska (1999) is a positive example. These statistico-territorial units represent

simultaneously administrative areas, on which they are based. Analysing how much the population character of these areas fits conceptions of population forecasting in individual countries is not a matter of this paper, as this seems to be a wider problem. However, we will try to make a theoretical analysis using the territory of Slovakia as an example, as shown below.

Regional populations and the Functional Urban Regions

17. Our intention is to solve the principle question of selection of territorial units that would be more appropriate for regional forecasting. What is the initial point of the problem? In our opinion, we should analyze the term „(regional) population“ first. Regional population represents the best definition of a reproduction system in the process of forecasting.

18. Population's inner homogeneity can be regarded as one of the principal attributes. A certain degree of homogeneity in terms of structures and processes should be the key feature of populations. Determination of an acceptable homogeneity degree and amount of demographical features (not necessarily corresponding within the population) can cause multiple problems in reality. One of the effects can be delimitation of units with „inconvenient“ territorial extent as shown in the results of demographic regionalization.

19. In the Czech Republic, a socio-geographical and hierarchical regionalization using the 2001 census databases was done by Hampl (2005), based on several older regionalization stages coming from the 1991 census (Hampl 1996). Hampl (2005) respects commute to work and to school as the most frequent regional processes and utilizes them as the only processes in the complex socio-geographic regionalization. He indicates that especially commute to work has a significant integrating role, which confirms correctness of use of these attributes in application in the FUR model, although the Czech regional conception bears some specific features. If we take a look at the map of microregional (or, eventually, mesoregional) units of the Czech Republic according to the above cited author, from the demographic aspect, we can expect a relatively high degree of homogeneity at the lowest hierarchical level, abstracting from the very natural dichotomy centre (centres) – hinterland and city – countryside. In these forms we find strong centripetal relationship materialized by the commute flows. Nevertheless, this is still not the evidence of the demographical homogeneity of the regions, although they are considered as socio-geographical regions or even (from socio-economic aspect) as complex regions.

20. Analyzing the heterogeneity and inconsistency of an administrative district from the aspect of fertility and mortality, with probability, that in the future a certain difficult-to-identify part of the district will start behaving in a non-standard way deviated from the empirical knowledge of the district as a whole and threaten the correctness of the prognosis through higher degree of uncertainty is approximately as difficult as in case of the FURs⁵. The situation is much different in case of migrations. The migrations, playing an important role at regional level (of forecasting) as identically stated by several authors (Bleha 2005b, Kupiszewski 1987, Champion et al. 1998, Both 2006) are more comfortably definable.

21. How can a commute inherently included in the process of delimitation of a region affect migration's characteristics? Some authors distinguish between intra- and interregional flows, related to different reasons for migration. In the Slovak Republic, this fact is highlighted by

⁵ Although a mutual positive effect of daily commute and coherence on the one hand and a stronger isolation and homogeneity of the FURs on the other hand from aspect of natural reproduction (thus of its better comprehension in comparison with districts) cannot be excluded.

Bezák (2006) in his analysis of migration flows. This fact comes from the substance of the FURs and the process of their regionalization, where the rate of uncertainty of a hypothesis about future migration is decreased by share of interregional flows expressed for example as a share of gross migration within the respective FUR. In each FUR, we can identify a certain share of intraregional flows which are predominantly not connected with move closer to the place of work, declared as the official reason for migration. This phenomena will be in the future considered as the principal factor in order to include migration and spatial redistribution of population at mesoregional level. Although in the future we will have to deal with the problem of decrease (increase) of individual FURs' closeness, this reason – „the factor of including and disaggregation of migration“ – is considered as an important theoretical argument for regional forecasting for this type of regions, as migration is exactly the factor that might affect accurateness and quality of the forecasts. In Slovakia, we can generally expect increase of labour force mobility. Identification of moves and expected higher redistribution of inhabitants is simpler within the conception of FURs due to the above stated reasons.

22. Regions defined in the system 91B or A, respectively, are quite often almost identical with the normative units, *de facto* no longer existing administrative districts for which so far only one more complex demographical analysis has appeared (Jurcová 2004). In comparison with the FUR 80 system, Bezák (2000) observes adaptation of the FURs' borders to the administrative units and a significant geographical stability. The former tendency seems to be quite logical. Another matter is if this tendency was reflected in the forthcoming intercensal turbulent period with huge changes in commute to work. A satisfactory answer could be brought by a new system of the FURs elaborated according to the 2001 census. The facts mentioned above do not allow us to specify clearly which of the two systems (91A or 91B) is more appropriate for regional forecasting. Possibility to utilize bottom-up approach and thus possibility of multiple combinations are indisputable advantages. In specific parts of Slovakia, forecasting for large units would not be sufficient (for example the Bratislava FUR), so different approach will have to be used towards both, the core and its hinterland.

23. We have already mentioned the significant differences in population size. Considering the same hierarchical level, is future development in large territorial units easier to predict than the one in small ones? Do stochastic processes inherent in development of small units affect also the possibilities to create hypotheses about future development? Answers to these clear questions are not simple. Generally, larger population size of a territorial unit can balance out its heterogeneity and reversely, but only up to a certain degree. The factor of stochastic events and time fluctuations can be found often in case of local forecasts, made for cities, for example. Several FURs in both systems are smaller (in population size) than an average regional/district centre. This problem was quite frequently solved in forecasting prepared for former districts. In other countries, it is obvious to make forecasts for lower hierarchical units, being smaller in population size (counties in the U. S. A., municipalities in the Netherlands).

Table 1

| Advantages and disadvantages of the FURs in regional forecasts in relationship with administrative units | advantage +, disadvantage - |
|---|-----------------------------|
| cognition and research aspects | ++ |
| including migration | ++ |
| including fertility | o |
| including mortality | o |
| potential homogeneity | + |
| spatio-temporal stability | +/o |
| practical use in public administration and decision making institutions in Slovakia | - |
| practical use in relationship with the rest of the EU | - |
| access to statistical data for regional forecasts | -- |

Conclusion

24. We have introduced several theoretical and methodological arguments for utilization of the FURs in regional forecasting. These regions are more closed/isolated and more geographical than administrative units. We also assume better opportunities to embrace migration and thus better quality of regional forecasts. Absence of a system based on the 2001 census databases seems to be a practical disadvantage, although a certain temporal stability of the regional structure identified in 1980 can be supposed. On the other hand, dynamics of the processes after 1989 call for delimitation of a new system using the fresh data and for verification of regional structure changes, if we intend to use them practically in regional forecasting. Existing dual (basically hierarchical) system offers the advantage of a possible variability in the process of regional forecasting. Consequently, it is possible to utilize regions from one or the other system on the principle of complementarity, if necessary.

25. Although the model of FURs seems to be a system highly stable in time, changes in intercensal periods stemming from shift in methodology or regional structure changes bring its potential drawbacks. However, in case that the changes of regional structure are only marginal and provided that the methods remain unchanged, the spatial scheme of the FURs can be stabilized. This creates good conditions for utilization of the FURs as a quality scientific basis for regional forecasts in the future. Absence of regular series of forecasts in other EU countries for territorial units delimited by the same methodology in their official national statistics appears as a strong disadvantage. This reduces their chance of being used for forecasting, likewise they have not been implemented into the spatio-administrative conception of the Slovak Republic.

References

BEZÁK, A. (1990). Funkčné mestské regióny v sídelnom systéme Slovenska. *Geografický casopis*, 42, 57 -73.

BEZÁK, A., HOLICKÁ, A. (1995). Komparatívna analýza extrapolacných modelov pre regionálne populacné projekcie. *Geografický casopis*, 47, 233-246.

BEZÁK, A., (2000). Funkčné mestské regióny na Slovensku. *Geographia Slovaca*, SAV, Bratislava.

COOMBES, M. a kol. (2005). Travel to Work Areas and the 2001 Census: initial research.

CURDS. University of New Castle.

BLEHA, B. (2005a). Podmienky a predpoklady pre rozvoj (regionálneho) populacného prognózovania na Slovensku. *Slovenská štatistika a demografia*, 3-4. Bratislava,

BLEHA, B. (2005b). Regionálne populacné prognózovanie: teória, metódy, hodnotenie vybraných prognóz SR a CR a prognóza mesta Trenčín. Prírodovedecká fakulta UK, *Dizertacná práca*. p.150

BLEHA, B. (2006). Niektoré teoretické a metodologické aspekty regionálneho populacného prognózovania. *Geografický casopis*, 58, 61 -71.

BOTH, H. (2006). Demographic forecasting: 1980 to 2005 in Review. Working papers in Demography (pdf. verzia), c .100.

HAMPL, M. (2005). Geografická organizace společnosti v České republice: Transformační procesy a jejich obecní kontext. Karlova Univerzita. Praha

JURCOVÁ, D. (2004). Demografická charakteristika obvodov Slovenskej republiky 1996 - 2003. Infostat, Bratislava.

KUCERA, M. 1967. Historie demografických projekcí v CSSR. *Demografie*, 9, 300-302.

KUCERA, T. (1998). Regionální populací prognózy. Teorie a praxe prognózování lidských zdrojů v území. *Kandidátska dizertacná práca*. Prírodovedecká fakulta MU. Brno.

KUPISZEWSKI, M. (1987). Pomiar migracji vprognozovanju zmian rozmieszczenia i struktury ludnoscí. Dokumentacia. Geograficzna, Varšava.

KUPISZEWSKI, M. (1989). Využití Rogersova projekčního modelu při studiu zmen rozmístnění a struktury obyvatelstva v Polsku. *Demografie*, 31, 39-345.

KUPISZEWSKI, M., KUPISZEWSKA, D. (1999). Projections of Central and East European Populations. Working paper No. 25. Conference of European Statisticians Perugia. ECE/Eurostat.

MLÁDEK, J., a kol. (2006). Atlas obyvateľstva Slovenska. Univerzita Komenského, Bratislava.

MLÁDEK, J., a kol. (2006). Demogeografická analýza Slovenska. Univerzita Komenského. Bratislava.

PAVLÍK, Z., a kol. (1986). Základy demografie. Academia Praha, 1986.

PITTENGER, D.B. (1976). Projecting State and Local Populations. Ballinger publishing Company, Cambridge.

REES, P. a kol. (1996). Population migrations in the European Union. John Wiley, Chichester.

SMITH, S., TAYMAN, J., SWANSON, D. (2001). State and Local Population projections.

Methodology and Analysis. Kluwer Academic publishers, Norwell.

VANDESCHRICK, CH. (2000). Demografická analýza. Katedra demografie a geodemografie. Praha.

<http://www.planning.wa.gov.au/publications/WAtomorrow/WATsec6.pdf>

(Forecasts of Western Australia)

<http://www.communities.gov.uk/index.asp?id=1155842>

(*The Determinants of Migration Flows in England - A Review of Existing Data and Evidence* by Tony Champion, Stewart Fotheringham, Philip Rees, Paul Boyle and John Stillwell)

<http://www.stat.go.jp/data/mesh/index.htm>

<http://www.abs.gov.au> (Australian Standard Geographical Classification)

<https://www.bea.gov/bea/ARTICLES/2004/11November/1104Econ-Areas.pdf> ,

on line version of the paper:

JOHNSON, K. P., KORT R. J. (2004). 2004 Redefinition of the BEA economic Areas. Survey of Current Business.
