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REGIONAL MIGRATION AND THE DIMENSION OF DISTANCE IN EMPIRICAL ANALYSIS

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Abstract:

The phenomenon of migration is addressed by several disciplines, such as demography, sociology, economics, political science and history. Therefore, a wide range of analytical tools can be used to analyse this phenomenon. This study focuses primarily on regional migration and capturing the dimension of distance in empirical analysis. Cartograms can be used to analyse regional migration, and Webb diagrams that capture the evolution of net international and internal migration over time. It is also appropriate to use the efficiency matrix of migration indices and nodal graphs to analyse migration flows between different regions. Spatial econometrics is then important for migration analysis to test the validity of theoretical concepts of migration. However, it is often not possible to track the exact distance of migration flows in the data. Therefore, it is necessary to resort to proxy methods to determine the distance. Tracking internal migration plays a crucial role in regional development and is vital in assessing political, economic and social change. Therefore, appropriate analytical tools must be used to analyse it at the regional level.

Keywords:

Migration, labor market, statistical indicators, model

JEL Classification: J61, J21, E27

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Introduction

The phenomenon of migration is addressed by several disciplines, such as demography, sociology, economics, political science and history. Therefore, when studying this phenomenon, it is possible to use a wide range of concepts and perspectives to define the concept of migration and formulate subsequent typologies. Similarly, many theoretical approaches can be found dealing with migration modelling. Thus, when examining migration, one can encounter the application of multidisciplinary approaches using insights from existing theories, which implies the need for statistical reporting and applying quantitative methods.

Migration is often associated with a change of residence as a permanent change and with crossing borders between territories. Two aspects are at the core of the definition: (i) time and (ii) spatial distance (see Wood, 1982; Kok, 1999). Although the definition of migration has been refined, practical problems in analyses of migration may arise due to theoretical vagueness and de facto lack of specification of concepts. These problems are, for example the problem of points close to territorial boundaries and the minimum distance of migration (see Shryock, 2004), overlooking the problem of (non-)overlapping of administrative territory and territorial delimitation of labour markets (see Standing, 1982), repeated change of permanent residence and circulation of migration (see Nekorjak, 2009).

The dimension of space and distance plays a key role in migration analysis. Migration models are thus part of the so-called spatial econometrics, sometimes also referred to as regional economics or the theory of the spatial organization of the economy. In spatial economics and spatial econometrics, various influences from other disciplines are often absorbed and applied to explain economic phenomena. The tendency towards interdisciplinarity in the case of migration models is, therefore, in line with the historical development of economic science.

The direction and volume of migration are explained by so-called gravitational effects, such as labour market size, spatial distance, etc. A frequent feature of empirical studies with gravity models of migration is the use of Monte Carlo simulations (see, e.g., Hagerstrand, 1957; Azose & Raftery, 2015). Other examples of empirical studies include the work of Grogger and Hanson (2011) and Beine et al. (2009); these authors use a structural gravity model using multinomial logit. This modification contributed to the rationalisation of the gravitational migration model. Another application extension of gravity migration models can be panel data for modelling internal and international migration (Bunea, 2012; Royuela & Ordóñez, 2018; Cameron & Poot, 2019).

A number of empirical studies dealing with migration, its determinants and impacts on the economy, etc., appear in the current literature. However, the number of empirical studies primarily dealing with regional (i.e. internal) migration is only a fraction compared to the number of studies analysing international migration. This fact was one of the fundamental reasons for choosing the topic of this study and its focus on internal migration and, therefore, on the movement that takes place across the borders of sub-national governments within the country. Monitoring migration plays a very important role in assessing political, economic and social changes.

This study aims to describe the possibilities of capturing the dimension of space and distance in the empirical analysis of regional migration. The paper is structured in the following manner: Chapter 1 describes analytical options for capturing regional migration using the Czech Republic data as an example of demonstration. Chapter 2 spatial econometrics. Primary findings are summarized in conclusion.

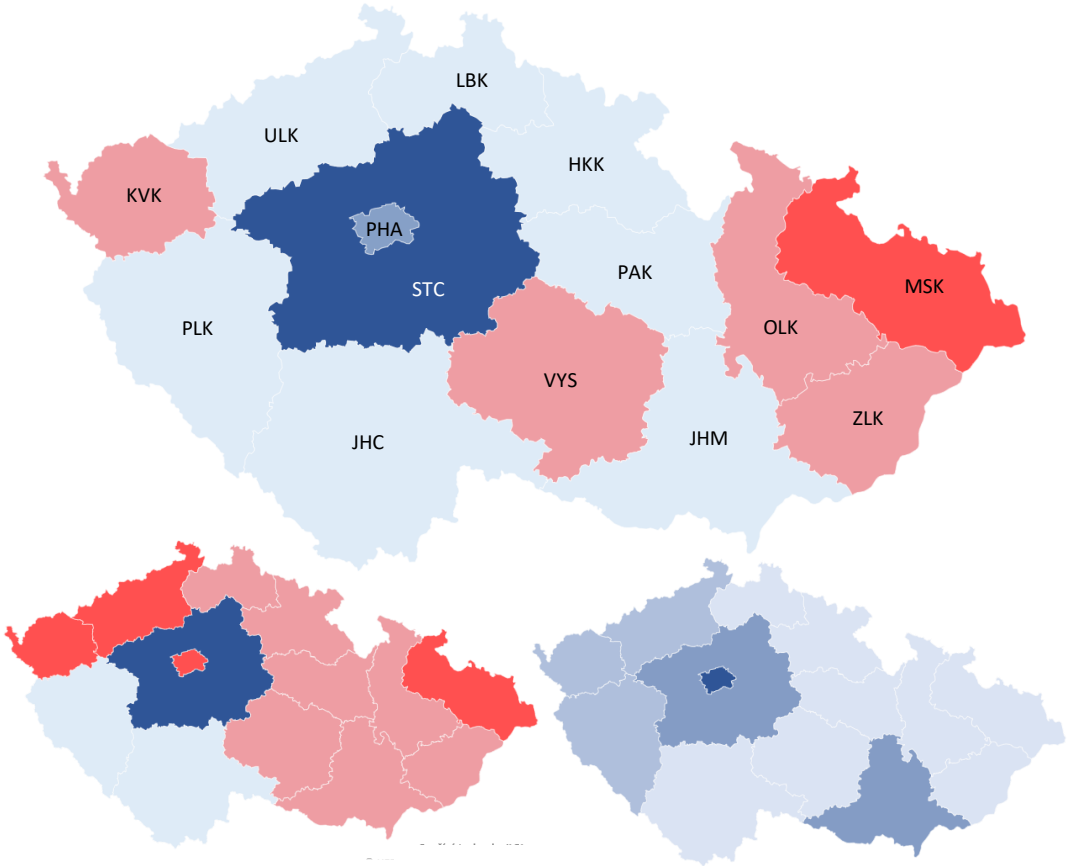
1 Analytical options for capturing regional migration

The basic characteristics of internal migration can be represented by several statistical indicators, such as the balance of migration (net migration), the turnover of migration, the efficiency index (IE) of migration and the immigration rate (immigration/emigration). Furthermore, to appropriately represent changes in space and time, these statistics are presented using cartograms, modified Webb diagrams, efficiency index matrices and nodal diagrams. For illustrative purposes, data on regional migration in the Czech Republic have been selected. The data were obtained from the Czech Statistical Office (CZSO). Specifically, the NUTS3 level data were obtained from individual Regional Administrations of the Czech Statistical Office.

1.1 Regional migration and cartographs

First, it is possible to look at internal migration from the perspective of the migration balance, which will make it possible to identify regions that have positive net migration. In Figure 1, there are three cartograms that calculate the cumulative net migration between 2000 and 2017. The top cartogram counts the internal migration of the population of the Czech Republic together with foreign migration, the bottom left cartogram expresses only the balance of regional migration of the population of the Czech Republic and the right cartogram expresses the balance of foreign migration in each region.

Figure 1 – Net migration in regions and comparison with foreign migration



Source: CZSO, own processing | Note: PHA: Capital City of Prague; STC: Central Bohemia Region; JHC: South Bohemia Region; PLK: Pilsen Region; KVK: Karlovy Vary Region; ULK: Ústí nad Labem Region; LBK: Liberec Region; HKK: Hradec Králové Region; PAK: Pardubice Region; VYS: Vysočina Region; JHM: South Moravia Region; OLK: Olomouc Region; ZLK: Zlín Region; MSK: Moravian-Silesian Region

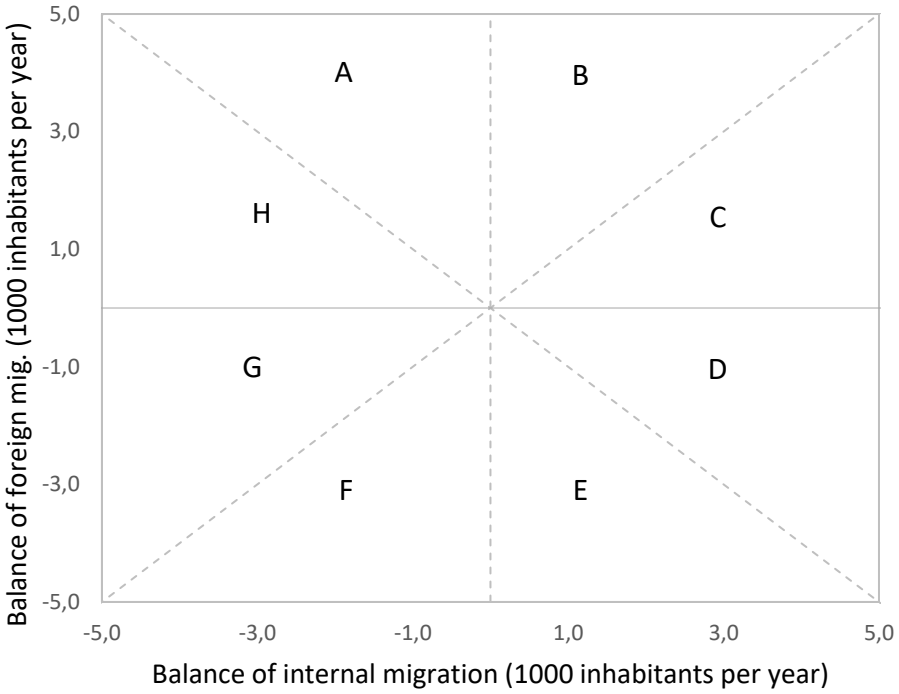
In terms of the overall balance of internal migration, the dominance of the STC region is evident. Its dominance is also evident in the case of the division of migration into internal and foreign migration. In the case of net foreign migration, all regions have had a positive balance of foreign migration over the years, i.e. foreign migration has had a positive effect on changes in the volume of the population in all regions. However, in the MSK, OLK, ZLK, VYS and KVK regions, it failed to compensate for the population decline due to the outflow of the Czech population from the regions. Only in the case of the PHA region did foreign migration replace the loss of the domestic population

The statistics show that more people come to the Czech Republic to work than go abroad. The Czech Republic is the second most attractive country in the CEE region in this respect, according to a study by the UK-based Legatum Institute (2018). Only Austria offered a more attractive labour market in the CEE region. Government initiatives through targeted projects may also have contributed to the interest of foreign labour in the Czech labour market. These include the Fast Track project: a fast-track procedure for intra-corporate transfers and localised employees of foreign investors; projects targeting the workforce from Ukraine: special procedures for highly skilled employees from Ukraine; special treatment regime for skilled employees from Ukraine; special procedures for agricultural and food workers from Ukraine. Some projects target students from abroad: the STUDENT scheme (see more MoI, 2019).

1.2 Webb´s diagrams

It is also possible to take a closer look at the development of net migration over time and compare it between individual regions. It is helpful to use a modified Webb diagram (see, e.g. Fiala and Langhamrová, 2016). The regional units are represented in a graph using a Cartesian coordinate system with two axes. The x-axis shows the average annual balance of internal migration, and the y-axis shows the values of the annual average balance of external migration. Both indicators have been converted per 1,000 inhabitants (mean population in the region). The diagonal lines are also important in the diagram, which, together with the coordinate axes, divide the diagram field into eight sectors marked with the letters A–H. Each sector contains one type of territorial unit (region) with a specific relationship between the internal migration balance and the external migration balance. The modified Webb diagram – see Figure 2 and the individual sectors are described in the legend below.

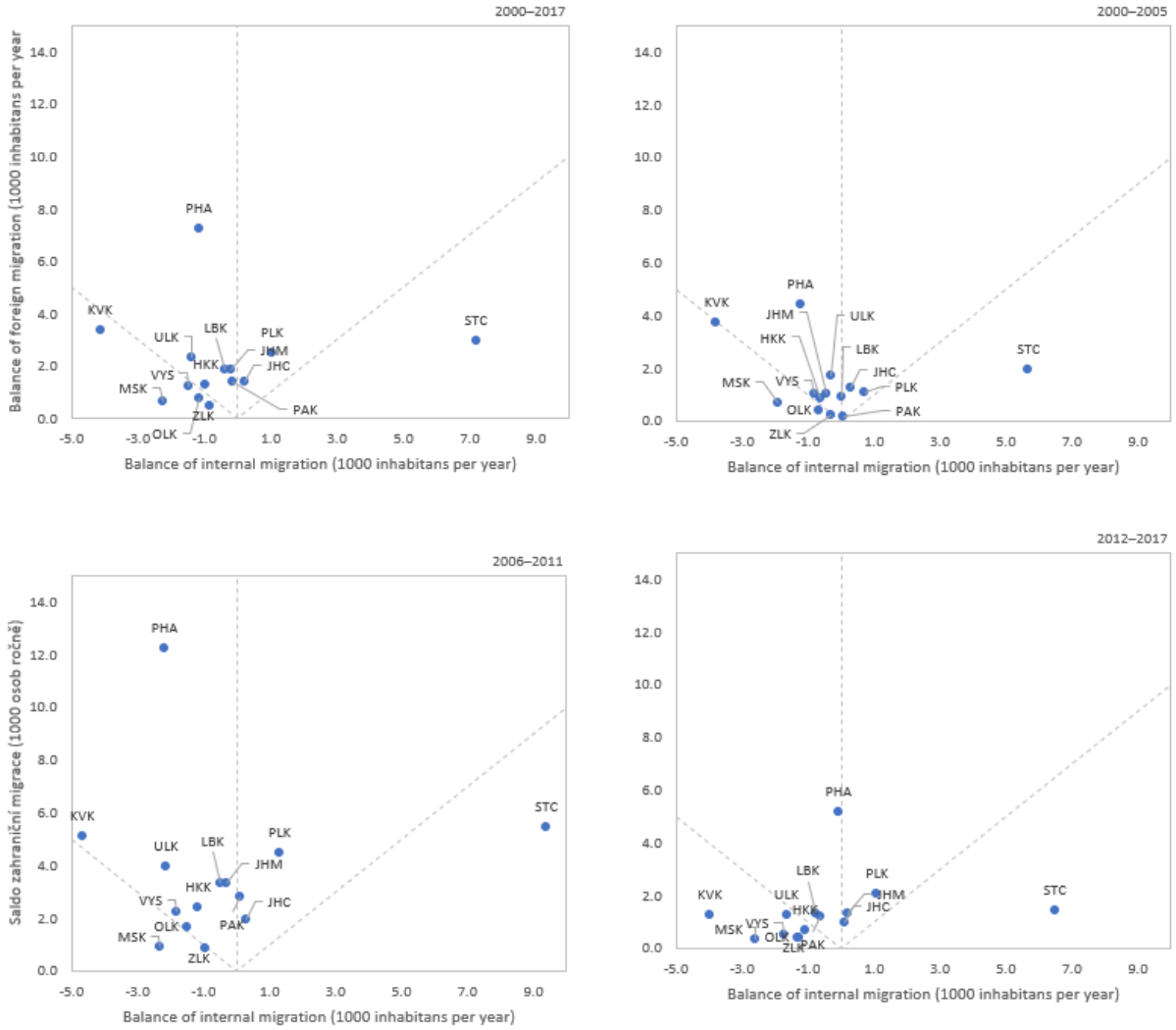
Figure 2 – Modified Webb diagram to show the migration balance



Source: adapted from Fiala and Langhamrová (2016), own processing | Legend: A: Increase in external migration > decrease in internal migration; B: Increase in external migration > increase in internal migration; C: Increase in internal migration > increase in external migration; D: Increase in internal migration > decrease in external migration; E: Decrease in external migration > Increase in internal migration; F: Decrease in external migration > Decrease in internal migration; G: Decrease in internal migration > Decrease in external migration; H: Decrease in internal migration > Increase in external migration.

The observation period was divided into three six-year periods of equal length. A total of 4 Webb diagrams were constructed, first for 2000–2017, then for the periods 2000–2005, 2006–2011 and 2012–2017. The results are presented in the following Figure 3.

Figure 3 – Webb diagrams of internal and external migration in the regions

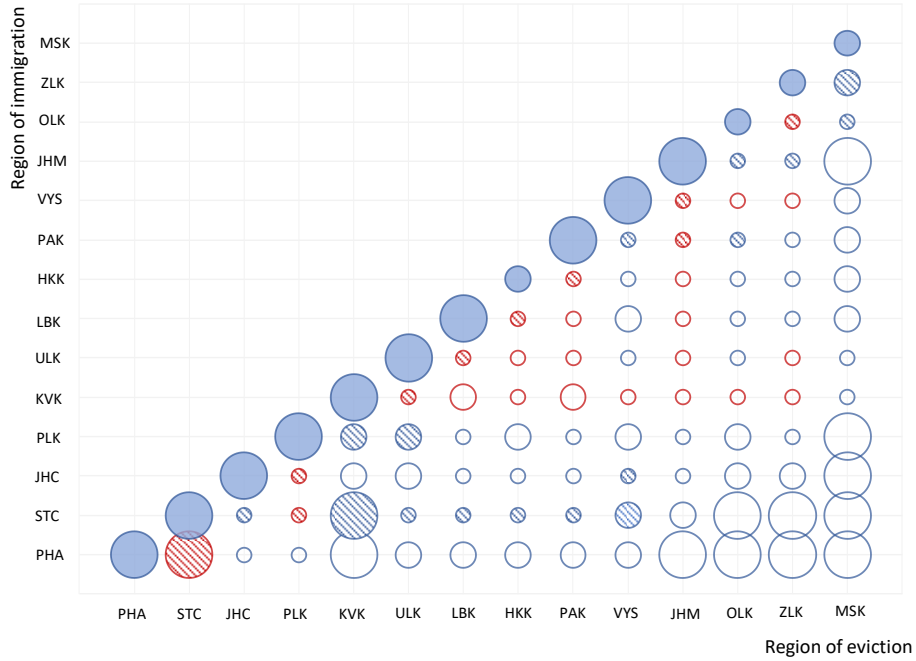


Source: CZSO, own processing | Note: PHA: Capital City of Prague; STC: Central Bohemia Region; JHC: South Bohemia Region; PLK: Pilsen Region; KVK: Karlovy Vary Region; ULK: Ústí nad Labem Region; LBK: Liberec Region; HKK: Hradec Králové Region; PAK: Pardubice Region; VYS: Vysočina Region; JHM: South Moravia Region; OLK: Olomouc Region; ZLK: Zlín Region; MSK: Moravian-Silesian Region

1.3 Migration Efficiency Index

The previous display of migration data through Webb diagrams does not allow a closer examination of the actual population flows between regions. One way to track these flows is to use a matrix of internal migration efficiency indices, with the x-axis being the region of emigration and the y-axis being the region of immigration. For clarity, only the IE values below the diagonal have been entered. Unfortunately, the obtained data do not allow tracking the flows of foreign migration between regions, so the IE values of foreign migration are reported on the diagonal, at least in aggregate, for a given region (see Figure 4 and the legend below).

Figure 4 – Internal Migration and International Migration Efficiency Index



Source: CZSO, own processing | Legend: bubble size corresponds to the size of IE, where abs(IE) < 0.1; 0.15-0.3 and > 0.3; blue bubble border corresponds to IE>0, red one corresponds to IE<0, hatched fill marks neighbouring regions, IE of foreign migration are on the diagonal.
Note: PHA: Capital City of Prague; STC: Central Bohemian Region; JHC: South Bohemian Region; PLK: Pilsen Region; KVK: Karlovy Vary Region; ULK: Ústí nad Labem Region; LBK: Liberec Region; HKK: Hradec Králové Region; PAK: Pardubice Region; VYS: Vysočina Region; JHM: South Moravian Region; OLK: Olomouc Region; ZLK: Zlín Region; MSK: Moravian-Silesian Region

1.4 Migration flows between regions

Node diagrams can be another useful tool for displaying migration flows between regions. Two diagrams were created to capture internal migration flows (see Figures 5 and 6).

Figure 5 – Migration flows between regions: cumulative migration flows

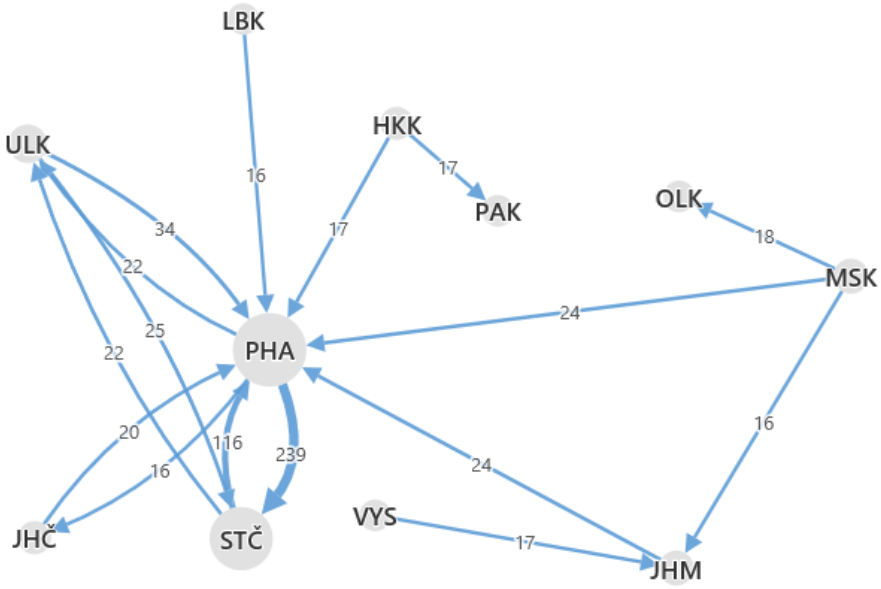
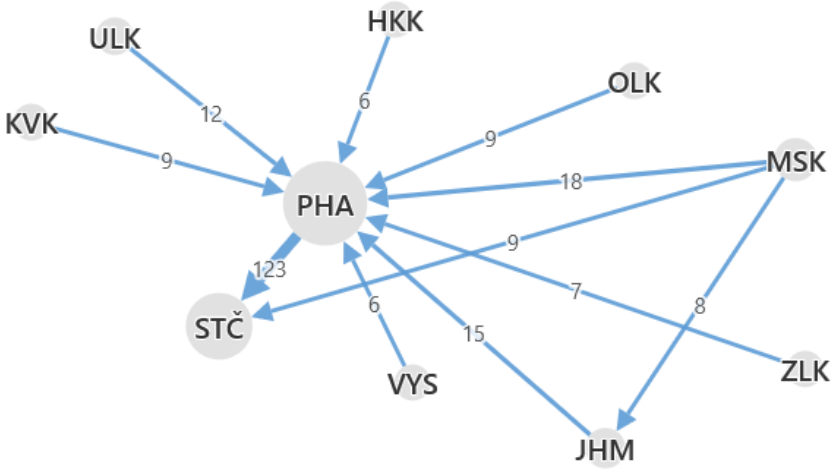


Figure 6 – Cumulative migration balance (threshold > 5 thousand)



Source: CZSO, own processing

2 Spatial econometrics

Spatial econometrics can be defined in a narrow or broad sense. In a narrower sense, it refers to methods and techniques for analysing regression models using data observed in discrete parts of the universe, such as countries or regions. Thus, it is primarily understood as a subfield of applied econometrics. In a broader sense, it includes models and theoretical tools of spatial statistics and spatial data analysis to analyse various economic phenomena such as externalities, interactions, spatial concentration and many others. Spatial econometrics is based on the assumption that spatial relationships are important for understanding economic and other social processes taking place in society, i.e., spatial interactions and dependencies are an important aspect, which is then incorporated into regression models (see more, e.g., Anselin et al., 2010; Elhorst, 2010; Arbia, 2016). For example, Hepple (1996) refers to spatial econometrics as a branch of spatial modelling and spatial analysis that primarily focuses on the quantitative modelling of socio-economic relationships using data for selected spatial units (states, regions, localities, etc.). This suggests that there is a strong link between economics, regional science and geography in the case of spatial econometrics. It is, therefore, an interdisciplinary field.

Indeed, the reference methodology for spatial econometrics lies in the advances in spatial statistics, where it is common to distinguish between different data typologies encountered in empirical studies that require different modelling strategies. The most important properties of spatial data are spatial dependence (see Cliff and Ord, 1973; Goodchild, 2009) and spatial heterogeneity (Anselin, 2010). Unfortunately, spatial data are often burdened with a number of imperfections that reduce their quality and can significantly undermine inferential conclusions based on spatial econometric modelling. The ideal situation considered in standard spatial econometrics textbooks is one in which the spatial units constitute the entire population, there are no missing data, and there is no uncertainty about spatial observations that are free of measurement and locational errors. Unfortunately, in practice, the reality is often very different, and the data contain all sorts of flaws: often random selection cannot be made, and the data fit the sample without random selection from the population, the presence of incomplete data, over-aggregation of the data, and almost always the data contain attribute and location errors.

In the case of regional migration modelling, the problem of using the method of classical inferential statistics and the problem of data aggregation, which results in the so-called MAUP (modifiable areal unit problem), are evaluated as relevant.

2.1 Statistical inference

Research working with spatial data is observational rather than experimental, which results from the impossibility of randomly selecting the independent variable under study and implementing the so-called controlled experiment necessary for applying statistical induction methods. Thus, the analysis of spatial data is characterized by the so-called natural experiment corresponding to the analysis of all (real-world) available data without making a selection or at least without the possibility of controlling it (see also Goodchild, 2009; Arbia, 2016). The authors Soukup and Rabušic (2007) point out the limitations of the use of common statistical inference procedures in the social sciences and warn against their automatic application regardless of the type of data analyzed.

2.2 Different definition of territorial units

The impact of different sizes and shapes of territorial units or, more generally, different definitions of territorial units on the results of statistical analyses is referred to as the modifiable areal unit problem (MAUP), a problem highlighted by authors such as Johnston et al. (2000) and Wong (2009). It was first identified by Gehlke and Biehl (1934). They show that the same underlying data can provide different results when aggregated in different ways. This problem affects a wide range of analysis types and, unfortunately, does not escape regression analysis. The results of regression analysis of spatial data may depend on the definition of the spatial units for which the data are available or into which the data under study are aggregated. In the case of econometric modelling of internal migration, it is usually challenging to obtain microeconomic data over a sufficiently long period of time to capture its evolution not only in space but also over time. Therefore, studies in this area usually rely on data that have already been aggregated to some extent. In the Czech Republic, the CZSO publishes population movement surveys, in the case of the EU Member States, the respective statistical offices in each country, and EUROSTAT is the starting point for the publication of these data.

2.3 Distance between regions

The econometric model should incorporate the dimension of space through the distance between counties and the differences in selected variables. Since we assume that migration is not only governed by differences in wages and unemployment but that the differential is also a relevant factor for other cardinal variables, these differences were calculated as the percentage difference between counties and then the differential was divided by the distance between counties:

$$diff_{rt}^{v} = \frac{\frac{v_{it}}{v_{jt}} - 1}{dist_r} \qquad (1)$$

The character v represents the selected cardinal explanatory variables, $dist_r$ is the distance between counties *i* and *j*, *vi* is the value of the variable in the immigration region, *vj* represents the value in the emigration region, and the index *t* represents the year.

However, tracking the exact distance of migration flows in the data is often only possible sometimes. Therefore, it is necessary to choose some proxy method. In the case of the Czech Republic, the distance between counties was measured through the distance between county towns, which was collected using the Mapy.cz map portal (distance of the fastest route in km travelled by private vehicle).

Conclusion

In the field of theoretical research on migration, one final goal remains. In the best possible case, this goal should be to create one complex theory of migration that could explain all aspects of migration (Borjas, 1989). Not all theories of migration (theoretical concepts and migration models) have a solely economic basis. Decomposition into individual problems is typical for studies in the field of migration. Multilevel research of people's movement according to territorial units or a focus on selective migration is also typical (see, e.g. Massey, 1993; 1994; Portes, 1999; Vigdor, 2002; Piché, 2013; Hejduková et al., 2016; 2017; Kaderabkova et al., 2019; Hromada et al., 2021; Kurekova et al. 2021; Cermakova et al., 2022;). Thus, when examining migration, one can encounter the application of multidisciplinary approaches using insights from existing theories, which implies the need for statistical reporting and applying quantitative methods.

Cartograms can be used to analyse regional migration, as well as Webb diagrams that show the evolution of net international and internal migration over time. For the analysis of migration flows between individual regional units, it is also appropriate to use the efficiency matrix of migration indices and nodal diagrams. These analytical tools can identify the so-called power regions, which in our case are the Capital City of Prague and the Central Bohemian Region where the Capital City of Prague has one of the highest balances of foreign migration and the Central Bohemian Region dominates in the balance of internal migration. When analysing regional migration, it is advisable to pay attention to the implementation of the space factor in the econometric model.

Spatial econometrics is then important for migration analysis to test the validity of theoretical concepts of migration. However, tracking the exact distance of migration flows in the data is often not possible. Therefore, it is necessary to resort to proxy methods to stabilise the distance. The analysis of internal migration showed that some regions experienced changes in the balance of internal migration between 2006–2011 and 2012–2017 (see Webb diagrams), which could be due to the impact of the economic crisis. Testing for the effect of the business cycle on migration can then be done using a significance test of the interaction root.

Monitoring internal migration plays a very important role in regional development and plays an important role in assessing political, economic and social change. It is, therefore, important that appropriate analytical tools are used to analyse it at the regional level.

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