

THE IMPACT OF TRANSPORT AVAILABILITY AND TRANSPORT SERVICE LEVEL ON THE ECONOMIC DEVELOPMENT OF MUNICIPALITIES IN THE CZECH REPUBLIC

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Abstract

Transport or traffic services are very important factors that influence the socioeconomic status of a region and the spatial interactions of a society. This proposition can be applied to the changes in regional diversity and economic development of municipalities in the Czech Republic. Accessibility, as a geographical phenomenon, is manifest in many spheres of life; above all, in the socioeconomic sphere. Also, the boundary between good and bad accessibility is relative. This paper deals with the evaluation and comparison of indicators of transport accessibility and transport service level with socioeconomic indicators in Czech municipalities. The goal is to find if there is a relationship between levels of transport accessibility and transport service and the socioeconomic level in Czech municipalities. The analysis will be quantitative. We will use correlation, regression and factor analysis, as well as geographical analysis based on maps.

Key words: the Czech Republic, transport availability, correlation analysis, regression analysis, level of socioeconomic development, municipalities.

INTRODUCTION

Population mobility has been the subject of significant changes over the course of the socioeconomic transformation of the Czech Republic. Along with mobility, transport infrastructure requirements have also increased. There has been significant investment in expressways, as well as changes in spatial relationships, which can be briefly and simply described as concentration processes on a higher scale. Transport has been, measurably, a co-determining factor in these processes, while clearly also being simultaneously shaped by them. This mutual process is perhaps best illustrated by the relationship between transport accessibility and regional development. However, the economic development of a region does not depend solely on the accessibility of its transport. It is determined by a number of other, mostly more significant socioeconomic factors. Therefore, it is not easy to distinguish how the different factors affect each other.

The aim of the article is to investigate the relationship between transport accessibility and economic status at the level of municipalities in the Czech Republic. A more detailed definition of transport accessibility and transport service level is presented and examined in the methodology part of this paper. These indicators of transport accessibility and transport service level in selected centres will be compared with socioeconomic indicators from municipalities in the Czech Republic. That is why we have formulated the research hypothesis in this way: Municipalities with better levels of transport accessibility show better levels of indicators of regional socioeconomic development in the Czech Republic. We want to define this relationship between transport and economic development based on the available data. We are using the same methods as Marada and Květoň (2010), who describe some statistical methods for the evaluation of transport conditions. We do not use indicators of automobilization, but we focus on transport service level in a similar way,

only a little more deeply. We also focus on the availability of car transport. The second aim of this article is to contribute to the spread of knowledge concerning the evaluation of regional disparities as caused by differences in transport accessibility. We proceed from Viturka's (2011) assumption that the main components of regional development are not in transport, but they can be significantly influenced by transport. Viturka (2011) lists three main components that influence regional disparities; the first is the quality of the business environment, the second is the use of human resources and the third is innovation potential. Based on the findings of Bruinsma and Rietveld (1998), Blažek and Uhlíř (2011) and Knaap and Oosterhaven (2011) we assume that levels of regional development and levels of transport accessibility are interdependent, but we aim to find how strong or weak that dependency is.

This article deals with quantitative research based on a comparison of individual indicators of transport accessibility and transport service level with socioeconomic indicators. From selected transport indicators, several explanatory factors will be determined using factor analysis. These factors will then be compared with socioeconomic factors using regression analysis.

The structure of the article is as follows: The introduction is followed by a theoretical discussion on the research that has been carried out so far concerning the relationship between regional development and transport service level or transport availability, including a description of the current understanding of the researched subject. This is followed by a methodological part that aims to provide a more detailed explanation of transport accessibility, transport service levels and the socioeconomic indicators used in municipalities of the Czech Republic, and to describe the methodology of comparative analysis into which these indicators will be entered. The reader can then understand the various phenomena and some of the difficulties that may subsequently be reflected in the comparative analyses. A discussion of the results follows. The discussion first describes each of the area distribution and regularities of the indicators mentioned before. These indicators are then subjected to regression analysis

which allows for their evaluation and from which it will be possible to answer the research question – whether the indicators used correlate and to what extent. The conclusion then summarizes the results of the individual analyses and their evaluation, and the contribution of the paper to further research.

THEORETICAL BACKGROUND

The theoretical part starts with an attempt at a general explanation of the relationship between transport and regional development, and then a definition of two contradictory approaches that explain this relationship from liberal and neo-Marxist perspectives. These approaches are, at the same time, adverse and complementary. They allow us to understand the various contradictory influences in the relationship between economy and transport.

The importance of transport is even emphasised by the originators of the theory of regional development, particularly the German economists, von Thünen, Weber, Christaller, and Lösch, in their works. These are, above all, location theories, and they are of particular interest here. The theories are based on classical economic theories, placing the importance of transport costs in the top position of so-called localization factors (such as new industrial plants, etc.). Santos et al. (2010) argue that in this context transport investment increases employment and productivity, not only in relation to new employees, but also to originally employed workers who now benefit from a wider range of urban agglomeration (or agglomeration effects).

Based on the available studies that deal with the relationship between the level of transport accessibility and the level of economic development (Seidenglanz, 2010; Marada and Květoň, 2008; Gutiérrez, Gonzáles and Gómez, 1996; Hučka, Kutscherbauer and Tománek 2008; and others), it can be assumed that improved accessibility leads to different dynamics in individual sectors of economic activity. Some sectors may grow, while others, mainly due to a relocation of economic activities, may decline or even completely withdraw from a region. These are the distributive effects of improved transport accessibility in an area. Moreover, one must not

forget the fact that expressways generally support growth in the communities they pass through and, in contrast, economically “drain” the surrounding municipalities (Blažek and Uhlíř, 2011). Therefore, although a region can theoretically grow as a whole, disparities within the region may widen. Or conversely, economic activities may only be relocated due to new infrastructure within the lower regional levels, while the examined macro-region as a whole may even decline economically (Eddington, 2006). In the analysis we will focus on examining whether there are traceable disparities of an economic nature within the municipalities adjacent to and remote from expressways.

Generally, some of the main consequences of changes in transport availability are in their impact on the labour market and concern the direction and intensity of the commute to work and of (e)migration in the region. All these data mostly relate to non-metropolitan, i.e. rural regions, whose position is determined relative to certain centres (Gateways) which enable access to wider markets and higher demand. That is also why we will focus exclusively on rural regions in our analyses, places where the transport accessibility of local centres is crucial. Data available from the latest census of 2011 concerning commuting are very useful.

In terms of spatial analysis, which is used primarily in the article, the spatially determining effects of transport systems on the spatial arrangement of the economic organization are crucial. They have also been a key subject in the study of localization theories since Von Thünen's spatial economy model (1826). Traditional location theory is characterized by the deductive method of analysis based on the assumption of flat and uniform areas, where economic activity is located. Attention is focused on determining the impact of distance on localization. Transport costs are then seen as an essential expression of distance (McKinnon et al., 2008). A similar simplifying approach will be used in this paper to consider the impact of transport availability in an area.

In this case, what is understood as the neoliberal approach is the concept of the New Growth Theory and the so-called “New Economic Geography”

(NEG), while it must be kept in mind that NEG is mainly based on economics. NEG is thus significantly influenced by its origins and often marginalizes social aspects of development. The New Economic Geography may appear, in some cases, to be a new cover for a quite traditional neoliberal solution to regional development, i.e. support for agglomeration and the removal of barriers, and for finding solutions to the underdevelopment of peripheral areas not by their individual development, but rather by connecting them to a city (on almost all scales) (more in Krugman and Venables, 1995; Knaap and Oosterhaven, 2011).

Using mathematical models and simulations, NEG aims to explain spatial patterns of production together with increasing profits, scales of production, variability of production, and reduction in transport costs. At the same time, it compares route variants and their correlation with changes in economic indicators in impacted regions (Knaap and Oosterhaven, 2011). NEG claims that a reduction in transport costs supports the concentration of production in a smaller number of centres rather than in a high number of dispersed centres in the area (McKinnon et al., 2008). The application of sophisticated mathematical models is not within the scope of this paper; however, they will be used as an inspiration in the method of basic correlation and in the regression and factor analysis of available data, which should help us to understand the spatial correlations.

As a contrast to the neoliberal approach, it is also appropriate to mention neo-Marxist theories. The best-known author of the concept of uneven development is Neil Smith. Specifically, transport accessibility is a typical example of the unequal access of a population to resources and opportunities. Smith (1990) understands that the role of transport investments in an economy is as a means of changing regional disparities. However, according to Smith, the problem is that the capitalist system favours those who are already rich and powerful. In practice this means that people in regions with improved transport accessibility display a tendency to commute to newly more accessible centres, rather than generate more jobs within their territory and increase the share of business activity.

The impact of transport infrastructure on regional development can be categorised in several different ways. The most commonly cited is the categorisation by Bruins and Rietveld (1998) of the direct and indirect effects and of the distributive, generative and draining effects of transport infrastructure. More than economic growth in a region, better transport accessibility supports an increase in the number of commuters and thus the higher mobility of the population. In this context, the effects of improved accessibility are understood more as distributive, rather than generative (see Blažek and Uhlíř, 2011; Hučka, Kutscherbauer and Tománek 2008).

As a result of diverse opinions, transport infrastructure is considered to have positive, neutral and negative effects on regional development. The positive effects can mainly be seen in the expansion of production activities. The neutral effects can be seen in the fact that these manufacturing activities and the subsequent economic growth are not created by the infrastructure directly and independently. Considerable financial demands on the construction of transport infrastructure and the relatively small return on investment are seen as having a significant negative impact (Gauthier, 1970).

The direct effects are usually generative and short-term in most cases, and are directly connected to construction, the associated jobs and the subsequent maintenance of the infrastructure. The direct effects also include savings in fuel and time due to more efficient commuting. The most significant indirect effects are on the productivity of the regional economy, the quality of the workforce, the localisation of companies, the behaviour of households and the price of land. Better connections between residences and businesses allow economies of scale and increase the productivity of the economy and the market as a whole. In the case of a significant decrease in transport costs, peripheral territories may also benefit from the improved infrastructure.

The localization of companies is considered to be one of the most significant effects of the construction of a transport infrastructure. Equally

significant is their position in relation to the city. Besides influencing the labour market through both the formation and the collapse of companies, and an improved commute to work, migration flows are also influenced. In peripheral regions, this may gradually lead to emigration and an increase in commuting. On the peripheries of towns transport availability has an impact on the growth of suburbanization and the price of land.

This paper complements the current level of understanding of these individual effects with a comprehensive analysis of all the various relevant factors that can be compared within the region of the Czech Republic. The quantitative analysis aims for as wide an assessment as possible, which previously has not been carried out in regard to the Czech Republic as a whole. Moreover, it utilizes the unique resources of the analysis of the comprehensive transport service level of individual centres of functional regions, which also have not been used to this extent in the Czech Republic. This analysis has evident drawbacks, since it is influenced by the very definition of the evaluated centres and catchment municipalities. However, it still represents an important complement to the research in general.

METHODS

In order to accomplish the goal of this paper, i.e. to determine the relationship between indicators of regional development and transport availability, various partial methods for the evaluation of transport accessibility and selected socioeconomic indicators must first be described. The main part of the analysis lies in comparing the individual thematic analyses and determining the relationships between these indicators through the main part of the research, i.e. the aggregation of indicators into individual factors in the first stage and their subsequent comparison through regression analysis.

Evaluation of Transport Availability

The analysis of transport availability is based on relational transport availability, i.e. the transport

availability of municipalities in the Czech Republic in the selected centres. Three types of spatial relations were chosen. Specifically, the spatial relations of municipalities regarding micro-regional, meso-regional and macro-regional centres. The micro-regions, meso-regions and macro-region (Prague) were adopted from the summary report Polyreg (Seidenglanz et al., 2011). These regions were identified in the report on the basis of people commuting to work in 2001 and analyses of population and employment size. The objects of availability were thus the micro-, meso- and macro-regional centres (cities) in the Czech Republic. For the purposes of the proposed classification, the elements of availability are defined as follows: An object of availability represents a selected target (a certain opportunity, activity or service), the availability of which will be determined. In our case, centres of employment opportunities (which also means regions defined by their people commuting to these centres) have been selected based on Polyreg methodology (Seidenglanz et al., 2011), as mentioned above. Employment micro-regions then form a territorially integral unit characterized by a relatively high level of internal compactness of the work commute (particularly the day-to-day forms). It consists of one centre (nucleus) and its catchment area comprising adjacent municipalities.

The transport element is represented by the connection between the subject and the object of accessibility, i.e. in this case the connection between the municipality as an administrative division unit (village centre) and the centre of employment opportunities (town as an administrative division unit). These data were obtained using online map services (Mapy API). The distance between the subject (starting point) and object (destination) was measured in several ways. Firstly, using the temporal distance (in minutes) achieved by driving a car along a properly selected transport route. Secondly, using the physical distance along the road measured in kilometres and thirdly, using the average speed at which the inhabitants of the village drive along the given route (i.e. the ratio of physical to temporal distances).

Evaluation of transport service level

The methodology of evaluation of the level of transport services in municipalities on micro-regional and meso-regional levels is adopted from the *Analysis of public transport level in municipalities in the Czech Republic* prepared by the Centre for Regional Development at Masaryk University (CRD, 2011), in which the author of this paper participated. Based on this methodology, municipalities will be categorized according to their level of transport service, which will allow for better comparison of individual categories of municipalities and the economic indicators of these municipalities.

The evaluation is based on a database that contains data on public transport service levels in municipalities in the Czech Republic. The database, access to which was provided to the analysis researchers by the CHAPS company, mainly contains information on the number of existing direct connections and connections with transfers from all municipalities to their respective centres, while only connections with a maximum of two transfers were accepted. Each municipality-centre pair is further described in the database by means of the arrival time of the first connection to the centre, the departure time of the last connection from the centre and the average travel time. Data on the numbers of connections were valid on the following dates:

- Tuesday, April 20, 2010 (weekday);
- Saturday, April 17, 2010 (weekend).

The analysis of the state of transport services in this study covered all municipalities in the Czech Republic. The state of transport services was analysed separately on a Tuesday (for the purpose of this paper, the day reliably represents the situation on weekdays) and on a Saturday (for the purpose of this paper, it represents the situation on weekends).

The state of public transport services was analysed only for two types of spatial relations:

Municipality–respective micro-regional centre and municipality–respective meso-regional centre (for definition of centres see *Analysis of transport availability*).

The basic data on the level of transport services were evaluated individually in the analysis, i.e.:

- Number of all public transport connections;
- Arrival time of the first connection to the respective centre;
- Departure time of the last connection from the respective centre;
- Average commute time (the weighted average travelling time of direct and transfer connections, while the share of direct and transfer connections is applied as a weight).

These four indicators were used in further analyses. The indicators of the first connection's arrival in the municipality and the last connection's departure from the municipality were converted to average point values and then implemented in correlations. The higher the point value (1 to 6), the worse the level of availability. All four indicators were used in complementary correlation analyses. The already integrated indicators of transport service levels for micro- and meso-regional levels were used in the factor analysis. Individual indicators were divided into five categories and each category was assigned a point value that characterized it. 1 point represented the worst level of transport service, 5 points the best level of transport service. To determine the average level of transport service of a micro-regional centre, all four point indicators for the micro-regional level (number of services, commuting time, and the first and last arrival) were averaged to a single average point indicator. The same method was used for the meso-regional level.

Analysis of selected socioeconomic indicators

Only selected data that illustrated the socioeconomic level available for the municipalities of the Czech Republic were used in the analysis. The key determinant in the selection of socioeconomic indicators was the availability of data down to the municipal level. The objective was to describe the main socioeconomic factors such as business activity, unemployment, migration and commutes. Indicators relevant to these factors and available for municipalities in the Czech Republic were sought.

The economic level of municipalities was evaluated based on business activities (and personal income tax yield), labour market analysis and the analysis of basic demographic data such as net migration and commutes to work from municipalities in the study area. Seven indicators were selected for the geographical analysis within the Czech Republic. Specifically, these are: business activity (the number of registered active businesses per 1 inhabitant (CZSO, 2012), the ratio of employers to people economically active in the community (PHC, 2011), the ratio of self-employed people to people economically active in the community (PHC, 2011), the unemployment rate (MoLSA, 2012), the tax yield of municipalities per inhabitant (tax on personal income from business activities (UFIS, 2012), the demographic indicators obtained from PHC (2011) (net migration between 2001 and 2010 out of 1,000 municipality inhabitants) and the ratio of inhabitants commuting to jobs outside the municipality to the number of inhabitants. All indicators were converted per capita (specifically per economically active inhabitant) so that they were mutually comparable in the following correlation, factor and regression analyses.

Factor analysis

The factor analysis builds on previous background analyses which are vital for an understanding of the whole issue. It is a crucial preparatory step for the subsequent regression analysis. Based on a number of indicators of transport accessibility and transport service level in the municipalities in the Czech Republic, we aimed to find integrative (explanatory) factors. The factor analysis that was conducted also included indicators of transport availability and service level which had already been partially integrated for two regional levels – micro- and meso-regions. Subsequently, two explanatory factors for transport indicators were devised: an indicator of transport accessibility that integrated data on individual car commutes by road, and a transport service level indicator comprised of indicators of commutes on public transport. To process the data, IBM SPSS Statistics 20 software licensed to Masaryk University was used.

Regression analysis of the transport factors with socioeconomic indicators

The purport of the crucial regression analysis is to identify and explore dependencies of variables in the statistical data, and these variables (phenomena, quantities) are considered random. A pair of random variables (dependent, whose dependence was verified in the correlation analysis) is represented by the independent variable X and the dependent variable Y. As the dependent variable, we first used the time distances of the municipalities by road to the micro-regional centres, because they best represented the indicators of transport accessibility. Then we used factors that resulted from the factor analysis of transport availability and transport service levels, first in the micro-regional centres and then in the meso-regional centres and as the last factor, we used the factor of transport availability in regard to the macro-regional centre – Prague. We assigned a set of independent variables to these dependent variables based on a previous correlation analysis so that the predictive value of the model was as high as possible. In the first analysis the following indicators were entered: the number of employment positions occupied in micro- and meso-regional centres for 2011 respectively, as well as the number of employment positions occupied in the municipality per economically active inhabitant in the municipality (2001), unemployment rate (2011), the gross rate of net migration between 2001 and 2010, the ratio of commuters to the total population (2011), the number of businesses per capita (2012) and tax on personal income from business activities (2012).

To research and describe the dependence of random variable Y on X, regression analysis was used, and the dependence was expressed via a regression function. In this case, we chose weighted linear regression because we assumed that the relationship between the examined variables was linear. The regression was weighted according to the populations of municipalities since this was the most important factor in explaining the interdependence of the phenomena, and it would make further analyses much easier. Relationships adjusted for the different population sizes of the surveyed municipalities subsequently showed greater dependence.

DISCUSSION OF RESULTS

Analysis of transport availability

The results of the analysis of transport availability via the road network clearly illustrate the varying degrees of quality of the transport infrastructure at different levels. The quality of the transport infrastructure is most notable at the macro-regional level, while on the meso-regional level, it is strongly influenced by the sizes of individual meso-regions. Thus, the areas in larger meso-regions that are more remote and have better transport connections are more evident, as shown in Fig. 2. The impact of transport infrastructure is least noticeable at the micro-regional level because the impact cannot have sufficient effect in such small areas as micro-regions, see Fig. 1. All the indicators used in the analysis were significantly determined by distance from the selected centres. The indicators thus show the residential structure and the chosen manner of definition of the surveyed territorial units, rather than the proximity of major roads and the average speed of commuting to centres of employment opportunities. This is particularly the case on the micro-regional level and also partly on the meso-regional level. Although the level of transport infrastructure was best illustrated on the macro-regional level, the drawback is that it only represents the transport availability of a single centre. This fact strongly influences the level of transport availability in Moravia and Silesia, see Fig. 3. If the inbound commute to at least three or four large centres such as Prague, Brno, Ostrava and eventually Pilsen was used, the level of transport availability would be somewhat more descriptive and would not disadvantage Moravia and Silesia to such an extent.

Analysis of transport service levels

The analysis of transport service levels allows us to synthesise the indicators presented in the methodological part of this paper, both for the weekday and the Saturday. The cluster analysis adapted details from the *Analysis of public transport level in municipalities in the Czech Republic* (CRD, 2011), which aggregated municipalities into certain clusters according to a combination of factors, see Fig. 4.

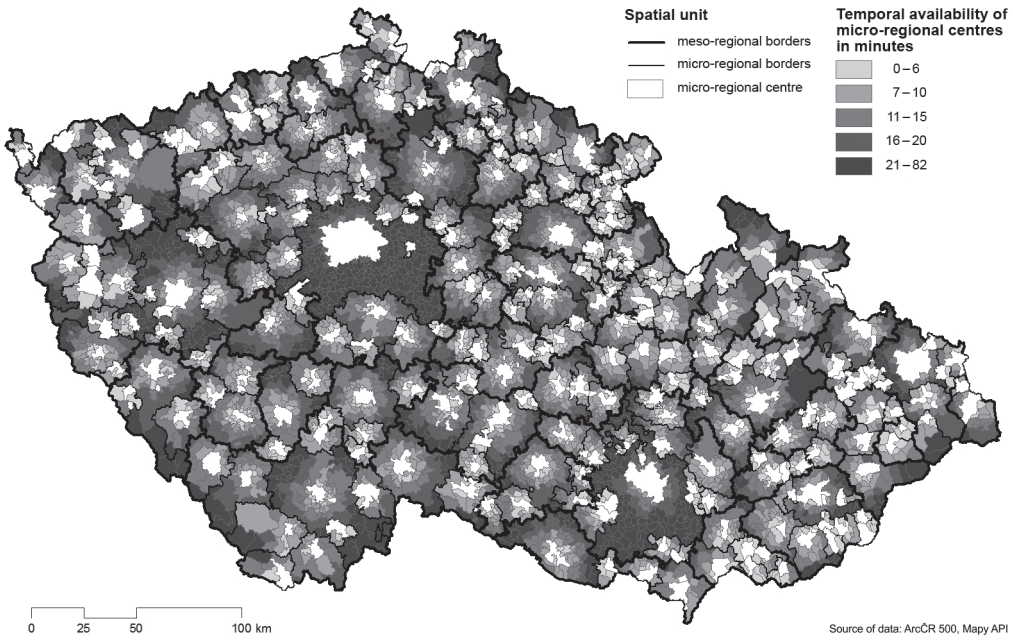


Figure 1 Level of temporal availability of micro-regional centres (2012). Source: Mapy API, 2012.

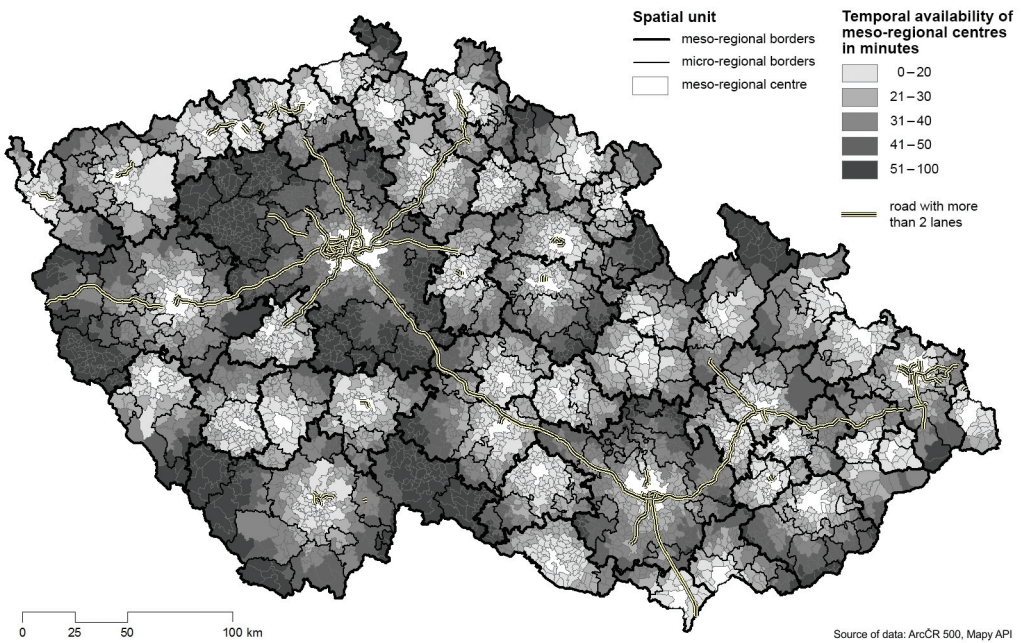


Figure 2 Level of temporal availability of meso-regional centres (2012). Source: Mapy API, 2012.

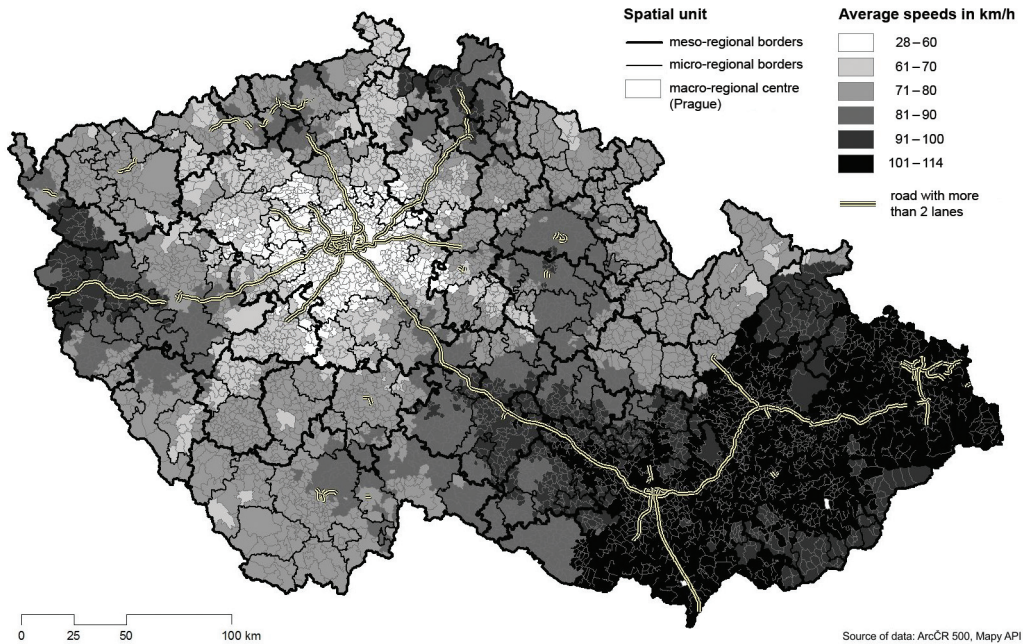


Figure 3 Average speeds at which macro-regional centres can be reached by road from municipalities.
Source: Mapy API, 2012.

The results of the analysis of transport service levels can be summarized in a few key points. First, high quality public transport services (number of services, their average travel times and temporal distribution during the day) are, both on weekdays and on Saturdays and over all types of spatial relations, usually provided better in municipalities in the eastern part of the Czech Republic, especially in Moravian regions (the regions of South Moravia, Zlín, Olomouc and Moravia-Silesia). Second, and somewhat lower in quality, but still with a good level of public transport service, even in comparison with the Moravian area, is the broader hinterland of Prague. This is followed by Liberec, Ústí nad Labem and Karlovy Vary. In contrast, the lowest quality of public transport, characterised by a relatively frequent lack of public transport service coverage of both territory and population on Saturdays, can be found in the territorial zone of the Czech-Moravian border – South Bohemia – Southwest Bohemia (CRD, 2011).

The spatial differentiation of individual indicators can be explained on the basis of specific socio-economic conditions. Perhaps the most important factor that influences the level of transport services in municipalities is the residential structure of the region, specifically, the size differentiation of municipalities. Larger municipalities display a higher level of transport standards (the regions of Moravia-Silesia, Ústí nad Labem and South Moravia). In contrast, regions with worse transport service levels have a higher number of their population in small municipalities and a higher number of small municipalities out of the total number of municipalities in the region (regions of Vysočina, Pilsen and Pardubice).

Another decisive factor that influences the level of transport services of the municipalities in the Czech Republic is the size and relative position of the analysed territorial units. The results of the analyses are, to some extent, influenced by the choice of centres, whose availability was examined

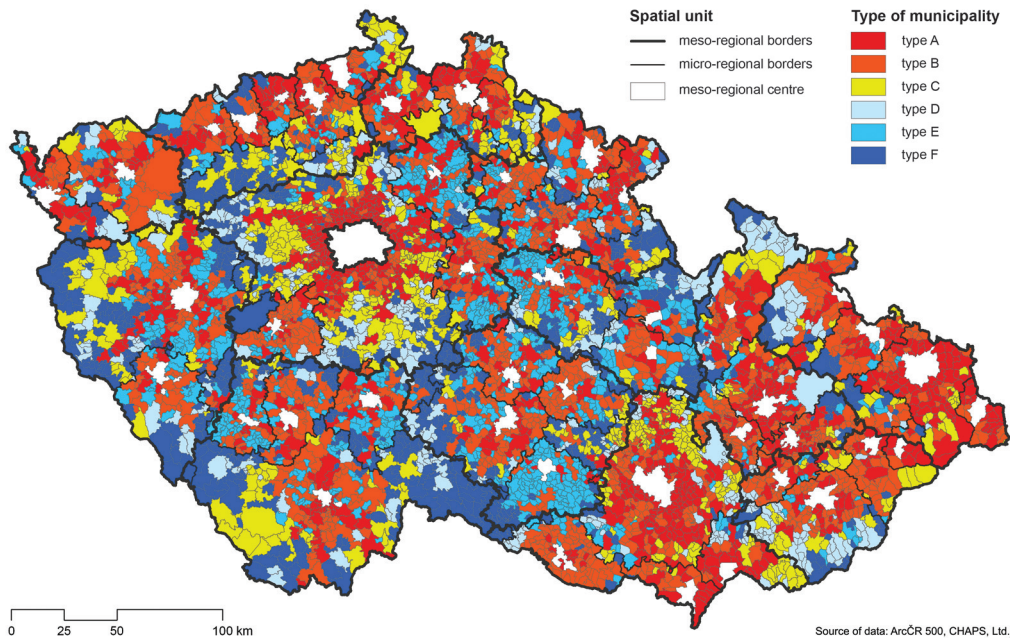


Figure 4 Typology of municipalities according to the average point value of transport service levels in the micro- and meso-regional centres in 2010. Source: Assembled based on data from CRD, 2011.

as regards the arrangement and the size, respectively, of their catchment areas. It is evident that the quality of transport services will be at a higher level in a regional settlement system of higher density and in spatial proximity to centres, than in a system with a less concentrated network of employment and service centres (thus larger regions will show substandard transport services on their outskirts). Polycentric regions will probably be characterized by higher transport standards than the regions with mono-centric settlement arrangements (CRD, 2011).

Another important variable is the functional significance of the examined centre – it is evident that larger centres have the potential to provide better transport services over a wider base area than functionally less significant centres. The character of the traffic data provided meant it was not possible to capture the plurality of choice among a greater number of potentially available centres. If this type of analysis were possible, the impact of the morphology on a residential system would presumably be even more pronounced (CRD, 2011).

Transport organisation was also an analytically significant factor. One important factor of this kind is the way in which the basic transport is provided in the area. The most important actors are the regional authorities and thus the resulting map largely reflects the regional borders (CRD, 2011). The impact of this factor is positively reflected in southern Moravia for example, thanks to a well-functioning and integrated transport system.

The last explanatory factor of transport services in municipalities that has been examined is the hierarchically superior transport routes that pass through an area. At least to a limited spatial extent, the provision of transport service connections in an area is influenced by the hierarchically superior transport routes that pass through the area. The impact of these routes is clearly evident in the case of radial railway lines which lead into major centres. Any comparable influence of motorway connections is speculative due to the impact of the tunnel effect. However, the concentration of bus transport services on radial primary roads acts in the same way as the railway (CRD, 2011).

Analysis of the socioeconomic sphere

The analysis is based on a comparison of selected socioeconomic indicators and their depiction on a map. Unlike previous transport indicators, this analysis is on a national scale. Indicators were relativized to the population size (or the number of economically active inhabitants) so as to be mutually comparable. We will define the main areas that have a concentration of good results of individual indicators (development areas), as well as the areas with poor results of indicators (peripheral areas). These maps will help us, particularly in the subsequent interpretation of statistical analyses when working with the same data sets of socioeconomic indicators. This will allow us to understand why some socioeconomic indicators are more suitable for subsequent analyses than others. The subsequent correlation and regression analyses of individual transport and socioeconomic indicators will allow us to determine more precisely why some indicators correlate more and others correlate less.

It can be concluded that the spatial differentiation of the selected indicators roughly correlated. In the cases of the number of outbound commuters and the rate of net migration, the degree of similarity was lower than with economic indicators. The greatest degree of similarity in the spatial differentiation of the indicators was displayed by the number of businesses per capita, see Fig. 5, to a lesser extent by the number of employers and self-employed people, and by the unemployment rate, see Fig. 6. The distribution of the relativized rate of net migration and the number of outbound commuters showed less consistency. The lowest consistency was shown in the distribution of revenue from taxes.

The results from developing and peripheral areas are broadly consistent with the more detailed and complex analyses of the socioeconomic sphere conducted by Novák and Netrdová (2011) and with the typology of municipalities used in the Strategy of the Regional Development of the Czech Republic for the period 2014–2020 (MRD, 2012). Based on their analysis of the socioeconomic sphere, Novák and Netrdová (2011) claim that development areas are located around the cities of Prague, Brno, České

Budějovice, Pilsen, Hradec Králové and Pardubice. Some development axes in the direction of Prague–Mladá Boleslav–Liberec and Prague–Pilsen are clearly developing. Development areas form around smaller district towns, and as with Rychnov nad Kněžnou, Tábor, Prachatice, Uherské Hradiště, Klatovy, Lanškroun, Humpolec and others, they also form in the areas surrounding “successful” cities. In specific cases development areas can form without ties to big cities (Krkonoše, Šumava, Beskydy, Hrubý Jeseník). The development of these areas is tied to both winter and summer tourism. In the case of Šumava and Český les, the proximity of economically strong Bavaria plays a role, as it affects the amount of investment in the area close to the border.

Conversely, the peripheral and problematic areas, as based on our analysis and on the analyses conducted by Novák and Netrdová (2011), Musil and Müller (2008) and in particular the Ministry of Regional Development CZ (2012), can be simply identified along the regional borders, especially at the junctions of three (four) regions; typically the junctions of Karlovy Vary, Pilsen, Central Bohemia and Ústí nad Labem. Peripheral and problematic areas can also be identified at the edges of the Central Bohemian Region. The greatest degree of spatial compliance with the results of the above-mentioned analyses can be found in the distribution of the number of businesses per capita and in the distribution of the unemployment rate, as well as, to a lesser extent, in the rate of self-employed and the relativized rate of net migration.

Regression analysis results

The results of the regression analysis show that for the high degree of explained variability decisive influences were the number of businesses per capita (see Fig. 4) and the number of inhabitants commuting from the municipality. The higher the number of employment positions occupied (EPO) in the centre, the worse the average availability of municipalities via individual car transport (ICT) in a given employment region. This is naturally due to the fact that larger employment centres create larger employment micro-regions and therefore there is a greater number of less accessible municipalities. Additionally, transport availability is made worse

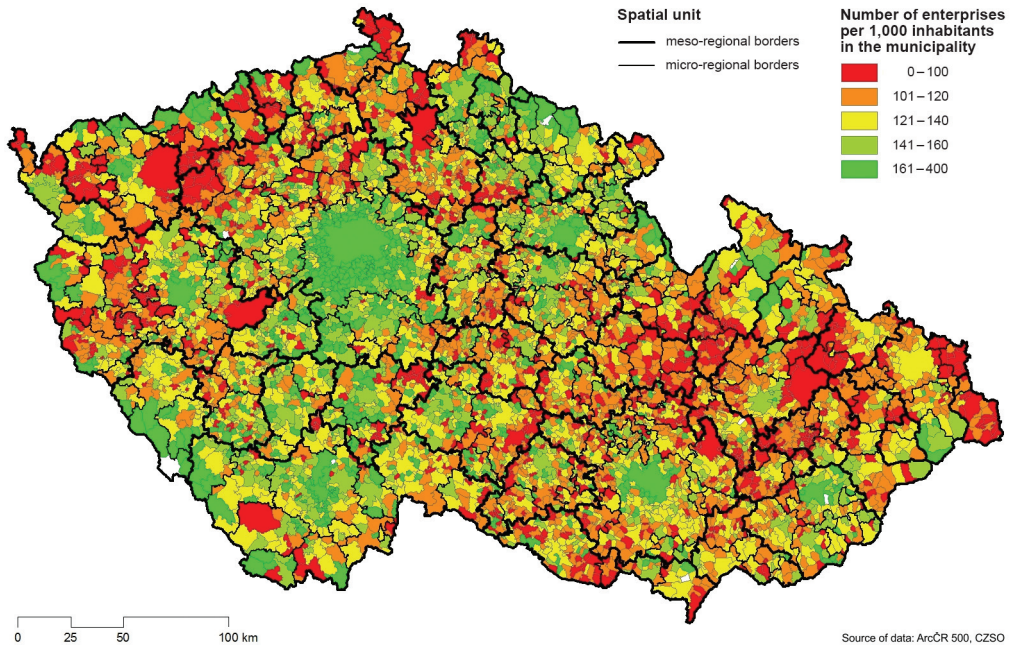


Figure 5 Number of active registered economic entities per 1,000 inhabitants in the municipalities of the Czech Republic in 2012. Source: CZSO, 2013.

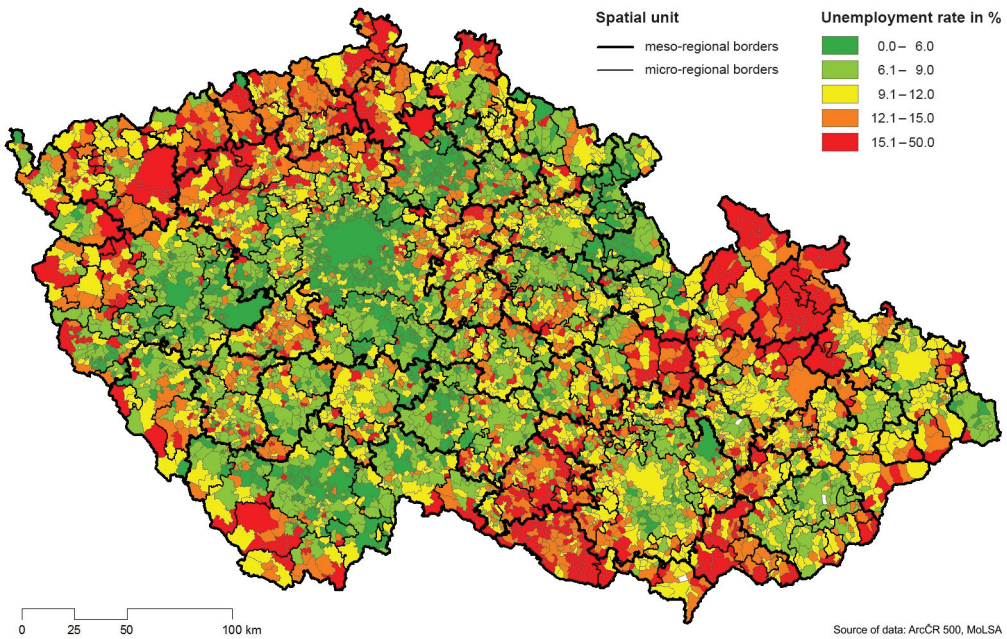


Figure 6 Unemployment rate in municipalities of the Czech Republic by 31 December, 2011. Source: MoLSA, 2012.

by the long passage through the larger centres to the municipal centres (Prague, Brno etc.). In other words, in larger centres people are more likely to commute from farther away.

The highest rates of regression coefficients can again be observed at the macro-regional level. This is partly due to the fact that the indicator of employment posts occupied in the centre played a less important role as there was only one centre examined (Prague). The informational value of the transport accessibility factor at the macro-regional level was also the largest of all the other levels (0.57). The better the transport accessibility of Prague, the lower the unemployment rate, the higher the positive net migration rate, the higher the number of businesses per capita in the municipality and, to a lesser extent, the higher the revenues from personal income tax. In contrast, better transport availability indicates a lower rate of outbound commuters on the macro-regional level. This is affected by the location of many other inbound work commute centres across the Czech Republic, which significantly relativizes the concentration of outbound commuters close to Prague. The regression coefficient of all these dependencies was around the value of 0.2, which indicates a weak dependence.

At the meso-regional level, it is possible to observe the dominant impact of the size of meso-regional centres expressed by the number of EPO. The better transport availability of a meso-regional centre, the greater the degree of positive net migration and the higher the share of inhabitants commuting to jobs outside the municipality. Other factors correlated very little with the improvement in transport accessibility. On the other hand, as for the transport service level, it is evident that the impact of the size of a centre (number of EPO) is relatively small, although it is still the most important of the other factors. The better the level of transport services to a meso-regional centre, then logically the number of EPO in the centre will be higher, as will the number of EPO in the municipality and the number of businesses per capita in the municipality. To a lesser extent, there is also a better positive net migration rate in such a municipality, as well as a lower unemployment rate and also a higher number of outbound work commuters.

At the micro-regional level, the factor of transport availability was most influenced by the size of the centre. Better transport availability of a micro-regional centre was clearly related to higher numbers of outbound commuters, higher rates of positive net migration and, to a lesser extent, higher numbers of businesses per capita. When looking at the relationship to the level of transport services, the power of the micro-regional centre again becomes quite evident, as well as the economic power of the municipality itself as measured by the number of EPO. Other factors are little related to the level of transport services at the micro-regional level. So a better level of transport service indicates, to a lesser extent, a lower unemployment rate and a higher number of outbound commuters. On the other hand, paradoxically, it indicates a lower number of businesses per capita in the municipality.

From the overall view of the various socio-economic indicators, it is clear that the size of a regional centre has the greatest effect on the level of transport accessibility and transport service. Also, higher rates of positive net migration and higher numbers of outbound commuters indicate better transport accessibility via ICT and a higher level of public transport services. Unfortunately, these indicators do not directly indicate the level of socioeconomic development of the municipalities surveyed. Perhaps only the net migration rate could indicate whether the community is developing or not. Higher numbers of businesses per capita indicated better transport accessibility and transport service at all levels, except the micro-regional level. From the map of the spatial distribution of business activities, it is evident that most business activity occurs in municipalities closer to regional centres (of employment). This is especially the case with the larger and economically successful centres (such as Prague, Brno, Pilsen, Zlín, Hradec Králové and Pardubice), while this phenomenon is not seen in economically weaker centres in structurally affected regions. Revenues from tax on personal income from business activities show no significant relationship to the transport indicators. To a small extent, it is true that the better the transport accessibility via IAD, the higher the revenues from personal income tax.

Table 1 Rates of regression coefficients between selected socioeconomic predictors and factors of transport accessibility.
Source: own calculations.

Socioeconomic predictors	Physical distance to micro-regional centre	Micro-region		Meso-region		Macro-region	
		Transport availability	Transport service level	Transport availability	Transport service level	Transport availability	Transport service level
Number of employment positions occupied (EPO) in the regional centre (2001)	0.80	0.80	0.31	0.70	0.20	—	—
Number of employment positions occupied in economically active (2011)	-0.07	-0.04	0.19	0.02	0.16	0.15	0.15
Unemployment rate (2011)	-0.01	-0.00	-0.05	0.03	-0.08	0.23	0.23
Gross migration balance per capita 2001/2010	-0.12	-0.17	0.03	-0.25	0.09	-0.21	-0.21
Number of businesses per capita (2012)	-0.06	-0.06	-0.05	-0.02	0.16	-0.19	-0.19
Share of inhabitants commuting to jobs outside the municipality per capita (2011)	-0.15	-0.19	0.06	-0.18	0.06	0.19	0.19
Revenues from personal income tax per capita (2012)	-0.03	-0.03	-0.02	-0.03	-0.01	-0.07	-0.07

CONCLUSION

The mutual influence of transport accessibility and socioeconomic level of a region is extremely complicated. The aim, therefore, was to present a critical approach to the neoclassical and neoliberal traditions still significantly represented in the Czech Republic. Those approaches automatically perceive improvements in transport accessibility being caused by the construction of higher classification roads as the multiplication effect of the development of the region. And those improvements are mainly seen to be the result of a reduction in transport costs which are barriers to the free market. Based on the critical search of results in the economic, sociological, and logistic technical literature, we were looking for a comprehensive methodology for the evaluation of the level of transport accessibility and transport services. We particularly applied methods of geographical and statistical analysis which best monitor inequalities in the development of an area. The focus was on the quantitative analysis of spatial data on the socioeconomic level of the population and the business environment in comparison to the level of transport accessibility and transport services in municipalities of the Czech Republic.

The method of evaluating transport accessibility that was applied via ICT is strongly influenced by the density of micro- or meso-regional centres, and eventually by the eccentric position of Prague within the Czech Republic as a macro-regional centre. Although the definition of regions and regional centres used in this paper is based on the commute to work, which has a great influence on the socioeconomic factors, the resulting values often provide details about the residential structure rather than the quality of the transport infrastructure. The methodology partially defines the peripheral and core regions, however, it hardly takes into account the employment capacity of individual centres. A large number of micro-regional centres, e.g. in the regions of Náchod and Ústí nad Orlicí, and meso-regional centres in the regions of Vysočina and Central Moravia strongly enhance the level of transport accessibility, although these centres are relatively economically weak and do not correlate

significantly with higher levels of socioeconomic indicators. We tried to emphasize the impact of transport infrastructure on transport accessibility using temporal availability indicators; the average speed of commuting and the time expenditure level of transport infrastructure. However, the effect of the physical distance of the municipality from the regional centre is still crucial.

The analysis of transport service levels proved to be a little more suitable because it was possible to create an average point value of the transport service of municipalities to a micro- or meso-regional centre that corresponds with the complex socioeconomic typology of municipalities. The typologies of developing and central regions defined according to the Strategy of the Regional Development of the Czech Republic for the period of 2014–2020 (MRD, 2012) are, in essence, consistent with other typologies of territory by Novak and Netrdová (2011), and Musil and Müller (2008). Developing (urbanized) areas determined according to the MRD typology (2012) essentially coincided with the best-served municipalities. This was also evident in peripheral and stabilized areas but to a lesser extent. The transport service level was significantly affected by the residential structure (the more populous communities were better served), by the organizational aspects (organization of public transport by the regional authorities, the presence of well-functioning integrated transport systems) and, to some extent, by railroad routes, which improved transport services, even on weekends. These factors rather complicated the municipalities' dependence on the economic level. In contrast, the factors of hierarchically superior transport routes passing through the area and the number of employment posts occupied in the regional centre accentuated the relationship with the economic level of municipalities.

The analysis of selected socioeconomic indicators showed varying degrees of consistency with the comprehensive definition of the socioeconomic typology of communities. The greatest degree of correlation for all municipalities in the Czech Republic with other socioeconomic indicators was displayed in the number of enterprises and the number of employers. A closer look at selected

cities confirmed that the economically more successful cities indicated a higher share of employers than the demographically comparable but economically weaker cities. Another indicator which confirmed in basic terms the definition of developing and peripheral regions, was the registered unemployment rate. The share of outbound commuters was by far the highest in municipalities with good transport accessibility to big cities and in contrast, it was small in peripheral regions (especially in border areas). The relativized net migration rate was the highest among communities with good transport availability in the hinterlands of big cities, and this roughly indicated the problematic peripheral regions with higher rates of emigration, low business activity, and high unemployment rates.

On the basis of the factor and regression analysis of the above-mentioned indicators, it is now possible to answer the research question posed at the beginning of this paper. Did the results confirm that municipalities with a better level of transport accessibility and serviceability display a better level of indicators of regional socioeconomic development in the Czech Republic?

The regression analysis based on factor analysis showed statistically significant degrees of correlation. In principle, the better transport availability, the better the positive net migration rate, and higher business activity. In most cases the communities with better transport availability also display lower unemployment rates. When the analysis included the factor of the number of employment posts occupied in the centre, the transport availability correlated significantly with the socioeconomic indicators. The weakness of the correlation and regression analysis is that it correlates transportation availability to the centres with socioeconomic indicators of all municipalities in the Czech Republic. Consequently, the most economically successful communities (the micro-regional, or meso-regional centres) which also have the best traffic accessibility, do not enter the analysis on the side of traffic indicators, as they are simultaneously centres of inbound commutes. This is one of the reasons why the relationship between transport and socioeconomic indicators is clearer on macro-regional and

meso-regional levels, where the influence of centres that have already been included in the analysis on these levels is reflected.

We therefore contradict the premise that better transport availability automatically indicates the better development potential of the area. Although in principle this premise was confirmed, there are numerous examples that stand against this assertion. This is also confirmed by some of the results in the draft of the Strategy of the Regional Development of the Czech Republic for the period of 2014–2020 (MRD, 2012, p. 49). In many cases territories with good transport connections display a high level of non-competitiveness. It is not only the connection to transport infrastructure that is of great importance, but also the role the transport infrastructure plays in connecting the centres. Municipalities located on a highway that links economically strong centres (Prague–Pilsen, Prague–Brno, Prague–Mladá Boleslav–Liberec) have significantly higher development potential than those located on a highway connecting economically weak centres (Vyškov–Kroměříž, Olomouc–Mohelnice). Thus the level of transport accessibility is more an additional factor in regional development rather than a factor generating development on its own.

It can be concluded that the relationship between transport accessibility and the socioeconomic level of municipalities is roughly determinable, but is largely influenced by other factors that greatly complicate the relation between these two sole factors (transport and level of development). It is therefore not possible to clearly establish the isolated impact of the level of transport accessibility on regional development since it is determined more by other factors. These include: the quality of human resources associated with the willingness to work, business activity, the size of population centres, the quality of the business environment, the difference between the quantitative and the qualitative supply and demand of the workforce, direct foreign investment and the implementation of innovation and technology. Thus transport accessibility is a significant factor, not only supportive, but indispensable. Transport is a necessary condition, but not sufficient by itself. Perhaps transport alone can only have a more significant impact in cases of localization of direct foreign investment.

References

- Blažek, J., Uhlíř, D.** 2011: *Teorie regionálního rozvoje: nástín, kritika, inspirace*. Nakladatelství Karolinum, Univerzita Karlova v Praze.
- Bruinsma, F., Rietveld, P.** 1998: *Is Transport Infrastructure Effective? Transport Infrastructure and Accessibility: Impacts on the Space Economy*. Springer-Verlag, Berlin-Heidelberg.
- CRD (Center for Regional Development MU)** 2011: *Analýza dopravní obslužnosti v obcích ČR*. Zpráva pro Ministerstvo dopravy, Brno.
- Eddington, R.** 2006: *The Eddington Transport Study. Main Report: Transport's role in sustaining the UK's productivity and competitiveness*. HMSO, Norwich.
- Gauthier, H. L.** 1970: Geography, Transportation, and Regional Development. *Economic Geography* 46 (4), 612–619.
- Gutiérrez, J., Gonzáles, R., Gómez, G.** 1996: The European high-speed train network. *Journal of Transport Geography* 4 (4), 227–238.
- Hučka, M., Kutscherbauer, A., Tománek, P.** 2008: Metodologická východiska zkoumání regionálních disparit. *Regionální disparity* 2, 5–32.
- Knaap, T., Oosterhaven, J.** 2011: Measuring the welfare effects of infrastructure: a simple spatial equilibrium evaluation of Dutch railway proposals. *Research in Transportation Economics* 31, 19–28.
- Krugman, P., Venables, A. J.** 1995: Globalization and the Inequality of Nations. *The Quarterly Journal of Economics* 110 (4), 857–880.
- McKinnon, D., Pirie, G., Gather, M.** 2008: Transport and Economic Development. In **Knowles, R., Shaw, J., Docherty, I.** eds. *Transport geographies: mobilities, flows and spaces*. Blackwell Publishing, Oxford, 10–28.
- Marada, M., Květoň, V.** 2008: Importance of transport possibilities in rural areas of Czechia. In **Majerová, V.** ed. *Sborník příspěvků z mezinárodní konference Countryside – our World*. ČZU, Prague, 390–402.
- Marada, M., Květoň, V.** 2010: Diferenciace nabídky dopravních příležitostí v českých obcích a sociogeografických mikroregionech. *Geografie* 110 (1), 21–43.
- MRD (Ministry of Regional Development CZ)** 2012: *Strategie regionálního rozvoje ČR pro období 2014–2020 (draft)*. (<http://www.mmr.cz/getmedia/5acbe736-6893-4ff6-b548-c3d5b57dbc83/SRR-%282012-12-11%29.pdf>), accessed 2013-11-07.
- Musil, J., Müller, J.** 2008: Vnitřní periferie v České republice jako mechanismus sociální exkluze. *Czech Sociological Review* 44 (2), 321–348.
- Novák, J., Netrdová, P.** 2011: Prostorové vzorce sociálně-ekonomické diferenciací obcí v České republice. *Sociologický časopis* 47 (4), 717–744.
- Santos, G., Berhrendt, H., Maconi, L., Shirvani, T., Teytelboym, A.** 2010: Externalities and economic policies in road transport. *Research in Transportation Economics* 28, 2–45.
- Seidenglanz, D.** 2010: Transport relations among settlement centres in the eastern part of the Czech Republic as a potential for polycentricity. *Acta Universitatis Carolinae, Geographica* 45 (1–2), 75–89.
- Seidenglanz, D. et al.** 2011: *POLYREG. Podpora polycentrického regionálního rozvoje: vybrané výsledky*. Centrum pro regionální rozvoj, Brno.
- Smith, N.** 1990: *Uneven Development*. Second Edition. Blackwell, Oxford.
- Viturka, M., Žitek, V., Klímová V., Tonev P.** 2011: Application of Microeconomic and Macroeconomic Approach to Evaluating Disparities in the Regional development. *Ekonomický časopis* 59 (7), 655–668.

Data sources:

CZSO, 2012: *Public database*.

CZSO, 2013: *Population and Housing Census 2011*.

Mapy API, 2012.

Ministry of Finance of the Czech Republic: *Schéma rozpočtového určení daní pro obce od roku 2008*.

MoLSA CZ, 2012: *GIS 0 – Prostorová analýza, prosinec 2011 (unemployment rate)*.

UFIS, 2012: *Prezentační systém účetních a finančních informací státu*.

Résumé

Vliv dopravní dostupnosti a obslužnosti na ekonomickou úroveň obcí v České republice

Článek měl za cíl zjistit, jaký vztah je mezi dopravní dostupností a regionálním rozvojem neboli socio-ekonomickou úrovní v České republice. Aby byla data co nejvíce podrobná, byla zvolena nejnižší

možná úroveň v rámci České republiky, tedy úroveň obcí. Hodnocena byla nejprve dopravní dostupnost jednotlivých obcí individuální automobilovou dopravou z mikroregionálních, mezoregionálních i makroregionálního střediska. Byla hodnocena časová dostupnost, průměrná rychlost dojezdnosti, časová náročnost silniční sítě.

Dále byla hodnocena dopravní obslužnost obcí veřejnou hromadnou dopravou opět do mikroregionálních a mezoregionálních středisek. Mikro, mezo a makroregionální středisko/a byla převzata ze souhrnné zprávy Polyreg (Seidenglanz, D. et al. 2011). Dopravní obslužnost byla hodnocena opět více ukazateli ilustrujícími kvalitu a rychlost dopravních spojení mezi obcí a spádovým střediskem jak ve všední den, tak o víkendu.

Tyto faktory dopravní dostupnosti jsme srovnávali s vybranými ukazateli hodnotícími socioekonomickou úroveň obcí, konkrétně podnikatelskou aktivitu, nezaměstnanost, podíl vyjíždějících a migrační saldo. Bylo nutno vybrat ukazatele dostupné za všechny obce.

Po srovnání uvedených dat formou geografické analýzy v mapovém vykreslení bylo přistoupeno nejprve k faktorové a poté k z ní vycházející regresní analýze. Modely regresní analýzy dospěly k výsledkům, které prokázaly závislost mezi jednotlivými faktory. Tato závislost však nebyla příliš silná. Zjednodušeně můžeme formulovat tvrzení, že čím lepší je dopravní dostupnost, tím vyšší je kladná míra migračního salda a také podnikatelská aktivita. Ve většině případů je v obcích s lepší dopravní dostupností i nižší míra nezaměstnanosti. Pokud jsme do analýzy zahrnuli faktor obsazených pracovních míst ve středisku, výrazně více nám se socioekonomickými ukazateli korelovala dopravní dostupnost, pokud jsme zařadili faktor komplexní typologie obcí, korelovala naopak výrazně více dopravní obslužnost. Úskalím korelační i regresní analýzy je fakt, že koreluje dopravní dostupnost do center se socioekonomickými ukazateli všech obcí České republiky. V důsledku toho ekonomicky nejúspěšnější obce (mikroregionální, respektive mezoregionální centra), které jsou zároveň nejlépe dostupné, pak do analýzy na straně dopravních ukazatelů vůbec nevstupují, jelikož jsou zároveň centry dojezdnosti. Je to jeden z důvodů, proč

je vztah dopravních a socioekonomických ukazatelů čitelnější na makro a mezoregionální úrovni, kde se tudíž projevuje i vliv středisek, které už na těchto úrovních do analýzy zahrnuty jsou.

Dobře dopravně napojená území v mnoha případech vykazují vysokou míru nekonkurenceschopnosti. Velký význam nehraje pouze napojení na dobrou dopravní infrastrukturu, ale také role dopravní infrastruktury v propojování středisek. Výrazně vyšší rozvojový potenciál mají obce, které se nachází na rychlostní komunikaci spojující ekonomicky silná centra (Praha–Plzeň, Praha–Mladá Boleslav–Liberec), než obce na dálnici spojující centra ekonomicky slabá (Vyškov–Kroměříž, Olomouc–Mohelnice). Úroveň dopravní dostupnosti je tedy spíše doplňkovým faktorem regionálního rozvoje, než že by jej mohla sama o sobě generovat.

Vztah dopravní dostupnosti a socioekonomické úrovně obcí je sice v hrubé míře vysledovatelný, ale je ovlivněn z velké části dalšími faktory, které vzájemný vztah pouze těchto dvou faktorů velmi komplikují. Nelze proto jasně stanovit, jaký izolovaný vliv má úroveň dopravní dostupnosti na regionální rozvoj, jelikož ten je determinován spíše jinými faktory. Jsou to například kvalita lidských zdrojů související s ochotou pracovat a podnikatelskou aktivitou, dále kvalita podnikatelského prostředí, nesoulad mezi kvantitativní, ale také i kvalitativní nabídkou a poptávkou pracovní síly, přímé zahraniční investice, implementace inovací a technologií a mnohé jiné. Dopravní dostupnost je faktor sice významný, ale spíše doplňující, podpůrný.

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