



Macroeconomic Effects on Development of Sparsely Populated Areas

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The text describes the basic macroeconomic effects on the development of the areas of low population. In the framework of this analysis, the primary characteristics were mapped for the sparsely populated regions (micro-regions) of the EU.

Introduction

Urban regions and their incorporation in the polycentric settlement systems are being discussed by the expert and political bodies in a number of the European countries and at the pan-European level. Although the concept of polycentric systems is rather indefinite, in transition from monocentric hierarchical settlement systems to polycentric ones, the projects and the documents of the European Union based on them offer a possibility of territorial cohesion strengthening. In recent years, the polycentric networks and chains have provided the responses to both the globalization challenges under which the solitary centres are exposed to an unreasonable pressure of global competitors and the issue of growing territorial disparities between the metropolitan regions and the rest of the territory. Some papers, however, highlight the conflicts between the goals and policies of polycentrization. The latter issue was identified especially in the Central and Eastern Europe. On a European scale, a number of analyses and political documents are concerned with especially an uneven development between the investment-attractive and densely populated European pentagon defined by the areas of London, Paris, Milan, Munich and Hamburg and the rest of the continent. Attention has been most recently paid to the possibilities of polycentric response to the problems of rural peripheral regions whose population and economic importance do not allow creation and functioning of the sufficiently strong and attractive service centre accessible from the whole region.

Traffic services rank among the most debated topics in the context of the living in the country. Many foreign and domestic expert studies acknowledge importance of this issue and the fact that the transportation and the related accessibility of the country is a problem even in foreign countries.

The main aim of this study is to highlight the differences in traffic services in the Czech country as their level is different in every region. Another goal is to describe traffic services provided by the public transport in the size categories of villages in individual regions of the Czech Republic and to compare them with the availability of passenger cars in individual households. Passenger cars are more or less necessary alternative of the public mass transport.

In the event of traffic services provided by the public transportation, we can see a so-called vicious circle of the public mass transport in the country. This circle can be simplified as follows:

- A low population of the serviced settlements results in the low economic efficiency of the transport links, which requires the subsidies from the public funds.
- Efforts in increasing the profitability leads to reducing the low used links which results in the reduction of the supply and the quality of traffic services. For this reason, some passengers start to use other modes of transport (as a rule, their cars).



- As the population decreases, the profitability of transport links is reduced.

This phenomenon was observed in the country both abroad (e.g. in Great Britain) and in the Czech Republic during the transformation period. As the employment opportunities and higher-tier services continue to be concentrated in the bigger populated areas and the basic services (grocery stores, primary schools, pubs, etc.) are more often placed in the departmental centre of the municipality, the role of traffic services will have the increasing importance. The demand for transportation needed for commuting to satisfy basic daily needs in the country is still growing. Economically, this demand is low, especially in the low populated villages in peripheral regions.

Trends in Traffic Services

Due to the low demand for transportation, the bus and railway transportations are economically least effective in areas of very low population. Due to unavailability of data from individual carriers, this statement is hard to be proved even at the "gross" level of regions. Despite this fact, this statement can be considered valid thanks to a number of regional studies (e.g. Květoň 2006, Jansa 2004, Marada et al. 2010, etc.)

A notable reduction in the number of public mass transport links was typical mainly in the first half of nineties. The current period can be characterized as fragile stabilization of the public transport supply. Many reasons for this stabilization can be found, but the most noteworthy one is the influence of institutional factors.

Regional Differentiation of Traffic Services

The following part focuses on comparison of the supply of traffic services provided by the public bus transport and the endowment of households with passenger cars according to the population size of villages in individual areas. The railway transport was not rated as individual areas have a different level of railway infrastructure and the train stop can be found only in a minority of villages. The intention is to point to the differentiation of both selected indicators not only at the level of EU areas, but especially with respect to the size of villages.

The results related to 2016 are listed in Table 1 (we can assume that the current situation will not differ too much). In case of the bus transport, the dependence of the bus transport supply on the population size of villages is clear. The lowest bus transport supply is, on average, in the category of villages with population of up to 500 inhabitants. On the other hand, a higher number of passenger cars is in the smallest villages. It can be expected that a declining quality of traffic services provided by the public transport in the rural and peripheral areas is more and more often replaced by the private motor vehicle transport or other alternatives of traffic services.



Apart from the differences based on the size categories of villages, also relatively important regional differences and differences among the EU countries are reflected. When comparing all EU countries, the lowest supply of the bus transport is in Finland. The Czech Republic demonstrates a lower supply of public bus transport in Bohemia, while the regions in Moravia and Silesia are characterized by a higher level of traffic services provided by buses probably due to a less fragmented structure of settlement, i.e. on average bigger rural settlements. The villages which are both larger and higher populated are typical especially in the south-eastern and central Moravia and in Silesia.

Uneven positioning of non-served municipalities is also interesting. In the Czech Republic, most municipalities are located in Bohemia or in the Vysočina region. In case of Moravia and Silesia, this situation is rather exceptional. An important role of the type of rural settlement has been proved again. Generally, more deployed settlement in Bohemia in comparison with Moravia causes worse economic efficiency of provided traffic services and investments. The best served municipalities are, as a rule, located near the big towns. This trend, however, does not hold true in Germany where the transportation system is relatively well developed.

Economic Performance of Low Populated Region is a result of interaction of many factors linked to local specific conditions, historical development of the economic basis of the given region and its ability to respond to external stimuli (innovation). It is characterized by the GDP creation per capita. The above indicator represents a relation between the total volume of the generated GDP and the number of permanent residents in the given territory. Its advantage is that it reckons with the population which is relatively easily identifiable even in the international context. Drawback: It does not reckon with the performance of economically active citizens only but the calculation can be considerably affected by the balance of commuting to/outside the given region.

Human Resources

The economic success of the low populated region is decided by the way it is able to make use of the spectrum of sources available. In this regard, human resources play a critical role as their flexibility, knowledge and innovativeness determine whether the region can response to the internal and external economic stimuli. If the local inhabitants are able to make use of these impulses for valorization of local (or regional) sources, the region is highly likely to be successful in the global competition. On the other hand, it is not necessary to adapt to this model in all EU areas and to focus the development on the critical industries and currently prosperous fields only.



Their importance and positions, however, changed dynamically in a few years after 1989 due to structural changes. The low populated region ranks, for a long time, among the economically weak and structurally affected regions. The improper transformation of economy and other structural changes have adversely affected educational structure over a long period of time, as exemplified by the brain drain (a very low share of people with university education). Although this brain drain is apparently even more supported by relative nearness of an attractive region, the impacts of the brain drain further deepen the related degradation processes even in other areas of the socio-economic structure as demonstrated by the shrinking population, reducing price of real property, a reduced ability of these regions to make use of the local sources to create new jobs and, last but not least, in the conditions for the civil society development. Discontinuation of adverse processes in the South Bohemia region is clearly subject to improvement of the offer of jobs both in the structure and the total volume.

Also disagreement between the quantity and also quality supply and demand of labour especially at the microregional labour markets appears problematic. To correct this deficiency, it is necessary to utilize a wider range of tools from strengthening the active employment policies, optimization of the structure of fields of study at secondary schools and universities, promotion of further education, increase in the investment attractiveness of problematic regions to mobilisation of local inhabitants.

Sectoral Structure and Tourism

The sectoral structure reflects the potential of regional competitiveness, however, at the same time, it indicates possible instability of the low populated region development, its lability and dependence on a relatively small group of impulses. On the other hand, relative lagging behind is associated with the production base built on the traditional raw materials exploitation and non-innovated heavy industry. In comparison with other economically advanced EU countries, an important structural problem from the further development viewpoint is a high share of the processing industry in the national economy structure. An important industry which can help initiate the economic development mainly in stabilized and peripheral areas is **tourism**. For its development, this industry uses both the landscape potential and cultural monuments and the natural resources in the area. A number of touristy areas lie in the stabilized, in some cases also peripheral areas defined by the basic typology of the low population regions. From the regional policy perspective this industry is, apart from other effects, an important generator of employment opportunities.

Foreign Direct Investment

Integration of low populated regions in the variable global economy places heavy demands on the ability of innovations and the ability to adapt to current trends and to utilise new knowledge and information. A large inflow of investors not only creates new jobs, but also leads to spreading of the new corporate culture based on emphasis on the staff knowledge.



Transport and Traffic Services

A geographical location and the related transport accessibility and traffic services help create preconditions for the development of economic activities and achieving the regional competitiveness. Importance of the geographical location and transport accessibility has been decreasing for a long time in connection with a relative reduction in the price of transportation, and the quality aspects of competitiveness are coming to the fore. **The transportation, however, plays a critical role in starting the low populated region.**

Especially the road transport can be considered the primary and defining mode of transport which can be associated with the term "regional competitiveness". The basic road network of regions is quite dense; a part of that is in unsatisfactory condition. Besides a positive effect in the form of sufficient traffic permeability of the territory, this also entails important drawbacks in the form of high operating costs (maintenance, reconstructions). The road network is characterized by its concentric arrangement with an important relation to the main roads. Thanks to the boom of automobilism and the road and freight transport, importance of the railway transport gradually changes and decreases, especially in the regions of low population. For these regions, especially the transit railway corridors of an international relevance and long-distance lines are important from the viewpoint of transport of cargo and especially the passengers.

Despite this fact, the need for completion of missing stretches of transit railway corridors and further improvement of their parameters and capacity in case when building of new fast railway links appears to be unachievable in the medium term can be considered a priority. Regional railways are an important part of traffic services and integrated transport systems in the big towns and cities as well as an important factor of traffic services in peripheral regions. These railways, however, need considerable improvement of their technical condition to enable an increase in speed and better interlocking.

An important role in the development of sparsely populated regions and their competitiveness in human resources is currently played by **integrated transport systems (ITS)**. ITS have enjoyed the boom especially in the recent decade. At present, this system was built in the majority of regions with a differently developed level of integration. The **cycle transport** which becomes a very important element in tourism is a significant addition and alternative for the development of low populated regions.

Tourism

Tourism is a specific part of the low populated areas development. Spatially, it is a very differentiated phenomenon. It is utilized only in selected regions and locations with favourable conditions for its development. Therefore, rather different regularities work here than in other sectors of national economy (factors which affect its localization and development are different). The result is an ability of tourism to help in reducing socio-economic disparities in the areas (regions in peripheral areas,



mountain regions, etc.). From the perspective of the development of low populated areas, the stronger internal relations of actors which lead to relatively lower outflows of money from the region are an important specific feature of tourism. The reason is complexity and cohesion of the product of tourism. For a number of regions, tourism represents the only potential for development of their infrastructure, business and employment. Attractiveness of the tourist destinations is primarily given by attractiveness of their natural and socio-cultural environment. Natural and cultural values are the basis of the offering of majority of destinations in low populated areas. Care for these values is, thus, in the interest of tourism as such. Application of sustainable development principles in tourism is, therefore, more than important. Tourism makes it possible to develop and valorise the natural, cultural and historic potential of given places which would remain, to a large extent, not utilized without tourism. An intermediated influence of tourism on performance of other sectors is substantial for development of low populated areas. Tourism helps to employ a lot of people. It is especially an ability to generate employment which is a very interesting and valuable feature of tourism.

Innovation and Technology

Effective functioning of the research and innovation system is a key pillar of development of economic prosperity and competitiveness of regions. The permanent and intensive interaction of both systems is crucial. An effective and good quality research is a primary source of new knowledge. It expands achievable technological possibilities which can be used for innovation. The prerequisite for economic improvement of achieved scientific and research knowledge is the well-developed cooperation between the companies and research institutions and linking of this cooperation to the area of education and training. The quality of research depends on the modern (i.e. globally competitive) research infrastructure, quality human resources, research internationalisation (from the viewpoint of both the composition of individual institutions' teams and international cooperation with top partners), focusing of capacities and resources on the fields of study carefully selected in compliance with the concept of intelligent specialization. For low populated areas, research is a possible initiator of their development.

Public Administration

An integral part of the low population regions' development is the quality of the institutional environment – the quality of the public administration performance which demonstrates in the quality of business environment. Various evaluations declare the necessity to improve law enforcement, to relieve bureaucratic burden, to simplify the system of taxes and to prevent its frequent changes and to restrict corruption and frequent changes in the legal environment. **These qualities are not of a regional dimension.** They are generally applicable. In this regard, it is necessary to change the legislative environment and functioning of the public administration system in relation to both the citizens and the political level in running the country and public institutions. From the viewpoint of the promotion of development of low populated areas, it is a specific part of the public administration



activities, which is focused on promoting the development of sufficiently dense network of consultancy services, options for networking (Internet expansion) as a part of support of the business entities especially in economically problematic areas and cooperation between the public and business sectors. Another important aspect is support for development of these regions by means of fostering traffic services.

Unless the above facts are supported, the depopulation of low populated regions will continue and the migration will increase.

The recent years saw aggravating of the problems of individual **disadvantaged groups of inhabitants** (disabled people, older persons, minorities, homeless people, etc.) in the areas being studied especially due to impacts of the economic recession. Their "at risk of poverty" level increases and their access to the labour market is aggravated. These problems must not be underestimated. If they are not solved, the social exclusion of disadvantaged groups will intensify and the numbers of these groups in population will rise.

Unemployment

The long-term higher risk of unemployment in low populated areas threatens especially the risk groups at the labour market (graduates, persons over 50 as well as the people with disabilities, etc.). As to the education, the persons with basic schooling or persons with a certificate of apprenticeship (without a general secondary education exam) are most affected by unemployment and their positions at the labour market continue to deteriorate. The unemployment rate of the persons with the completed university degrees is steadily the lowest, even in the low populated areas. We can expect further increase in the unemployment rate in low populated areas, especially at the risk groups. Reduction of their labour market prospects can cause follow-up social problems of these groups of inhabitants.

Healthcare

Likewise the education, demographic changes are also reflected in the healthcare and social services - however, here it is a different type of changes (ageing of population). In recent years, the life expectancy has gradually increased and the lifestyle of inhabitants has changed as well as their health problems. The availability of healthcare in low populated areas has not increased – the number of physicians has been reducing for a long time. It is, therefore, absolutely necessary to develop transport systems enabling commuting for healthcare even outside the public service.

Social Services

At present, the network of social services is not homogeneous in the low-populated territories of the European regions and the content of this network is not clearly defined. As ageing of inhabitants continues, the interest in social services is expected to grow steadily. Availability of social services is generally better in urban centres and worse in peripheral regions.



Culture

Culture covers a wide range of activities: art, culturally educational activity, cultural heritage, churches and religious communities, radio and TV broadcasting, enforcement of the copyright and the like. A specific feature of the culture is considerable importance of non-professional activities, especially the leisure and community activities. Especially in the country, there are theatrical clubs and other associations in charge of the social and cultural events. Non-professional activities are focused especially on local or regional traditions which increase attractiveness of the area for tourism and strengthen identification and relations of the inhabitants with the region they live in.

Social Exclusion

The social exclusion is currently one of the biggest social problems in the European Union. Various groups of people are endangered by it, for instance, the Roma communities, but also older people, low-income groups and others are at risk of social exclusion. Apart from social consequences, the exclusion has a spatial context, too – accumulating of persons endangered by the social exclusion in a certain area leads to the formation of socially excluded locations. The problem of these locations is especially a low quality housing, overcrowding of flats, unsatisfactory infrastructure, high cost of running the dwelling (energy leaks, wasting) and maintenance, occupation of the dwelling without the lease agreement, insufficient legal protection of tenants and bad recovery of payable debts of the landlords. These areas are also characterized by the presence of various negative phenomena, such as poverty, over-indebtedness, addictions (gambling, alcohol, drugs), etc. The inhabitants in socially excluded locations generally have low legal awareness and low trust in institutions (including the courts and the police). Usury is also one of the most pressing problems in the socially excluded locations. These phenomena consequently generate the above-average level of crime in the given locations. The key prerequisite for integrating the socially excluded inhabitants is their integration in the educational process and the labour market.

Development and State of the Environment

Thanks to the development of economic activities of the human being during the evolution, the originally natural landscape more or less changed in a vast majority of the EU's territory (natural ecosystems became artificial ecosystems), which entailed a number of negative consequences that need to be solved using the environmental protection tools. The life quality of inhabitants of individual regions depends on the quality of the environment and technical infrastructure. Achieving the highest value is one of the goals of all decision-making activities. The priority areas of the environmental protection currently include the waste water management, waste handling, air and climate protection and protection of natural values of the landscape and its sustainable utilization.



Main Factors of Low Populated Areas Development

Position of Regional Policy in the Public Policy System of EU Countries

The regional policy was conceived in EU around 2000. The essential incentives for its creation were the deepening regional differences in the social and economic development of the countries in the context of the economic crisis and the commencement of the process for preparing for EU accession by the new members. Despite very fast building of regional policy pillars (passing of the regional development support law, Strategy of Regional Development and State Programmes of Support for the Most Problematic Regions), the regional policy was difficult to enforce besides the already introduced sector policies around in addressing the key priorities of the regional development (e.g. labour market, infrastructure or business support) and from the viewpoint of the volume of financial means spent by means of the specific regional support programmes.

Demographic Development and Labour Market

The recent demographic development which constitutes a key factor of the regional development is characterized by the deepening spatial differentiation of its main indicators as a result of wider socio-economic and spatial changes. Given the relative spatial homogenization of the natural population change indicators, the migration is what makes a difference in the territorial population distribution and this trend is highly likely to continue.

Economic Factors

A number of economic factors (economic performance, sectoral structure of economy, size of companies or modernization factors) continue to be among the decisive factors of the spatial differentiation of EU development. From the viewpoint of the economic performance, the bipolarity of the territory has had a long-term impact (in the economic decline period it deepened). This bipolarity is given by a dominant position of Prague as one of the poles of the European development (in terms of the GDP per capita, it ranks among 10 best performing EU units) and other parts of the country with not considerable differences in the economic performance among the individual regions which is, however, well below the EU average. However, differences at the level of smaller territorial units continue to deepen.

Infrastructure

If it has a quality and sufficiently dense network, the infrastructure has a considerably positive influence on the regional development. This, however, holds true only where there are other key factors of the development available in the given territory, namely human resources and the innovation potential. The conditions given by the geographic location of low populated areas are characterized by the connection to the international infrastructure networks.



Technological Changes and Innovation

Technological development and innovation in the close connection to science and research are an increasingly important driver of the economy development across economic sectors and the factor which, if applied well, may contribute, to a large extent, to removal of essential barriers in the development of individual regions (e.g. reduction of the energy and material demands) or initiate the major structural changes towards higher competitiveness.

Quality of the Environment and Living Conditions of Population

The quality of the environment in the Czech Republic has a substantial impact on the state and prospects for development of individual regions. Impacts of the state and development of individual components of the environment manifest themselves not only in various parts of the country but also in individual types of the territory. Overall, the areas with a high degree of the environmental threat can also be found in the territories with the above-average concentration of settlement and economic activities.

Cultural Potential and Tourism

The culture constitutes an important factor of the regional development, differentiated in individual parts of the country by the size of its potential and possibilities of its use. Its use, to a large extent, replicates the concentration of tourism and spa industry.

Strong points in introducing the regular transportation in low populated areas:

- Infrastructure development for science, research and innovation in selected centres,
- Development of integrated transport systems,
- A growing share of technologically demanding fields in total sales in the processing industry,
- Increase in the number of economic entities,
- Growing cooperation between the public and private sector in building scientific and technical parks, business incubators, etc.
- High rate of households equipped with the Internet in metropolitan areas,
- Intensive development of non-motorised transport for safe commuting to work and tourism.



DISTRIBUTION OF TRANSPORT SERVICE IN LOW POPULATED AREAS

An important aspect in determining how the created transport service should be brought to a customer is to find a method of its distribution and suitable communication with a customer. This step can ensure that the transport service will be offered at the right place at the right time. The marketing business concept requires communication with the current and potential customers. Companies need to inform their customers on a new service, its properties, technology, price and the place where such service is provided.

1 – basic level

2 – expected level

3 – extended level

The main goal of the transport service is to satisfy the needs of customers in an optimal way which is referred to as usefulness of place and time. The distribution of transport services represents a special situation when the services which enable distribution of the consumer and industrial goods are to be distributed. In this case, the distribution in transport must be considered in a wider context, i.e. as a range of all negotiations with a customer and a decision which relates to the distribution of transport services to the customer. The decision on the method of sale of transport services directly affects any other marketing decision. The pricing behaviour of a transport company will also depend on the fact if it will sell its services directly to the customers or by means of other participants. The direct sale is considered to be the most suitable method of the sale of services. Although this method is common, a number of transport service providers seek new channels (e.g. Internet) to achieve the faster and more efficient sale. The selling channel must work as a system. The members of distribution channels are involved in not only the sale of transport services but also in information and financial flows, stimulating of the sale, communication with customers and accepting the risk. The more activities are ensured by the transport service provider, the higher prices it can offer. If any activity is provided by an agent, its costs and profit must be covered by its commission. In some cases (e.g. in the public passenger transport), the users of the transport may decide that some activities in the purchase of transport services will be performed by them (purchase of tickets from automatic vending machines or via the Internet). The marketing business concept requires communication with the current and potential customers. Companies need to inform their customers on a new service, its properties, technology, price and the place where such service is provided.

Communication must not become an end in itself. The main goal of communication is "shortening" of the distance between the transport service provider and the customer. This can be achieved by:

- Informing the customers on the types of provided services,
- Providing information on the place and time of service sale,
- Providing information on the forms of sale,
- Greater knowledge of the buying behaviour of customers.



The main communication channels in the transport include:

- Advertisements,
- Sale support,
- Personal sale,
- Public relations,
- Internet.

The set of individual communication tools forms a communication mix. Each of the above channels has its pros and cons. Given the variable nature of transport services, it is necessary to adhere to certain principles in the marketing communication, e.g.

- A) To provide tangible elements. The transport service is intangible. A customer buys a certain transport performance of the company. Tangible elements of the provided service may be formed by e.g. advertising materials on the transport company, refreshment during the transport, etc.
- B) Communication continuity. It is important for achieving differentiation and consistency throughout the transport service promotion (consistent company brands, symbols).
- C) Direct communication with the employees. While providing the transport service, some employees are in direct contact with the customers. It is, therefore, important to focus advertising also on the employees and to increase their motivation.
- D) Use of reference customers. This form of advertising can be an important tool especially in the passenger transport.

Creation of the communication programme must be based on the knowledge of transport needs of customers. The most suitable is the situation when a customer uses the services of a single carrier for a long time. Both parties can benefit from stability of customers. The carrier which has stable customers may reckon with:

- A) Better utilization of capacity of its means of transport,
- B) Certain level of consistent sales for provided services,
- C) More suitable temporal distribution of the service providing process,
- D) Certain specialization of the fleet with a focus on quality requirements of passengers and characteristics of the transported goods.

Stable customers of carriers may, on the other hand, reckon with:

- A) Better contractual conditions (discounts),
- B) Stable and reliable transport services,
- C) Creation of conditions for delivery in the JIT mode,
- D) Reliability and soundness of rendering those services which matter most to the customer.



OVERVIEW OF THE RESULTS OF ASSESSMENT OF LOW POPULATED AREAS WITHIN NATIONAL STUDIES OF EU

Although many studies estimated the values of time, there are two reasons why we fail to have sufficient evidence of how these values change with the mode of transport, namely

- 1) Studies dealing with the appraisal of the value of time tend to focus on a specific mode of transport more than on application of the mode of transport selection to avoid additional noise related with the data selection,
- 2) Models of the mode of transport selection often specify the common time parameters across the modes of transport and rely on the specific constant in differentiating of quality differences.

A majority of national studies dealing with the values of time estimated the values of the public transport and car. Values of the car were sometimes estimated for the car user and values of the public transport for the public transport users. For this reason, the effects of the user type and the appraised mode of transport are mixed. The most comprehensive description of the difference of value of time as per both the user type and mode of transport is included in the first Danish study of the national value of time (Gunn and Rohr, 1996). It describes how the values of time in vehicle change as per the user type and the mode of transport in relation to the value of the time in vehicle of the car users.

Summary

The given analyses prove that the quantity of bus and train transport links is directly proportional to the population of municipalities. In smaller villages, however, the public transport reflects the real demand of passengers only in a very limited way. This situation is also affected by especially "erosion" of the demand for transport services from the viewpoint of the link directions and temporal distribution.

While before 1989, commuting to work was arranged predominantly hierarchically (to the departmental municipality or another superior settlement), the present commuting destinations are far larger and commuting is often carried out at various times. In this situation it is more apt to use a private car than the mass transport which is expected to strengthen its indispensable importance in smaller settlements especially in the case of transport of citizens who are not allowed to drive their own car (passengers under 18 years old, older people, etc.).

The size according to the population of municipalities is also reflected in the rate of endowment of households with passenger cars. We can point to a total higher number of passenger cars in municipalities with lower population (less than 500 inhabitants). These municipalities currently have the relatively lowest supply of the public transport. This increased number of passenger cars in the country does not constitute any serious problem (in comparison with urban areas). The smallest



settlements, however, belong to the demographically old areas, i.e. the areas with a higher share of retired people for whom a higher risk of inability to drive a car can be expected (so-called transport exclusion).

The results of the comparative analysis, however, proved significant differences as to the supply of the bus transport not only according to the size of municipalities but also among individual regions. These differences in transport alternatives in regions are mainly affected by the type of settlement, its scatteredness or consolidation, and the related population. The policy of the region in the field of regional traffic services is essential. It should reflect "advantageousness" of the settlement structure by means of the various level of financial support. The statistics of the Ministry of Transport of the Czech Republic also show that some regions spend considerably less money on the regional traffic services per a part of the municipality or per an inhabitant than the others.

In comparison with foreign countries, other alternatives of transport are not much used in the small villages. Sometimes, the deployment of minibuses can be observed – their operation, however, is not considerably cheaper. Another alternative is utilization of the local municipal taxi (i.e. local municipal authority's car) based on the municipal timetable of shared journeys which help the inhabitants to agree on the journeys in the same direction. A number of these alternatives function in our villages in a spontaneous and not coordinated way. Their systematic coordination and organization could result in more frequent and satisfactory utilization.



METHODOLOGY AND SOURCE OF DATA FOR ASSESSMENT OF THE INFLUENCE OF TRANSPORT ON LOW POPULATED AREAS

Introduction

The methodology of the paper is determined with respect to the defined objectives. The first objective of the paper is to find whether the regions with a better level of transport accessibility also show better indicators of the socio-economic development of monitored EU regions (Saxony-Anhalt, Mazovia, Ozalj, Vysočina, Modena, South Bohemia, Žilina, Nagykálló). At the same time, our task will be to recognize whether the transport affects the economic development of low populated areas or this development happens independently of the transport. Although the data we will use fail to cover the whole range of the socio-economic level, they are able to describe relations of a few basic factors of socio-economic dynamics of municipalities, namely the business activity, unemployment, migration balance and commuting to work. With respect to the objectives of the paper, the methodology will be based on two fundamental approaches to evaluation of transport factors affecting the socio-economic sphere. First, we will evaluate an overall level of transport accessibility in selected EU municipalities. If we want to describe accessibility of the centres, it is, logically, the best indicator. Second, we will examine the public mass transport in municipalities as it is the second most important way of how to commute to the selected centres. Traffic services, moreover, allow us to evaluate well the differences at the transport infrastructure level. It also enables us to capture the spatial injustice factor as not all citizens can commute by car and they depend on the public mass transport. Factors of transport accessibility and traffic services will be then compared with socio-economic factors of the EU areas. As an additional research hypothesis, we will verify the assumption of whether the selected peripheral regions of EU show the worse transport accessibility and traffic services than the development (urbanized) areas.

Transport Accessibility Analysis

In the analysis of transport accessibility we decided to use the relational transport accessibility, i.e. transport accessibility of EU municipalities into their departmental places. We chose three types of spatial relations, namely spatial relations of municipalities and their microregional, interregional and macroregional centres. These regions were defined upon commuting to work in 2015. The objects of accessibility were microregional, interregional and macroregional centres of the selected EU areas.



Definition of Work Centres and Regions

A microregional centre is understood as a centre with a minimum of 1,000 occupied jobs, which was a target of at least one maximum flow of commuting to work from any other municipality. Also the microregion which includes municipalities from where the maximum flow of commuting was channelled to the microregional centre was defined this way.

Analyses consisted of the three main steps:

1. Determining of the number of occupied jobs for each municipality;
2. Directional determining of a maximum flow of commuting to work from each municipality;
3. Final application of both criteria and selection of a set of working centres:

Occupied jobs (OJ) in the municipality were calculated as follows: $OJ = EA_{zam} + EA_{doj} - EA_{vyj}$, where EA_{zam} is a number of economically active employed people in the given municipality, EA_{vyj} is a number of economically active employed people commuting to work outside the municipality and EA_{doj} is a number of economically active employed people commuting to work in the given municipality. The people with an unidentified economic activity were calculated proportionally between the economically active and economically inactive; within the economically active people they were further proportionally allocated among the employed and unemployed people and the women on maternity leave. The number of economically active employed people (EA_{zam}) was determined – EA_{OPM1} (a total number of economically active people after deduction of unemployed people). The commuting balance (i.e. the value $EA_{doj} - EA_{vyj}$) was calculated using the sums of total commuting to work outside and inside the relevant municipality (Note: the flows with an unidentified target were allocated among 4 strongest flows coming from the given place of leaving).

Table 1: Selected characteristics of monitored areas (2016)

Total population in centres	5504176
Total number of economically active (EA) people in centres	3414125
Of that:	
Economically active employed people	3200865
Unemployed people	228098
Total number of occupied jobs in centres	3609233
Total balance of commuting to work per a set of centres	590600
Share of a set of centres in a total number of selected areas in EU	65.4%
Share of the set of centres in a total number of EA in EU (selected areas)	60.2%
Share of the set of centres in a total number of occupied jobs in EU (selected areas)	80.1%

Source: Author



Working microregions were defined based on the above methodology of definition of the microregion working centres. The criteria: at least one municipality (other than a centre) should belong to the microregion and none of microregions should drop below the limit of 6,000 inhabitants after making partial adjustments. The adjustments were made to allow definition of compact non-perforated regions.

Table 2: Selected characteristics of monitored areas (2016)

Average population in the working microregion	40164
Average number of economically active people in the working microregion	17320
Average number of occupied jobs in the working microregion	17854
Average number of municipalities in the working microregion	29
Average population in the centres of microregions	23201
Average population in the centres of microregions	5121333
Average number of economically active people in the centres of microregions	10509
Total number of economically active people in the centres of microregions	2995487
Average number of occupied jobs in the centres of microregions	14109
Total number of occupied jobs in the centres of microregions	2785456

Source: Author

Elements of Accessibility

For the purposes of the suggested classification, the elements of accessibility are defined as follows. The subject of accessibility is the selected municipalities in monitored areas from where we examine accessibility to the centres, i.e. objects of accessibility. The object of accessibility represents a determined target (certain opportunity, activity, service) accessibility of which we want to find out. In this case, the centres of employment opportunities (of working nodal regions) were selected.

The transport element represents a link between the subject and the object of accessibility, i.e. the link between the municipality in administrative division and the centre of employment opportunities (town in administrative division).

Analysis of Selected Socio-Economic Indicators

The quantity analysis of the differentiation of socio-economic indicators in the monitored areas makes it possible to generalize the knowledge obtained from a large volume of data. The application of quantity analyses in the geographical research is, however, associated with many problems and restrictions related to especially a spatial nature of data. First, in analysing the data aggregated into territorial units we cannot exclude the fact that the relations monitored on the population level do not have to apply equally to all areas. The results of spatial statistic analyses considerably depend on the exact definition of used territorial units and the chosen scale level of monitoring. This phenomenon was very strongly felt in studying of the transport indicators which are, in principle, determined by the definition of the centres of commuting. As far as the socio-economic indicators are concerned, we considered the defined municipalities of EU as one unit and, therefore, determination of nearness of



the centre of commuting to work was less notable (perhaps except the share of people leaving the municipality). For the explanatory power of the summary analysis of the economic position of municipalities it is necessary that all indicators within a given analysis are consistent and represent the situation from a similar perspective. The indicators which fail to make this but are important can be used as supplementary in interpreting the results of analysis. In this case, these indicators were the rate of commuting to work and the migration balance.

The economic position of municipalities was evaluated upon the business activity, the analysis of the labour market and basic demographic data, such as a migration balance and commuting to work from municipalities in the territory under investigation. A few indicators were chosen for the geographical analysis and territorial differentiation in a whole set of monitored areas. Namely, the business activity (a number of registered active economic entities per capita, a share of employers in the number of economically active people in the municipality and a share of the number of self employed persons in the number of economically active people), unemployment rate, tax yield per capita and demographic indicators and a share of people commuting to work outside the municipality in the population of the municipality). The supplementary explanatory factors which we used in factor analyses included the population of municipalities and the number of occupied jobs in microregional and interregional centres.

Correlation of Individual Indicators

A correlation is an interaction between two variables. If one of them changes, the other changes, too. For an analysis, we used the calculation of the basic indicator of correlation dependence – correlation coefficient. The task of the basic correlation coefficient is to measure the intensity of change of the dependent variable character value during the change of the character value of the independent variable. Determining of this intensity (intensity of correlation dependence) is a necessary step for the regression analysis. In the case of the transport accessibility indicators and socio-economic indicators, the intensity of dependence of two phenomena (two random quantities X and Y) is measured using the correlation coefficient (marked as R or r_{xy}). The use of correlation coefficient assumes a normal division of both selections (if not, both selections need to be converted to this division). Another condition is linearity of the x_i and y_i relation, i.e. the regression function must be a line. The above coefficient is also frequently referred to as "Pearson correlation coefficient" in the scientific literature. The important term of the correlation and regression analysis is a correlation diagram, i.e. a scatter plot (XY) which displays both random variables. Due to the extent of study, it was not provided. The calculations were made using the Statistica. We calculated the correlation coefficients for individual pairs of variables, namely the indicators of transport accessibility and traffic services in the selected EU areas. We correlated this set of first variable with the indicators of the second variable, i.e. individual socio-economic indicators. First, we chose the level of significance, i.e. a probability that a random deviation will exceed the given value, i.e. a critical value. The correlation was done on the



level of significance $p = 0.05$ (95 %). Some pairs of variables (see the analytical part) proved to be significant on this significance level. The statistical set we used contained 5,333 municipalities. In case of the microregional level, we removed microregional centres from the set and worked with a set of 4,248 municipalities. Similarly, on the interregional level, we removed interregional centres and worked with 4,987 municipalities. At the moment when p is less than 0.05 (red figures) we reject the null hypothesis which says that the correlation coefficient equals zero, i.e. it is not significant. On the other hand, if p is greater than 0.05 (black figures), the relation on this level of significance is not significant.

CORRELATION ANALYSIS

Introduction

The correlation analysis was chosen as a method for determining significance of the relationship of individual transport and socio-economic indicators. The relationship between these quantities can have various intensity – from the full independence (0) to the full (functional) dependence (1). We want to evaluate the level of dependence of these two random quantities. The level of dependence will be characterized by the level of statistic dependence intensity. The level of significance was chosen as $p = 0.05$. If there is a correlation coefficient of a black colour in Tables 3 and 4, it means that the level of significance was not achieved ($p \geq 0$) and no significant relationship between the indicators can be found out. The correlations marked in red are, on the other hand, significant on the level of significance $p < 0.05$. Although their correlation coefficient is very weak, certain dependence is apparent on the given level of significance. Given the very high number of compared data, even very weak relations were statistically significant. While in comparing the data on 27 samples the mean dependence may be statistically not significant, in correlating of 2,000 samples the virtually unimportant, unusable relation may be highly statistically significant. First, we created the categories which were then compared using the correlation coefficient. Virtually all compared indicators of the socio-economic level of municipalities as well as their transport accessibility and traffic services were categorized. The signs of indicators in Table 3 and 4 show the correlation. A positive sign means that the higher is the first indicator, the higher will be the second indicator. A negative sign means that the higher is the first indicator, the lower will be the second indicator. In case of some indicators, understanding of this relation is basically inverted. For instance, a higher level of transport accessibility in fact means a worse accessibility, as the number of kilometres and minutes needed for commuting to the centre is higher as well as the average speed because an average speed is basically higher on a longer route to the centre. Similarly, a higher average point value of the first arrival at the centre and the last departure from the centre mean a later first arrival of the transport link from the municipality to the centre and the earlier last arrival of the transport link to the municipality. A higher value of the first arrival and the last departure, therefore, means a worse level of traffic services. Although the readers may find it confusing, the data were conceived this way and were not adjusted any more. Only the regional centres where the values of traffic services and accessibility were zero were removed from the data. The reason was that the accessibility to these centres was monitored (departures of transport links were consolidated with respect to deviations among individual monitored areas).



First, we evaluated the correlation of socio-economic indicators among them to determine the relevance of individual socio-economic indicators in other analyses. The number of companies per capita had the highest level of correlation with other indicators. It was followed by the share of employers in economically active people. Also a gross level of migration balance correlated relatively strongly with other indicators, especially the business activity indicators. Unemployment correlated most with a share of leaving persons (the more leaving persons, the lower unemployment). The share of leaving persons reflects the transport accessibility most, but, except for unemployment, it least represents the other socio-economic indicators.

Table 3: Levels of correlation coefficient among socio-economic indicators

Indicators	Number of active companies/inhabitants	Employers / Economically active people	Self-employed/Economically active people	Unemployment	Leaving people/inhabitants	Relative level of migration balance 2001/2011	Yield of personal income tax
Number of active companies/inhabitants	x	0.32	0.51	-0.18	-0.03	0.19	0.15
Employers/Economically active people	0.32	x	0.15	-0.10	0.09	0.29	0.23
Self-employed/Economically active people	0.51	0.15	x	-0.07	-0.03	0.21	0.12
Unemployment	-0.18	-0.10	-0.07	x	-0.27	0.01	-0.04
Leaving persons/inhabitants	-0.03	0.09	-0.03	-0.27	x	0.19	0.00
Relative level of migration balance 2001/2011	0.19	0.29	0.21	0.01	0.19	x	0.11
Yield of personal income tax	0.15	0.23	0.12	-0.04	0.00	0.11	x

Source: Author

Total resulting relations among the correlation analysis indicators are very weak, except for the relation between the traffic services indicators and the population. Especially the relation between the number of public mass transport links and the population shows the clearly highest level of dependence (0.67 on the microregional level). The influence of transport accessibility on the indicators of socio-economic position is considerably weaker on the interregional level than on the macroregional level. The reason is that we work with a very high number of interregional transfer points. If only the regional towns were among the interregional transfer points, the dependence would be higher. In our concept, the interregional transfer points are basically similar to the microregional centres. However, the following principle holds true: the better is the level of transport accessibility of the municipality to the interregional centre, the higher is the positive migration balance as well as the number of leaving persons and a share of employers.



On the microregional region, dependences of transport and socio-economic indicators are in the even less close relation than on previous levels. Paradoxically, the indicator of an average level of traffic services shows a higher level of correlation than on the interregional level. The better is the average number of traffic services, the higher is the population of municipality and positive level of migration, the share of employers and the share of leaving persons. On the other hand, unemployment is lower.

The influence of the transport accessibility is rather weaker. The average speed of commuting to the centre, which represents a greater distance from the centre, has the greatest dependence on socio-economic indicators. The higher is the average speed of commuting to the centre (greater distance), the lower is the share of leaving people and the share of employers and self-employed people. On the other hand, the rate of unemployment is higher. In case of other factors of transport accessibility, the dependencies are not too clear. Also on the microregional level, the following principle applies: the better is the (average) level of traffic services and transport accessibility, the higher is the positive level of migration, share of leaving people and business activity (a higher share of employers). Unemployment is lower. The results of some indicators are not, however, clear and, therefore, cannot be overestimated. What is more, the level of the so low correlation is the lowest on the microregional level.

Results of transport indicator correlations are provided in the Annex. They are divided into the microregional, interregional and macroregional level.



Table 4: Levels of the correlation coefficient among the indicators of transport accessibility and traffic services and socio-economic indicators on individual regional levels

Regional level	Indicators	Total population	Self-employed/Economically active people	Employers/Economically active people	Unemployment	Relative level of migration balance 2001/2010	Number of companies/inhabitants	(leaving persons/inhabitants) x 100	Income tax / capita	Difference in income from personal / corporate income tax
Into the microregional centre	Accessibility in km	0.01	0.13	0.01	-0.02	0.10	0.12	-0.09	0.02	0.01
	Time accessibility	0.00	0.16	0.02	-0.07	0.04	0.07	-0.09	0.03	0.05
	Average speed	-0.09	0.03	-0.11	0.08	-0.13	0.04	0.12	0.00	0.00
	Number of public mass transport links	0.67	-0.04	0.25	-0.10	0.17	0.02	0.05	0.00	0.00
	Average time of journey using the public mass transport links	-0.15	0.15	-0.04	0.04	-0.02	0.06	-0.10	0.00	0.00
	1st arrival of the public link to the municipality	0.31	-0.07	0.05	-0.08	0.07	-0.19	0.05	-0.04	-0.01
	Last departure of the public link from the municipality	0.40	-0.09	0.10	-0.03	0.19	-0.05	0.04	-0.02	-0.00
	Average value of traffic	0.49	-0.17	0.17	-0.03	0.12	-0.06	0.19	-0.03	-0.05



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Into the interregional centre	services									
	Accessibility in km	-0.03	0.04	-0.15	0.09	-0.10	0.02	-0.14	0.00	-0.03
	Time accessibility	-0.06	0.06	-0.07	0.09	-0.13	0.09	-0.16	0.00	-0.03
	Average speed	-0.05	-0.01	-0.14	0.03	-0.17	-0.08	-0.03	0.00	0.00
	Number of public mass transport links	0.51	-0.07	0.23	-0.13	0.18	0.08	0.04	0.00	0.00
	Average time of journey using the public mass transport links	-0.19	0.08	-0.15	0.07	-0.19	0.01	-0.16	0.09	0.00
	1st arrival of the public link to the municipality	-0.19	0.06	-0.09	0.08	-0.13	0.04	-0.11	0.02	0.00
	Last departure of the public link from the municipality	0.31	-0.05	0.13	-0.07	0.21	0.03	0.05	0.02	0.00
Average value of traffic services	0.18	0.00	0.06	-0.04	0.03	0.07	-0.09	0.02	0.00	
Into the macroregional centre	Accessibility in km	0.00	-0.22	-0.05	0.21	-0.27	-0.31	-0.06	-0.09	-0.05
	Time accessibility	0.00	-0.27	-0.08	0.21	-0.28	-0.21	-0.07	-0.05	-0.05
	Average speed	0.04	-0.15	-0.09	0.17	-0.31	-0.29	0.08	-0.07	-0.03

Source: Author



The problem of this analysis is the fact that we correlate the transport accessibility to the centres with socio-economic indicators of all municipalities from different regions.

Based on the correlation analysis of the above mentioned indicators, we will now try to answer the question asked at the beginning of the project. It was confirmed that the municipalities with a better level of transport accessibility and traffic services show also a better level of region's socio-economic development indicators in selected EU areas. The results of correlation analysis of individual indicators confirmed the statistically significant dependence thanks to a large volume of statistical samples. Generally, we can conclude that the better level of transport accessibility and traffic services indicated, in principle, a higher positive level of the migration balance, higher business activity, lower unemployment and a higher share of people leaving for work outside the municipality. It is, therefore, justified to ensure the quality and sufficient public transport in the low populated areas.

Regression Analysis Based on the Centre Size and Commuting

The results of the first analysis make it clear that the number of companies per inhabitant and the share of the people commuting outside the municipality has a totally decisive influence on the high level of the variability being explained. A higher number of jobs in the centre means a worse average accessibility of municipalities for the private motor vehicle transport in the given working region. This is naturally based on the fact that the bigger centres of work create bigger working micro-regions and, as a result, a higher percentage of the municipalities accessible in the worse way. What is more, also the long passage through the bigger centres into the centre of the municipality makes the accessibility worse. In other words, the people commute to the bigger centre from the bigger distance more often.

Table 5: Degrees of regression coefficients among the selected socio-economic predicates and the transport accessibility factors

Socio-metric indicators	Distance of the micro-centre	Accessibility of micro-regional centre	Traffic services of micro-regional centre	Accessibility of mezo-regional centre	Traffic services of mezo-regional centre	Accessibility of macro-regional centre
Number of occupied jobs in the regional centre	0.8	0.8	0.31	0.70	0.20	-----
Number of occupied jobs per economically active people in the municipality	-0.07	-0.04	0.19	0.02	0.16	0.15
Rate of unemployment	-0.01	-0.00	-0.05	0.03	-0.08	0.23
Gross number of migration balance per inhabitant	-0.12	-0.17	0.03	-0.25	0.09	-0.21



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Number of companies per inhabitant	-0.06	-0.06	-0.05	-0.02	0.16	-0.19
Share of people commuting outside the municipality per inhabitant	-0.15	-0.19	0.06	-0.18	0.06	0.19
Yield of personal income tax per inhabitant	-0.03	-0.03	-0.02	-0.03	-0.01	-0.07

Source: Author

The explanatory power of the transport accessibility factor on the macro-regional level was the greatest of all levels (0.67). A better transport accessibility of the macro-regional centre means a lower unemployment rate, higher positive level of the migration balance, higher number of companies per inhabitant and, to a lesser extent, also a higher yield of the personal income tax. On the other hand, the better transport accessibility demonstrates a lower share of the people commuting on the macro-regional level. This is affected by the location of a great number of other centres of commuting to work in all investigated areas which markedly put into context the concentration of the people commuting near the bigger towns. All of these dependencies move around the regression coefficient value of 0.2, which shows a weak dependence.

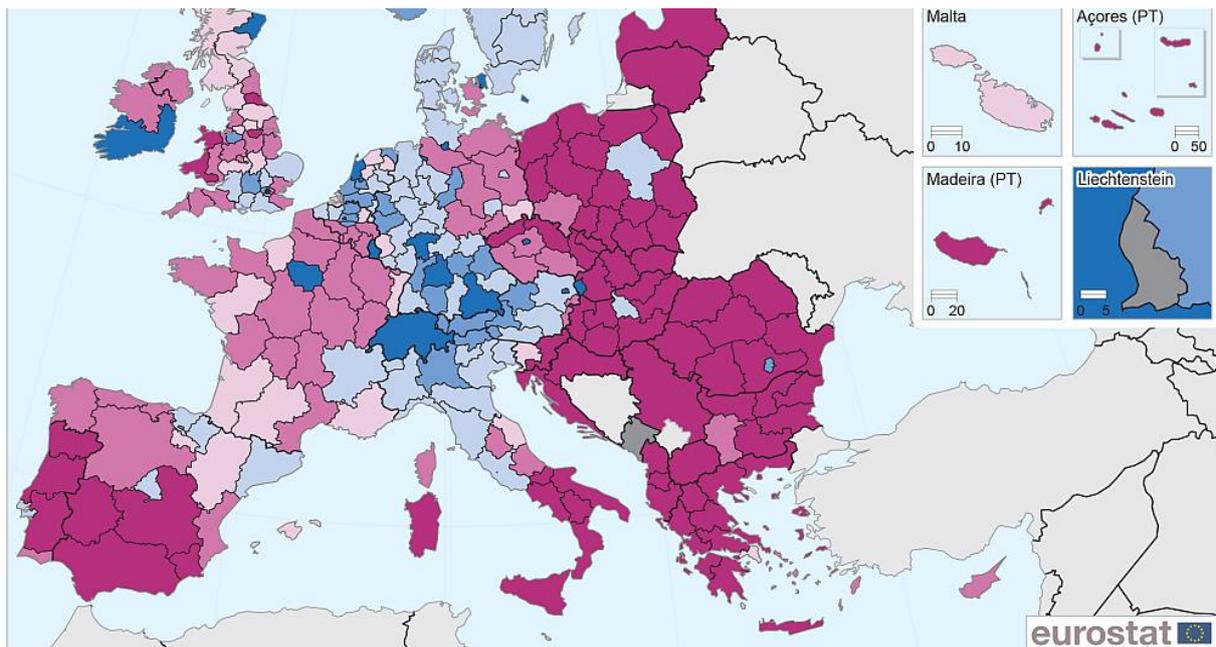
On the mezo-regional level, we can see the dominant influence of the mezo-regional centre size expressed by the number of occupied jobs. The better transport accessibility of the mezo-regional centre means a higher positive degree of migration balance and a higher share of people commuting to work outside the municipality. Other factors correlated with the better transport accessibility in a very limited way. In case of the traffic services, on the other hand, we can see the relatively lower influence of the centre size although it is still the most significant of all factors. A better level of traffic services of the mezo-regional centre logically means a higher number of occupied jobs in the centre and a higher number of jobs in the municipality as well as a higher number of companies per capita in the municipality. Such a municipality is also, to a lesser extent, characterized by the better positive migration balance, lower unemployment and a higher share of people commuting to work.

On the micro-regional level, the factor of transport accessibility is affected most by the centre size. A better transport accessibility of the micro-regional centre is clearly associated with a higher number of the commuting people and a higher positive level of the migration balance as well as the higher number of companies per inhabitant. Looking at the relationship with the traffic services, we can see very clearly the power of the micro-regional centre and the economic power of the municipality itself expressed by way of the number of jobs. On the micro-regional level, other factors are not associated too much with the traffic services. The better traffic services thus imply, to a lesser extent, the lower unemployment and a higher share of the people commuting outside the municipality. Paradoxically, they imply the lower number of companies per inhabitant in the municipality.

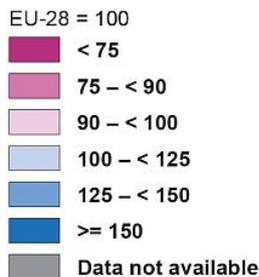


To sum up the individual socio-economic indicators, it is clear that the size of the regional centre has the biggest impact on the level of transport accessibility and traffic services. Also a higher positive degree of migration balance and a higher number of commuting people imply the better transport accessibility for the private motor vehicle transport and traffic services provided by the public mass transport. Unfortunately, these indicators fail to demonstrate the socio-economic (development) level of the municipalities under research. Only the migration balance can imply well whether the municipality makes a progress or not. A higher number of companies on all levels, except for the micro-regional one, implies a better level of transport accessibility and traffic services. Looking at the map of the spatial distribution of the GDP activity, it is clear that the centres which are closer to the regional (working) centres show a higher business activity throughout Europe. The yield of personal income tax, basically, fails to demonstrate any important degree of the relationship with transport indicators. A better transport accessibility for the private motor vehicle transport, however, means, to a lesser extent, a higher yield of income tax.

Figure No 1: Amount of GDP in regional areas of EU

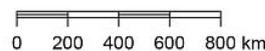


(% of the EU-28 average, EU-28 = 100)



Administrative boundaries: © EuroGeographics © UN-FAO © INSTAT
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Cartography: Eurostat - GISCO, 07/2017





Correlation and Map Comparison

As a last analysis, we chose the correlation and the map comparison of selected transport indicators with a comprehensive socio-economic typology of municipalities as per the indicators used in the execution of the RUMOBIL project by all participants. We made a comparison of the average point values of the typology and the transport indicators, specifically the average value of traffic services to the micro- and mezo-regional centres. The typology of the areas under study (selected low-populated areas) was assessed from the viewpoint of the synthesis of indicators of the municipality conditions development and the settlement structure. The typology compares the development features of municipalities also in the context of the settlement conditions and the spatial structure of socio-economic phenomena. The level for the typology definition (types of areas) is determined by the variation range from positive values through the transition zone to negative values. The positions of territorial units in the indicators values were taken from the analysis of partial activities (T.2.1.1. and T.1.3.3.) as made by the RUMOBIL project participants.

The development areas can be characterized as economic centres of a regional importance with a higher population concentration and a higher number of businesses. The cores of given regions often represent dominant centres of employment. These are the highly urbanized areas.

Peripheral areas, on the other hand, are the geographically outermost territories coping with the long-term cumulated problems (e.g. montane regions, border regions, internal peripheries or the areas with specific problems). Here, the negative features cumulate, such as insufficient endowment of the area, often poor transport accessibility or high unemployment.

In the development areas, we can find a high degree of conformity between the municipality typology and traffic services. As far as the peripheral areas are concerned, the comparison of results is rather more complicated. Basically, we can define the peripheries in both characteristics. The traffic services are greatly affected by the organization of transport in individual regions in connection with the average size of the municipality.

If we apply the statistical correlation, we will get a relatively strong relation between the socio-economic typology of municipalities and the average value of traffic services provided by the public mass transport links in the micro- and mezo-regional centres. The correlation achieves the value of more than 0.5; we can, thus, show the medium dependence on the given level of significance. The better the socio-economic level of municipalities is, the better the level of traffic services is. Also the time demandingness of transport infrastructure used to serve the mezo-regional centre shows the low dependence. The better the socio-economic typology of municipalities is, the better the time demandingness of transport infrastructure is. It means that the combination of the distance and the average speed of commuting to the mezo-regional centre is better. Very weak dependence can be seen with time demandingness of transport infrastructure serving the micro-regional centre. It also



exemplifies that the better the socio-economic level of the municipality is, the worse the time demandingness of transport infrastructure serving the micro-regional centre is.

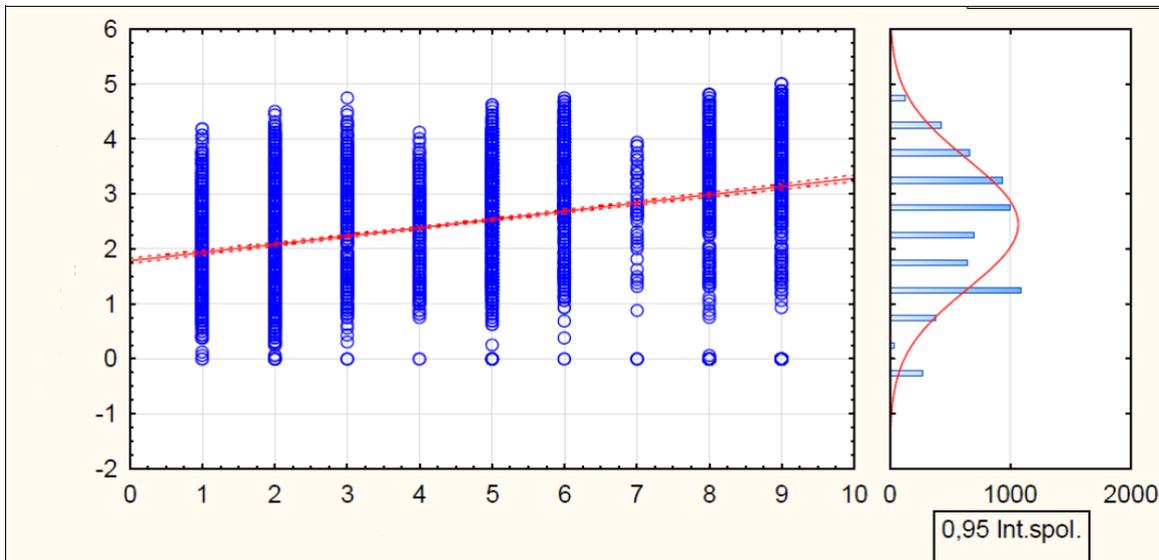
Table 6 Degrees of correlation coefficients between the region typology and the traffic services and transport accessibility indicators

	Average point value of traffic services (micro and mezo-regional centres)	Time demandingness of transport infrastructure (micro-regional centres)	Time demandingness of transport infrastructure (mezo-regional centres)	Time demandingness of transport infrastructure (micro- and mezo-regional centres)
Socio-economic typology of regions	0.601	0.075	-0.327	-0.175

The above described correlation coefficients of two strongest dependencies, namely a socio-economic typology of municipalities with an average value of traffic services and time demandingness of the transport infrastructure serving the mezo-regional centre were supplemented with the scatter plots. The scatter plots interleave the average values of the total traffic services with the aggregated socio-economic sphere indicators. The interleaved regression line describes the trend of values relatively well. Values are aggregated into the columns as it is the point scale. The graph unambiguously proves the important effect of the public transport on the low-populated regions.



Figure No. 2 The scatter plot of dependency of the average value of traffic services with the typology of municipalities interleaved with the regression line and distribution of values (areas of the RUMOBIL project).



The right-hand part of the picture shows the frequency bar chart of individual values. The probability distribution of data shown in the bar chart models, describes or foresees the random behaviour of variables. It can be described using the probability, distribution or frequency functions (frequency bar chart). In both cases, it is roughly the normal distribution. In case of dependency of traffic services on the typology, the distribution of values is less close to the normal distribution than in case of dependency of the time demandingness of transport infrastructure and the typology of municipalities. Both the regression line and the frequency bar chart prove the suitability of the applied method of correlation and the regression line interleaving is roughly the same as the distribution of values. As the last analysis to compare the socio-economic typology of municipalities with the level of traffic accessibility and services, we used the regression analysis based on the factors defined in previous models. The dependent variable, i.e. the typology of municipalities (i.e. the combination of socio-economic factors), significantly depended on the traffic services. Dependency on the level of traffic accessibility, on the other hand, was very low. This also confirms the results of previous steps.

Table No. 7 Degrees of regression coefficients of traffic accessibility factors (predicators) affecting the region typology.

Transport factors (independent variable)	Typology of regions (dependent variable)	Explanatory power of the model
Micro-regional accessibility	-0.05	0.32
Micro-regional traffic services	0.61	
Mezo-regional accessibility	-0.14	0.35
Mezo-regional traffic services	0.59	

Source: Author



Conclusion

Based on all analyses made in this Chapter we can conclude that the better the level of public traffic services and, to a lesser extent, the level of transport accessibility of the private motor vehicle transport are, the better the total socio-economic indicators indicating the development potential and the population density of municipalities are.

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