

INDIRECT BENEFITS OF D11 MOTORWAY FOR SPATIAL SOCIOECONOMIC DEVELOPMENT

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For municipalities situated up to 15 minutes of car travel from the D11 motorway between Praha and Hradec Králové, the following characteristics were surveyed:

- proportion of commuters to Prague
- number of job opportunities in the municipality
- unemployment rate in the municipality (4/2008)
- transport accessibility (time needed) from the municipality to Prague or to a district town
- transport accessibility (time needed) to the nearest exit
- theoretical (determined by a model) location potential of the municipality in relation to Prague and to a district town (the power of Prague or a district town expressed by the formula: the number of inhabitants divided by the distance from the town to the surveyed municipality)
- total location potential (the sum of both partial location potentials)
- municipality potential (total location potential related to the surveyed municipality power, i.e. the number of inhabitants in the municipality)

The analysis of the data above produced several fundamental, statistically relevant correlation relations among the surveyed characteristics.

The location potential of Prague shows the closest correlation relations. A correlation with 5 other characteristics was proved on the 99% significance level.

Based on the relationships thus obtained, we may judge that the potential of Prague has a much higher weight for the surveyed municipalities than the potential of Hradec Králové, and therefore the

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location in relation to the capital city is much more significant for the municipalities than their location in relation to Hradec Králové.

Key words: motorway, D11, development

1 Introduction

It is in the interest of each country to develop harmonically and in a balanced way the whole of its territory, to reduce the differences between the levels of individual regions to reasonable level and to support their economic and social development. A lower performance of some regions may be caused by their remote location and poor-quality transport accessibility. These effects result in insufficient exploitation of the territory as the production factor and, moreover, require enhanced assistance from public funds in the form of social services and incentives within the region (such as higher expenses for unemployment benefits).

In terms of economic effectiveness it is essential for all public funds invested in a supported region to bring the highest possible effect in the form of private investments. Analogically to the creation of new jobs the effect on the existing jobs, as well as secondarily arising other jobs, is investigated. In both cases, the so-called multiplication effect is at work causing that the impact of the initial impulse (investment) sets off a multiplied growth in an economic environment.

Due to the significance of transport infrastructure for the development of economy, fast and high-quality accessibility of individual regions and enhancement of the quality of life of their inhabitants, a natural need arises for qualifying the corresponding financial resources spent on its implementation within a short-term as well as mid-term horizon.

The specification and expression of economic benefits of transport has dramatically gained in importance during the last years being the subject of numerous national as well as international studies and evaluation projects.

Due to the exceptional demands and scope of preparatory phases of road development projects, the research is oriented towards the benefits of road transport. The results of previous partial studies allowed expressing the association of the economic power of districts of the Czech Republic and the quality and capacity of transport routes, the positive effects on the safety on new roads and the quantification of unfavourable effects on the inhabitants living in the close vicinity of existing congested highways. In general, transport geography studies concur in opinion that motorways are important condition of regional and local development, but not sufficient one.

Two categories of benefits may principally be distinguished:

- benefits of transport infrastructure,
- benefits of transportation performances (processes).

The benefit of transport infrastructure consists in improving transport conditions in order to reach financial economies. The principal effects are lower operating costs for means of transport, lower time losses and lower accident-related and environmental costs. The starting point is cost savings; the assessment compares the costs for transport for the case of the implementation and without the implementation of the respective investments.

These benefits are usually referred to as direct benefits serving, above all, for the users of the transportation route. They include, in particular, the following:

- time savings,

- energy savings (driving fuel),
- reduced vehicle wear,
- reduced accident rate.

Talking about the benefits of transport, we, above all, refer to the benefit of higher transportation performances. The economic benefit of transport (both in passenger and freight transport) is manifested through national-economic benefits arising through mobility in the sense of possibilities of overcoming distances affecting the division of labour and the productivity of the population and the economy.

These benefits are usually referred to as indirect benefits serving, above all, for the inhabitants of the affected territory. They include, in particular, the following:

- increased number of job opportunities
- -improved environmental conditions (noise, emissions) for the people living along existing overloaded main roads
- assessment of ecological effects on the territory,
- higher value of the territory by the establishment of commercial and industrial zones,
- higher economic power of municipalities resulting from improved transport accessibility,
- better accessibility of the territory for tourist trade and relaxation of inhabitants,
- revitalization of building activity during the construction of the transport route and its successive maintenance,
- setting limits for sustainable development of the territory.

In order to quantify indirect benefits, first it is necessary to delimit the territory which may be presumed to be affected by the construction of a high-capacity road. A suitable strategy seems its subdivision based on individual exits of the future road with hinterlands specified by accessibility of up to 15 minutes of travel by motor vehicle.

The main assessment factors used describing the changes resulting from the new situation were four cumulated benefits listed below, which are currently the subject of investigation based on the analysis of data availability in relevant databases, including the criterion of the time series of data acquisition:

- increase in the number of job opportunities,
- effect of mobility on the economic growth,
- higher value of the territory,
- environmental effects on the territory and its inhabitants.

In order to project these factors into real conditions, selected characteristics have been used together with the evaluation of the results of their analysis, as is described in the chapters below.

2 Selected characteristics for determining indirect benefits of transport infrastructure

Municipalities selected for analysis were chosen – in agreement with previous research (Lehovec et al. 2003) – within the distance of 15 minutes of car travel along the D11 motorway (Praha - Hradec Králové). An average speed 60 km/hour was entered into software ArcView which selected municipal areas touching this distance. Therefore analysed area could seem a bit wider but it allows distance of motorway influence revisal and it does not lower results of analysis. The following characteristics of probable indirect benefits have been assessed:

- percentage of commuters to Prague
- number of jobs in a municipality
- unemployment rate in a municipality (4/2008)
- transport accessibility (in time) from a municipality to Prague or the provincial capital
- transport accessibility (in time) to the nearest exit
- theoretical (specified by a modification of gravity model) location potential of a municipality towards Prague and the provincial capital (the power of Prague or provincial capital = number of inhabitants) divided by the distance of the city to the investigated municipality)
- total location potential (sum of both partial location potentials)
- potential of a municipality (overall location potential related to the power of the investigated municipality, i.e. the number of inhabitants)

For simplification of this primordial, elementary analysis, only Hradec Králové and Praha have been considered as provincial capitals at the “end” of D11 motorway. City of Pardubice as important centre influenced by motorway D11 will be included into analysis in next steps. However, Pardubice is a bit side of D11 main direction and in passenger transport it is substantially served by railway transport.

3 Correlations between investigated characteristics of municipalities located along d11 motorway

The data analysis provided several principal, statistically relevant correlations between the investigated characteristics in the case of the D11 motorway.

3.1 Location potential in respect to Prague

The closest correlations are manifested by the location potential of Prague. A correlation with 5 other characteristics was proved on a 99% significance level.

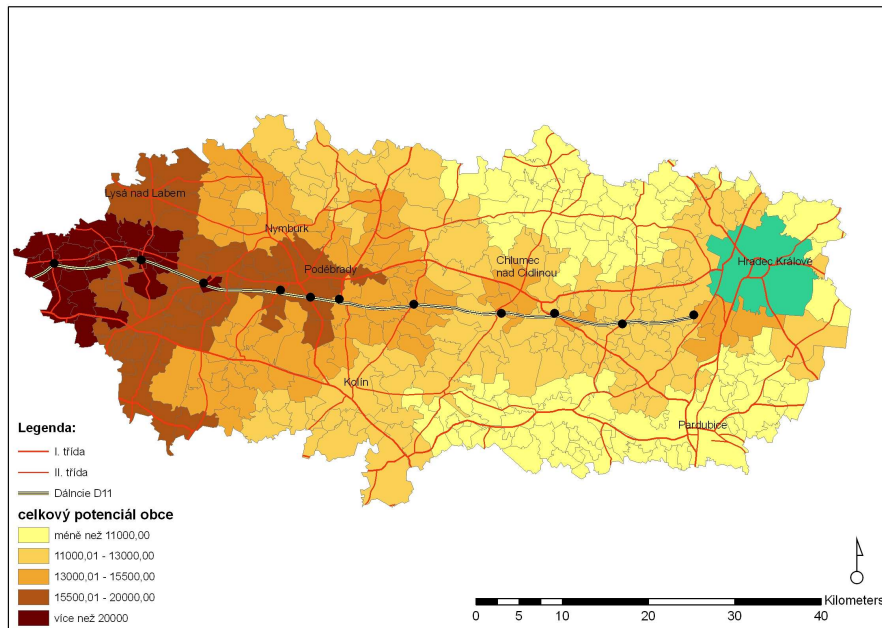
A strong negative correlation on a 99% significance level was manifested with the location potential of Hradec Králové (- 0.569) and the distance of a municipality from the exit (-0.502). These values imply that the potential of Prague naturally diminishes with shorter distances of a municipality from Hradec Králové, and, at the same time, with growing distances from the motorway exit. As a consequence of a slightly lower relevance of the relation between the location potential of Prague and the distance of a municipality from the exit (as compared to the relation to the location potential of Hradec Králové) we may say that off the motorway the location potential of Prague follows a more random pattern, or declines with a lower regularity than on the motorway.

A positive correlation of the location potential of Prague was also recorded, on the one hand, with the potential of a municipality (0.365) and with the overall location potential (0.974) on the other. If we compare the values of these dependencies with the relations between the potential of Hradec Králové, the overall location potential (-0.367) and the potential of a municipality (-0.144), the evident outcome is not only the opposite orientation of the relation resulting from the localization of Hradec Králové at the opposite end of the motorway, but also a far lower intensity of the relation between the investigated characteristics. These relationships, therefore, lead to a conclusion that the potential of Prague has a much greater relevance for the investigated municipalities than the potential Hradec Králové, and, therefore, the position towards the capital city is much more significant for municipalities than their position towards Hradec Králové.

Overall location potential

The overall location potential showed a relatively high value of a negative correlation (-0.556) with the distance of a municipality from the D11 exit, i.e. that the growing location potential (i.e. with a better accessibility to Hradec Králové or, mainly, Prague) is inversely proportional to the distance from the motorway exit. This points out in particular the localization of exits leading towards larger centres, or easier access onto the motorway in the vicinity of both investigated centres.

Map 1: Overall potential of municipalities – D11 motorway



Map 1 clearly shows that municipalities lying in the motorway corridor, whose overall location potential has been increased, are predominantly situated up to 15 km from the D11 exits. Higher values are reached for closer distances from the D11 motorway and, above all, from Prague. Due to the increased potential of municipalities, a greater attractiveness for living both in the municipalities themselves and in their surroundings may be presumed.

3.2 Mobility

A significant positive relation (a correlation coefficient of 0.835) of mobility (i.e. the percentage of commuters to Prague) was logically manifested with the location potential of Prague.

It implies that the percentage of commuters to Prague grows with shorter distances from the capital city. The largest percentage of economically active commuters travelling to Prague, therefore, exists in the hinterland of the capital city.

A comparable correlation coefficient (0.827) was reached by the relation of mobility to the overall potential, which is caused by a significant mutual correlation of the location potential of Prague and the overall location potential (see above). If the relation of mobility to the potential of a municipality is investigated, a relatively low correlation level (0.392) is revealed. Due to the similarity of the indicator with the overall location potential (the calculation of the potential of a municipality further included the power of a municipality) and a lower intensity of the mutual relation, we may assume that it is the power of a municipality above all (i.e. its population size) that has a decisive influence acting against the investigated relation and lowering the correlation coefficient's value. This is caused by the fact that the

size of municipalities within the investigated territory along the D11 motorway changes in an irregular pattern (i.e. both small and big municipalities may be found at the start, but also at the end of the motorway), while mobility declines with growing distances from Prague.

A negative correlation coefficient was recorded in the relation of mobility to the location potential of Hradec Králové (-0.425) and the distance of a municipality from the exit (-0.258). This relation only confirms that with a growing distance from Prague (or with a shortening distance towards Hradec Králové) and from the motorway exit the percentage of commuters to Prague declines.

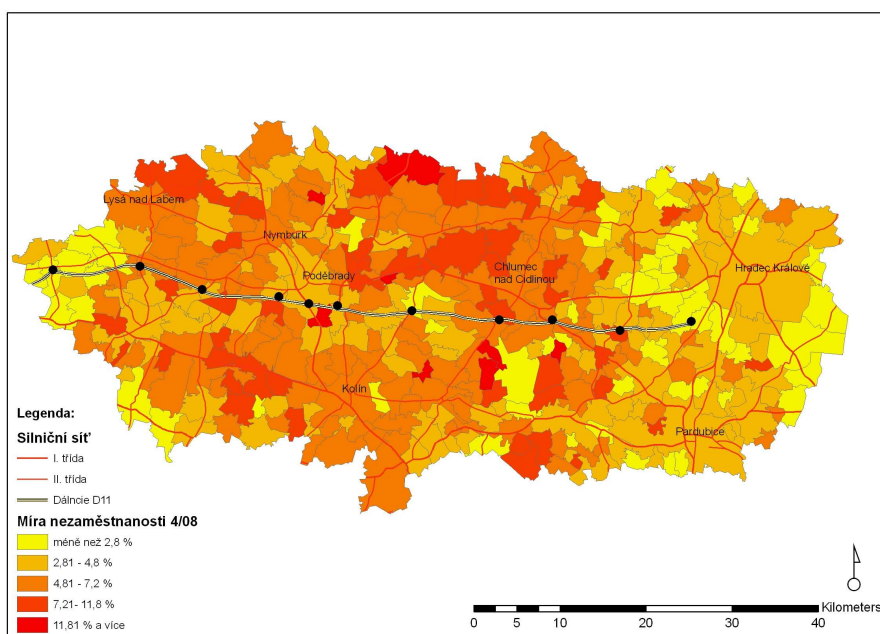
3.3 Job opportunities

The number of job opportunities is in no way affected by the distance from Prague or from Hradec Králové, and the overall potential of a municipality does not play any role in here either. Thus, the number of job opportunities solely depends on the size of the respective municipality, i.e. also on the municipality potential, which is based on the population size of the municipality. The correlation coefficient of this relation amounts to 0.711.

3.4 Unemployment rate

The unemployment rate as seen on Map 2, significantly depends solely on the location potential towards Hradec Králové (-0.308), but relatively weakly, and it is done rather by specific situation than general trend. The unemployment rate declines with the growing location potential of Hradec Králové, i.e. with shortening distances towards this provincial capital. This is caused by two factors. On the one hand, the strip of municipalities along the motorway includes relatively few municipalities in the hinterland of Prague with a very low unemployment rate, while, on the contrary, close to Hradec Králové, but also to nearby Pardubice, there is relatively a large number of municipalities with a low unemployment rate due to the abundance of job opportunities in the both provincial cities.

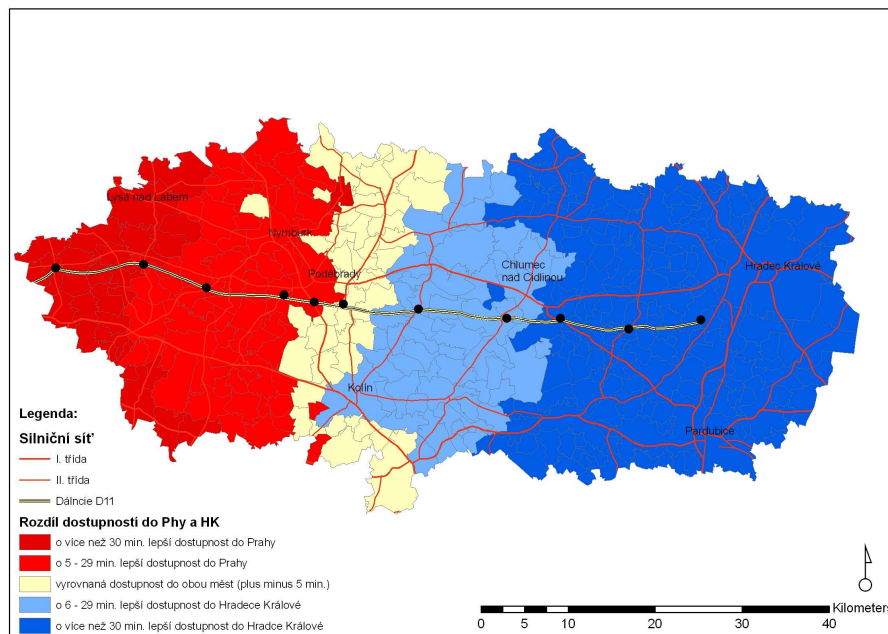
Map 2: Unemployment rate (April 2008) – D11 motorway



3.5 Transport accessibility

The comparison also included the accessibility values to Prague and Hradec Králové and the volumes of car travel to Prague. Map 3 displays the zones of the investigated territory subdivided according to different accessibility levels to Hradec Králové and Prague. Blue zones correspond to better transport accessibility to Hradec Králové, while red zones express better transport accessibility to the capital city. The yellow strip includes the municipalities with balanced transport accessibility both to the provincial and the capital city.

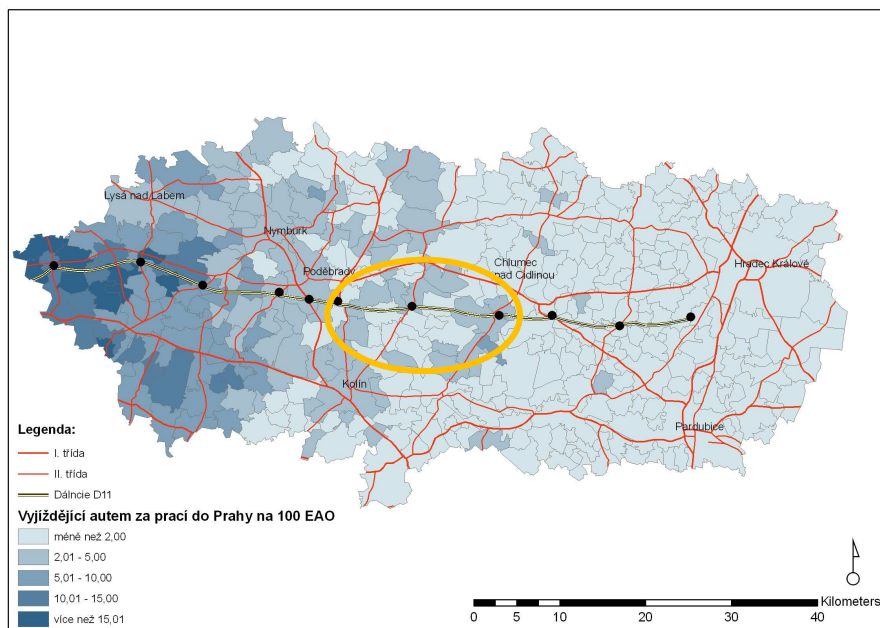
Map 3: Differences in accessibility to Prague and Hradec Králové for municipalities along the motorway



Source: authors' calculation

Maps 3 and 4 further show that commuters to Prague also come from the municipalities which have better transport accessibility to Hradec Králové, who – judging by the criterion of minimizing the time and financial demands connected with commuting to work - should rather commute to the provincial capital of Hradec Králové. The potential of Prague and its attractiveness, however, is greater, and therefore the commuters to the capital city also include the economically active inhabitants who live closer to Hradec Králové. This phenomenon may be observed in the strip of municipalities situated between Poděbrady and Chlumec nad Cidlinou (highlighted by an orange oval on Map 4) and it may be considered as an indirect effect of the D11 motorway, which considerably raises the accessibility of the Prague job market.

Map 4: Volumes of cars commuting to Prague



Source: Czech Statistical Office

4 Conclusion

The effect of the motorway on the unemployment rate in investigated municipalities has not been statistically fully proved, but the fact is that unemployment is reduced particularly by increased commuting. In terms of time savings and reducing transportation costs, however, it would be optimal to work at the place of living or in its close surroundings; commuters for longer distances, however, may use their higher qualifications. It has been proved that a greater number of job opportunities are offered by municipalities with larger populations regardless of their location in relation to the motorway. The rate of the motorway effect on the growth of the number of job opportunities is difficult to prove (among others due to the “shading” of the general economic development, lack of data etc.) along one investigated motorway route. There is always interference of job attractiveness of cities and quality of accessibility. Here, a solution could be intensive research of other routes of high-capacity roads and selected settlements as conclusions drawn from a limited number of case studies presently still do not lend themselves to generalization.

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