Group-specific analysis of commuting in the most disadvantaged areas of Hungary

Alpek B., Levente and Tésits, Róbert and Bokor, László

University of Pécs, Frugeo Geography Research Initiative

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Levente B. Alpek
University of Pécs,
Hungary
E-mail:
alpeklevente@gmail.com

Róbert Tésits
University of Pécs,
Hungary
E-mail:
tesits.robert@gmail.com

László Bokor
Frugeo Geography
Research Initiative,
United Kingdom
E-mail:
laszlo.bokor@frugeo.co.uk

The study aims to examine the commuting opportunities of the most disadvantaged job seeker groups living in Hungary's most disadvantaged regions, as well as Hungary's spatial and group-specific boundary conditions. The study also aims to develop and present an indexation process (fMFÁ model), allowing the measurement of the mobility degree of different territorial units (in this case, the municipalities) and effects of certain factors determining commuting (transport subsidies, individual choices and options). The index measures the degree of mobility by considering individual and several types of public transport, expenses and expected time of commuting. The present document defines mobility for territorial units, separating its objective and subjective types. The group-specific analysis of boundary conditions is implemented through a questionnaire survey and logical models, the aim of which is twofold. On one hand, the model specifies the maximum commuting distance, which would be accepted rationally for the most disadvantaged job seekers. On the other hand, it presents a decision-making dilemma, namely the choice between commuting to work and local employment. Thus, the study provides insights into the specific features of labour market mobility of the target group. The Average Mobility Level Model and the Adjusted Mobility Index also evaluate the regional structure of the group-specific features of commuting. Through all these, the present study may promote a more efficient spatial allocation of employment policy measures. Strengthening of local employment in areas where group-specific mobility degrees are lower and support to improve commuting opportunities and employment centres where the mobility degrees are appropriate can contribute to the decrease of unemployment.

Keywords:
commuting,
unemployment,
disadvantaged groups,
disadvantaged areas,
regional mobility,
Adjusted Mobility Index

Introduction

In Hungary, the dynamic rise of work-related commuting began in the 1960s. In this year, approximately every seventh, and by the 1980s, every fourth active wage earner had been commuting. Following this dynamic growth, the *growth in the number of commuters* became slightly moderated, but the national share remained nearly constant or even increased (Szabó 1998). As regards the regional specificities, concerning work-related commuting, the location of the place of residence was more and more significant; however, the dividing line did not lie primarily between villages and cities but the more advanced agglomerations and peripheral areas (Bihari–Kovács 2006).

In accordance with the spatial analysis of mobility, the need for clarifying the conceptual system arose as early as the early 1990s (Iván 1994, Illés 1995, Nemes Nagy 1998). In line with the approach of the present study, the most convincing statement is one that looks at commuting as a type of labour movement and searches its driving force in the concentration of residences and workplaces in different settlements (Kapitány–Lakatos 1993).

Research at the end of the 1990s conducted detailed analyses on the general forming factors of daily commuting (village-city duality, release of agricultural labour, administrative network, suburbanisation and the role of motivation), spatial characteristics of daily commuting, related socio-economic processes, and effects of some sub-policies. There were several points to address the difficult situation of the disadvantaged areas, the binding immobility due to low estate prices, and the weighing constrains of commuting. It was pointed out that peripheral villages and cities struggle to become involved in the inter-municipal labour flow (Szabó 1998). Therefore, questions arise from the perspective of nearly 20 years: has the situation been resolved and has the development of infrastructure and improvement of the accessibility of assets made the labour market dynamisation of the most disadvantaged job seeker group possible?

At the turn of the millennium, Gábor Kertesi analysed the factors affecting village commuting. The chalked up participation model and its empirical analysis pointed out the roles of those who completed the highest level of education and the adverse selection in labour market, including the residential effects of the type of commuting, role of family, travel expenses, housing prices and the questions related to employment discrimination (Kertesi 2000).

Tamás Bartus emphasised that the former approaches focused primarily on settlements instead of individuals; therefore, his objective was to highlight the role of expenses at a personal level. He raised the question of how travel distances affect the possibility of commuting. He stated that an employee – in the absence of travel allowances – is likely to choose to travel to work. Besides the limit values for distance, Bartus also included statements based on time and expenses (Bartus 2003). Moreover, it is also pointed out that travel expenses especially affected and restricted the work-

related chances of women and others with low levels of education (Kertesi 1997, Bartus 2003).

In the mid-2000s, articles focused on the different roles of means of transport, stating that settlements with better vehicle supply have lower unemployment rate and that the intensity of transport services and connections have a significant impact on the development of the labour market's local situation. The differences in supply, since the change in the political system, have become dramatically aggravated (Köllő 2006).

Although it is proven that after the change in the political system, the Hungarian labour market went through several transition stages; the most common forms of work-related migration remained the daily or weekly and short- or long-distance commuting (Kulcsár 2006). This upholds the relevancy of the questions, especially in the depressed areas and in cases of disadvantaged groups of which the nature and special characteristics of mobility issues have not fully been discovered yet. It is assumed that the transport situation of the disadvantaged areas, hindered by the highly limited opportunities of each social group, is less suitable for the dynamisation of the labour mobility. These effects have not been investigated yet; therefore, their analysis, focusing especially on the inner spatial differentiation of the disadvantaged areas, is one of the objectives of the present work.

The territorial investigations that address the identification of the labour market districts, the spatial segments of commuting that are also known as Local Labour Systems (LLSs), form the basis of the present work. Thus, the group-specific indexing of the mobility levels can be carried out. In the absence of an employment centre[1], the socio-economic situations worsen and the subject area may become sidelined, thus increasing its peripheralisation. The weak, local labour market forces people to commute to greater distances (Radvánszky–Sütő 2007). The latter phenomenon is highly significant from the conceptual perspective of the analysed spatial structure processes.

The question of commuting is strongly connected to other possibilities of reducing spatial differences, because daily labour migration is a relevant solution only if the other available alternative is highly expensive. In Hungary, the rate of ownership of private apartments by their occupants is high; furthermore, buying a home despite the high costs comes with high risk factors (Hegedüs 2003). Accordingly, compared to relocation, daily commuting presumably plays a more significant role in the easing of unemployment in the less developed areas (Bartus 2012). At this time, it must be highlighted that the role of the housing benefit policy may trigger trends other than those stated above (e.g. the homemaker's scheme). Besides pointing out the role of travel allowance on the increase in mobility, the authors also look to identifying the

[1] The main settlement(s) where people commute to work.

settlements – where the labour is from – which makes it worth commuting to distant workplaces. Thus, the analysis delineates the scope of the available, not available and isolated settlements from which it highlights the outstanding rate of those in the latter group located in the depressed areas (Bartus 2012).

The present mobility model broadens the range of analysis, which is important because of, on one hand, the changes occurring in the circumstances and, on the other hand, the need to answer the questions that remain open. The first refers to the increasingly dominant role of public employment, the salary of which is available in the distant workplace; as a result, it 'must' compete with, not the amount of benefits, but the higher public employee wages. This reduces the marginal utility of income available through commuting. Extension of the analysis is needed for the expansion of the horizon of the means of transport, evaluation of opportunities of the passenger vehicle and rail transport, and simulation of spatial effects, which is the key objective of this present work. It is important to note the research finding that states that the improvement of availability would not overleap the limit values necessary for the enhancement of mobility (Bartus, T. 2012). Therefore, the following question arises: Which limit values are affecting the disadvantaged job seekers from a mobility point of view?

The weight of spatial aspects had significantly grown by 2010 in the independent research analyses. János Pénzes, in his 2013 work, analysed the correlation among employment, commuting and level of income for North East and North West Hungary; this analysis had been preceded by similar evaluation of the Northern Great Plain and Western Hungary (Pénzes 2010, 2013). The delineation of the employment centres and districts forms the core idea of this study. In connection to this, Pénzes lays down the 60-minute psychological and timely limit of commuting. He also points out how the level of employability and income are becoming distant from the central areas (Pénzes 2013), which is the key reason for the increase in the periphery's relative competitive disadvantages. In conclusion, he states that 'the employability's spatially differentiated deterioration followed a specific pattern which also strongly correlates with the phenomenon of commuting' (Pénzes 2013).

Furthermore, the scope of spatial analyses involves a research, which aims to delineate LLSs based on most recent data and provides the basis for selecting the commuting relations analysed in this study. The objective of the work of János Pénzes, Ernő Molnár and Gábor Palóczi is to identify districts based on their labour market attractiveness. Their results show the labour market centres' decreasing number and increasing sizes. Besides the stronger centres covering vast areas, the dominant roles of the centres of small and more closed districts could be observed at the periphery (Pénzes–Molnár–Pálóczi 2014). Their study not only forms the basis of the present analysis due to its topicality but its delineation criteria and resolution also comply with this article's objectives.

With regard to the analysis on mobility, the overview of the literature pointed out that daily commuting is a multicomplex, socio-economic phenomenon influenced by several factors; however, it has not identified the most specific reasons amongst the most disadvantaged job seekers that influence spatial relationships at the highest level. Moreover, what the magnitude of these factors represents remains an open question. The analyses have further involved the spatiality, but a study that specifically targets disadvantaged areas and their job seekers' spatial mobility at the municipal level has not been conducted yet. The objective of the present study is to, therefore, analyse the conditions of the disadvantaged job seekers' mobility within a given segment of space. This is approached theoretically by using two models, which is then followed by crosschecking the purpose of testing of the obtained limit values and models with the results of the questionnaires and identifying other subjective factors. The obtained parameters form the basis of indexing the analysed people's level of mobility at the municipal level.

Research methods

As regards this present analysis, both primary and secondary resources have been used. For primary analysis, specific attention was paid to a cumulatively disadvantaged group of job seekers, who were distributed a questionnaire survey during a year's time (2015–2016); 579 responses were recorded. The investigation defined disadvantaged job seekers as persons who had at least two drawbacks as listed below:

- age of over 50 years,
- young (under 18 years),
- primary school or lower level of education,
- large family (in a relationship, married or raising three or more children) or single with children,
- long-term job seeker (for over one year),
- young entrant and
- bad financial situation.

Statistical records about the target group were not available during the investigation; therefore, the survey focuses on persons receiving Employment Replacement Support (FHT) and job seekers returning from public employment. The survey was based in districts with a complex development programme and the most disadvantaged microregions. The sampling used the following procedure. The questionnaires were received by local government offices of 885 settlements located in all regions (sent to the e-mail address). The cover letter and complementary phone calls asked the local governments to complete and return the questionnaires digitally. Mayors of certain small settlements, based on their local knowledge, forwarded the questionnaires to disadvantaged job seekers who did not meet the above criteria. To

increase the sample size, 113 South-Transdanubian settlements were involved during a field survey.

Some of the questions focused on mobility-related factors, especially stressing the analyses of affordable travel expenses and time frames. Besides the demographic questions, emphasis was given to wage-related elements and the availability of public means of transport. The restrictive factors of mobility were extracted using open questions. Among the factors limiting mobility, the present study distinguishes between the exogenous and endogenous elements depending on whether they are available to the individual and accessible by sensible efforts (inner factors), as well as elements according to the circumstances (outer factors) that may not be 'controllable' by the job seeker (or may only be controlled counter-selectively). The transition between the *endogenous and exogenous* elements is not clear, as it is affected by the range of available assets for the individual and variability of the socio-economic space. The exogenous and endogenous limits can be divided into those that are directly linked to daily commuting (travel expenses, availability of means of transport, travel time and resident commitment) and those that indirectly affect mobility (level of education, inclination to learn and marital status).

The input data of the models discussed below were collected in the second half of the investigation (January–March 2016). The data for the space/time matrix of the mobility model come from different sources according to the means of transport and transport relations. In the case of commuting by car, data come from the Google Maps route planner (https://www.google.hu/maps), whereas scheduling databases (http://www.volan.hu and http://www.mav.hu) were used for information in the case of public transport (bus and rail). Wage data (guaranteed public employment wages, minimum wages, guaranteed minimum wage, and employment replacement support) were determined based on the 'http://officina.hu/' portal and the Hungarian Gazette 206 of 2015 and 170/2011. (VIII. 24.) Government Decree.

The values refer to wage items applied from 1 January 2016. The calculation of overtime earnings was based on the values of Act I of the 2012 Labour Code and published in the 'https://jobline.hu/' portal. The analysis of transport subsidies was based on 39/2010. (II. 26.) Government Decree. In the present analysis, according to the above-mentioned sources, Mt = 86%, that is the aid covered 86% of the monthly cost of the journey. The amount of cost reimbursement calculated for cars (based on the same sources) is nine HUF/km. The average consumption for 100 km was fixed at six litres. The average unleaded gasoline 95 and diesel fuel prices during the period of data collection (January 2016) were published by the National Tax and Customs Administration of Hungary (http://www.nav.gov.hu/). The model was calculated using 21.5 working days per month.

In the analysis of the boundary conditions applied to the rational job seekers resulted in the formulation of two logical models. In the first case, the analysis of travel expenses is based on whether the individual acts and decides rationally, which

then determines that the viable amount of money emerges from the relationship between the wage proposal, including travel expenses provided by workplaces accessible by travel, reduced by the time value of lost working hours due to commuting, and the locally available salary.

$$J = B_y - (k_u + k_i) - B_x, \quad (1)$$

where B_y – Earning available at the new workplace, k_u – Travel costs, k_i – Time value of working hours lost by travelling, B_x – Locally available salary, J – Additional income available by commuting.

Tamás Bartus introduced a logic similar to the formulation above (Bartus 2007). If the additional income is positive with the above conditions, the individual is willing to commute. If J=0, the individual is indifferent towards commuting or staying in place; this is the limit value of mobility.

The other approach to the viable travel distance's limit value involves the job seeker taking the travel time as the working hour's increment; therefore, the additional input will be experienced as a specific earning reduction (the fixed monthly wage will be spread over longer periods of time). This means that the individual is willing to work as long as the hourly rate is higher than the average in the public employment sector. In this case, the following applies:

$$KMI = \frac{\sum_{i=1}^{a} \frac{K_e}{K_{össz}} * (KAérték_x + TAérték_x)}{n}, \quad (2)$$

where t_x – Working time in the local workplace, t_y – Working time in the distant workplace, t_u – Travel time.

The approach formulated and explained in point [1] can now be used with the following changes to examine the effects of the internal factors:

$$J_f = Be_y - ke_u - B_x, \quad (3)$$

where J_f – The remaining additional income due to travel commitments, Be_y – The probable value of the expected wage in the new workplace, keu – Travel expense, B_x – The probable value of the local income.

The value of lost time due to commuting k_i is omitted from the endogenous approach, because although the given factor expressly affects both the directly circumstance-affected, optimising individual and the job seeker with qualified rationality, the previous approach does not include its volume immanently. In this present situation, however, where the limit values are defined by individual expectations, Be_y also carries the value of k_i and thus the inclusion of k_i would lead to doubling.

The indexing of mobility levels was done with the assistance of the *folyamatos Mobilitási Fokok Átlaga* (fMFÁ)/Continuous Average Mobility Level and the *Korrigált Mobilitási Fokok Átlaga*/Adjusted Average Mobility Level (KMFÁ) models. The purpose of these models is the quantification of the mobility capability and skill defined along with variable factors. By 'mobility,' the present study means commuting

to work. We distinguish two different types of mobility. By objective mobility degree, we mean the accessibility of settlements (with no group-specific effects) in relation to the employment centre/attracted village, that is their integration in the transport network. The value of objective accessibility is high, provided that the employment centre can be reached quickly and cheaply by car, train or bus – regarding the optimised model by at least one of the above. The subjective degree of mobility is the empirically corrected version of the objective mobility; here, the values are weighted by the ratio of the availability of certain means of transport within the target group. For example, if the objective accessibility by car is suitable but available only for a small proportion of the target group, the degree of mobility decreases.

The fMFÁ model shows the favourability of the village/town's objective accessibility by assuming the comprehensive availability of the public transport in the analysis (namely, whether it is available for everyone or whether any service runs to the settlement). The higher values refer to better mobility possibilities. The general model approach, on one hand, counts the unlimited availability of the means of transport and, on the other hand, assumes that the choice of freedom collectively affects the conditions of the work-related commuting.

The reality is, however, more nuanced in two respects; one, the availability of public means of transport is not fully comprehensive and, two, individuals do not use all three available options at the same time. The former clause is resolved by KMFÁ's determination of the values. The optimised fMFÁ model is the approach of the latter with regard to the real situation. This model looks to identify how the mobility level develops, assuming that the job seekers optimise their possibilities and, in every case, choose a means of transport that is the most advantageous for the purpose of commuting to work.

The backbone of the model was based on the simplified mobility graphs of the analysed area/relations. The peaks of these were given by the indexed area's 'attracted' towns, villages and settlements functioning (or possibly having the ability to function) as employment centres. In the analysis of the settlements, the study used the results of the most recent literature (Pénzes–Molnár–Palóczi 2014); therefore, the present research does not intend to target the re-evaluation of the employment centre/attracted village relations or identification of the employment centres. For determining the commuting corridors, the study takes into account routes that are combinations of, first, the expenses and, second, the time factor and require the least possible financial sacrifice from job seekers. Thus, the paid and 'detour' routes are not preferred; however, for longer travel distances, expenses may be accepted if the related direction saves significant amount of time for the commuter. The calculation is based on a questionnaire survey on the time and cost preference system. The cost and time values used in the quantification of the mobility degree are based on the following principles:

• Ktgn – *n*-th cost limit (in present work HUF, but currency choice can be free). The model calculates using four steps, defined by the cost limit values based on the questionnaires. Ktg1 is the tenth percentile of cost-taking, Ktg2 is the thirtieth percentile, Ktg3 is the sixtieth percentile, and Ktg4 is the 90th percentile.

• Tn – *n*-th time limit (in minutes), which also forms group-specific 'psychological' boundaries, in the form of a time factor (theoretical maximum commute time spent on a daily basis). The model again calculates using four steps, defined by the time limits determined by the values found in the survey. T_1 is the tenth percentile of time taking, T_2 is the thirtieth percentile, T_3 is the sixtieth percentile and T_4 is the ninetieth percentile.

In the case of the most disadvantaged, unemployed group studied, the related parameters were as follows: Ktg_1=1,000, Ktg_2=4,000, Ktg_3=8,800, Ktg_4=20,000, T_1=5, T_2=14, T_3=30 and T_4=50[2].

The definitions of percentile and tercile limits depend on the investigator's preference system in the relation to commuting. In this case, according to the calibration of the model, mobility opportunities are excellent if the commuting cost and time factors are appropriate for 90% of the job seekers. In contrast, within the limits of the survey, mobility is highly unfavourable when traffic conditions in terms of commuting are adequate for a maximum of 10% of the job seekers. If the full mobilisation of the examined group is a high priority, the increase of the limits is necessary and vice versa. The method used provides the option to simulate the effects of the differently principled travel support systems. In the case of the model, we examined the impact of the travel allowance (up to *86% of the monthly travel costs)* and mobility opportunities in the absence of transport subsidies separately.

The model provides an opportunity to examine the effects of carsharing/employee shuttling on the degree of mobility. However, this assessment is beyond the scope of this writing. Carsharing can be raised into the model by reducing the cost of commuting by car. Expanding the scope of the investigated means of transport with a secondary vehicle used by a number of job seekers allows for a more complex analysis. The model – in case of employee shuttles – can be further specified by the reduction of costs or addition of a secondary shuttle organised by a new employer.

Following the formulation of the basic parameters, as a first step the model we calculated (for all analysed means of transport and relations) the settlements cost baseline value (KA value) using the formula below:

[2] Ktg_x – Cost limits, T_x – Commuting time limits.

$$KAérték = \left\{ \begin{array}{l} Ha\ x \le Ktg_1;\ 4 - x * \dfrac{1}{Ktg_1} \\ Ha\ x \le Ktg_2;\ 3 - (x - Ktg_1) * \dfrac{1}{Ktg_2 - Ktg_1} \\ Ha\ x \le Ktg_3;\ 2 - (x - Ktg_2) * \dfrac{1}{Ktg_3 - Ktg_2} \\ Ha\ x \le Ktg_4;\ 1 - (x - Ktg_3) * \dfrac{1}{Ktg_4 - Ktg_3} \end{array} \right\},$$

Similarly, the determination of the time baseline value (TA value) was included:

$$TAérték = \left\{ \begin{array}{l} Ha\ x \le T_1;\ 4 - x * \dfrac{1}{T_1} \\ Ha\ x \le T_2;\ 3 - (x - T_1) * \dfrac{1}{T_2 - T_1} \\ Ha\ x \le T_3;\ 2 - (x - T_2) * \dfrac{1}{T_3 - T_2} \\ Ha\ x \le T_4;\ 1 - (x - T_3) * \dfrac{1}{T_4 - T_3} \end{array} \right\},$$

where x always means the calculated travel time or distance in a given relation.

The resulting KA and TA values – in every relevantly taken means of transport (in this case, motor vehicle, bus and train) and reference direction (employment centres) – are averaged to obtain the fMFÁ value. In the fMFÁ model, it is possible to build in a particular entity (the subjective availability of means), whose value determines the KMFÁ. Subjective effects can be visualised by the correlation of the means of transports' frequency of availability ($K_e/K_{össz}$). According to the above mentioned, the average values of the adjusted mobility levels were calculated using the following formula:

$$KMI = \frac{\sum_{i=1}^{a} \frac{K_e}{K_{össz}} * (KAérték_x + TAérték_x)}{n},$$

where KMI – Adjusted mobility index, K_e – Number of people those who are provided with the given means of transport in the given relation, $K_{öszz}$ – Number of people included in the survey in the given settlement, $KAérték_x$ – Given means of transport's KA value in the analysed settlement in reference points (x), $TAérték_x$ – Given means of transport's TA value in the analysed settlement in reference points (x), n – Number of analysed means of transport.

Following the encoding, the processing of each questionnaire, data systematisation and structuring were carried out using the MS Access 2016 database manager software. MS Excel 2016 was used for some data selection and encoding results, calculation of descriptive statistical parameters and determination of fMFÁ values. The statistical operations were run using the IBM SPSS Statistics 22.0 program. The digital maps attribute tables were uploaded and data groups were organised using Libre Office 3.6, and QGIS 2.12.2 (Quantum GIS) was used for the imagery and visualisation.

Results

Development of mobility level boundary conditions in the most disadvantaged group of job seekers

Travel time, commuting distance and commuting expenses in the disadvantaged group of job seekers (exogenous approach)

In case of the parameters of model no. 1, it follows from the analysed group's structural characteristics (particularly, low qualification) that the expected value of the available wage proposal – presuming that the workplace exists and is accessible – is the amount of the national minimum wage. The values calculated for the travel expenses for the analysed area in HUF/km/month were 442.47 for motor vehicles, 348.8 for train journeys and 274.6 for bus travel, considering that employee's minimum employment is 21.5 days per month. Another inclusive cost factor may be the value of loss of earnings due to time spent on travelling. This includes the following examples:

- Potential for loss of overtime or the decrease in or excess of burden
- Reduction in time spent on alternative income-generating activities (such as backyard farming and additional works)
- Loss of efficiency resulting from giving up of break periods

Based on the experiences of the survey, the summarised value of the above is recorded by the analysis in two lots (0 HUF/month and 3,150 HUF/month). It speaks for the nil value that the possibility of overtime within the frame of public employment is limited; there is hardly any chance for alternative income-generating activities (21% of the analysed group had this), and its expected value is low. Taking into account the value of lost income amounting to 3150 HUF is justified by those cases (13% of the surveyed group stated so) in which the above circumstances restrict the undertaking of mobility; therefore, the factor in the accurate model cannot be ignored.

The fourth model parameter, the locally available earnings within the scope of the analysed group, is well approximated; taking into account the weakness of the local labour market (demonstrated by the tendency of the relative spatial index that is typical to the region and higher than the national average), its rate maximises at about the wage of public employment.

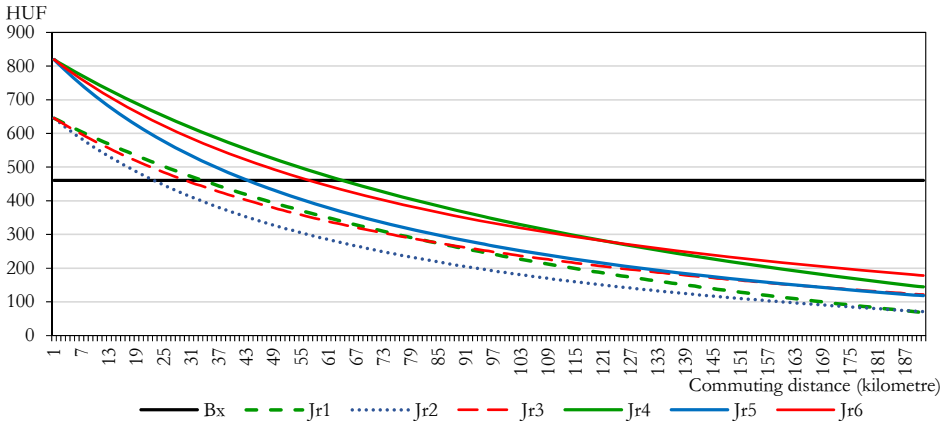
Based on the above discussed, it can be assumed that only the travel expense changes along with the increase in commuting distance. Although the expected value of wage increases in principle with the growing commuting distance in the case of non-disadvantaged job seekers or those with unequal opportunities, the correlation is not valid in the case of the analysed group and relations because of two aspects. The usage of invariant values, therefore, causes no issues. On one hand, for the persons concerned, especially in the case of the accumulation of unequal opportunities, the expected value of earnings in the distant workplaces is not potentially higher than the minimum wage. On the other hand, because the model works with 1 to 1 relations, the longer distance does not mean a stronger employment centre or more extensive labour market; it only refers to the transport situation's less favourable endowments.

The model's J=0 optimised value supposes that for rationally active, disadvantaged job seekers living in the multiple less favoured areas (HH-areas), the viable commuting distance (there and back again collectively) is between 64.8 and 261.9 kilometres.

Model no. 2, compared to the previously discussed, approaches the question in a completely different way. Among its variables, t_u can be estimated by the value of one km worth of travel time calculated along with the analysed area's enumerated relations; this is 1.16 minutes in the case of motor vehicles, 1.86 minutes for bus travel and 2.41 minutes for train travel. Because of commuting, the income value lost by the time for travel – according to the questionnaire survey – includes the possibility of overtime loss, the limitation of alternative income-generating activities (household management or additional works) or cost efficiency loss coming from the full or partial dispatch of the rest period. At this point, the relative hourly wage as a function of the viable commuting distance develops according to the method shown in Figure 1.

Figure 1

Development of the relative hourly wage as a function of the commuting distance and its relation to the public service hourly rate



J_{r1} – Commuting by motor vehicle with a zero value income loss due to journey time; J_{r2} – Commuting by train with a zero value income loss due to journey time; J_{r3} – Commuting by bus with a zero value income loss due to journey time; J_{r4} – Commuting by motor vehicle with a value of 3,150 HUF income loss due to journey time; J_{r5} – Commuting by train with a value of 3,150 HUF income loss due to journey time; J_{r6} – Commuting by bus with a value of 3,150 HUF income loss due to journey time.

According to the two end values (J_{r1} and J_{r4}), the resulted, rationally viable travel distances for an entire daily journey changes significantly in this case. The minimum value is fixed at 21.8 km and the maximum at 63 km; therefore, in one direction, the viable travel distance hardly exceeds 10 km and 31.5 km. Moreover, the preference of the means of transport changes as well, because according to model no. 1, the best option is bus and the worst is motor vehicle; whereas in model no. 2, railways is the shortest and motor vehicle is the longest viable travel distance. Beyond this phenomenon stands model no. 1, which did not take into account the travel journey's time saving advantages due to the type of transport's own speed, whereas model no. 2 insists on the importance of this specifically.

Both of the above approaches describe the behaviour of a rational, optimising person whose characteristics are reflected on the disadvantaged groups of people and actors of the space segment. To identify which of the above approaches interlocks more precisely with the decision-making process of the individual, the result evaluations must be compared with the experienced values.

Travel time, commuting distance and cost of commuting in the analysed group (endogenous approach)

In model no. 3, the probable value (Be_y) of the expected (gross) earning rounded to the nearest whole is gross 134,500 HUF; therefore, it is 23,500 HUF larger than the one outlined in the exogenous model. The group of the disadvantaged job seekers in this dimension can be broken into four significantly different types. Individuals with closely rational behaviour represent only 13.3%. Those who are considered as having minimum wage are guaranteed the minimum earnings acceptable for commuting in the hope of better employment. Therefore, Be_y values are 120,750 HUF. The largest proportion, approximately 30%, is represented by those who set their wage demands above the public servants' wages; they, however, even a small wage increase is sufficient for them to put up with the inconvenience of commuting. Their Be_y values are 98,356 HUF. High wage demand is represented by 20.7% of the group. Their reasoning includes typically subjective factors that can be divided into three categories. The factors are related to family, the inconvenience of commuting or giving up of additional salary and their convenient situation. Their Be_y values are 149,354 HUF. Extremely high wage demand appears among 25.3% of surveyed; in their case, the reasons are mostly subjective; their expectations are not based on their qualification but on domestic reasons (they are supposed to earn those wages to live well) or self-evaluation (then I would feel that they respect the work that I do). Their Be_y values are 190,526 HUF.

Even more extreme is the development of the endured travel expenses (ke_u). Between the smallest and the largest, the difference is a two-fold magnitude. The specimen's expected value is 9,031 HUF, which is far behind the analysed relations' average costs (approximately 21,000 HUF). This does not directly mean that there is

a strong limiting effect of the enduring expenses on commuting. The low expenditure commitments only express that the distant relations are highly dispreferred in the group.

Because both the endured distance and expense are flexible downward (the person more likely to travel and spend less on it), the discovery of the real limits requires knowledge of the distribution of the endured commuting distances. Thus, the group can again be broken into three segments. Only local employment and a very small commuting area (less than 10 km) is represented by 30% of the group. They are, according to their self-declaration, physically limited in commuting (for example, due to health problems or age) or their present expectations are met by the wages offered in the public employment sphere, which could only be imbalanced by irrationally high, non-accountable extra wages. The age above 50 is defined as a disadvantage; 8.6% of the surveyed stated it as the extreme limit of mobility, which even exceeded the influencing power of marital status and health problems. Also belongs here a proportion of disadvantaged job seekers who are willing to commute but consider it unfeasible due to poor transport conditions. The group with the largest number shows a striking similarity as regards the preference of journey distance with the results of model no. 2 (time prorated salary calculator). The endured distance – in one direction – is between 21 km and 30 km, and the underlying effects of the state of transportation play a decisive role. Nearly 73% of the group pointed towards some of the elements of the Jr_x variable as a mobility-limiting factor. The upper end limit – in 13% of surveyed – falls between 46 km and 50 km, which is shorter than the maximum of both exogenous models. The reasons can be clearly identified and are different compared to those measured in the two other groups. In the previous exogenous models, with a limit of the projected backlog, problems related to lower income expectations and availability of means of transport (which will be addressed in the KMI evaluation) play key roles. The importance of this latter element is shown in the disadvantaged areas where the average work-related commuting distance is 46 km; in this case, the research's basis of forming employment centres appears to be a relevant direction (backed also by personal motivations). Thus, by loosening their ties, commuting for work and integrating into the primary labour market – assuming the existing labour demand of the host centres – people from these areas can be helped most strongly.

The above effects and the values of the endogenous model variables are summarised in Table 1, which also includes comparison with the exogenous approach.

Table 1

Summary of values discovered during the empirical analysis and results calculated by the exogenous model

(HUF)

	Model [2]				Model [1]				Difference [2]-[1]		
	J_f	Be_y	ke_u	B_x	J	Be	k_u	k_i	ΔBe	$\Delta ke_{(u,i)}$	$\Delta Be_y, B_x$
Minimum	11,540	98,356	7,661	79,155	0	111,000	31,845	0	–12 644	–24 184	19,201
Average	45,825	134,500	9,520	79,155	0	127,000	44,695	3,150	7 500	–38 325	55,345
Maximum	98,007	190,526	13,364	79,155	0	144,000	61,695	3,150	46 526	–51 481	111,371

The lesson from the above is that, in the case of the respondents, the value of the remaining income is significantly higher than the optimum value calculated for the rational disadvantaged persons. Beyond this stand, on the one hand, higher wage demand and, on the other hand, lower endured travel expenses. The reason for this phenomenon is that the original model aimed to find end values; therefore, in the case of the calculated parameters, the benefit of the demanded income exactly equals the level of the current earning. Of the excess income, 100% is spent towards traveling, and the decision maker, in turn, maximises the distance. In contrast, the degree of sacrifice involving travel goes beyond the actual costs; thus, the commuter would like to earn extra income by the action of commuting between home and the nearby employment centre.

The individuals also have several effects on the value of the expected wage, which, either directly or with significant distortion, can be measured. This includes costs associated with abandoning other income-generating activities. Moreover, it involves, besides legally undertaken unskilled works, the real value of black labour, backyard income and even benefits received in the context of public employment; for the surveyed group, this amount in the entire specimen is the difference between the Be_y and B_x values, which is between 19,201 HUF and 111,371 HUF per month. The value of the remaining excess income shaped by the other component, the endured travel expense, is significantly below the data calculated for a person with unequal opportunities and distance maximising behaviour. According to this, for making decisions regarding expenses, the consideration of the time-relativised hourly wages is likely to be more significant (thus, model no. 2. describes the real situation). Individuals, as regards travel expenses, take into account the employment travel allowance, and in the absence of that, they opt for local employment. Among the trinity of travel time, distance and expense, the inflexibility associated with changes in the cost was stated by the majority of surveyed.

Overall, it has been established that the disadvantaged job seekers are significantly more inflexible than their in-model alter egos, who are aiming for rational decision making. In reality, this is justified by the empirical parameterisation and control of the mobility measuring models. Moreover, they call to attention the hindering effects of the analysed persons' substantial increase in mobility, which are as follows:

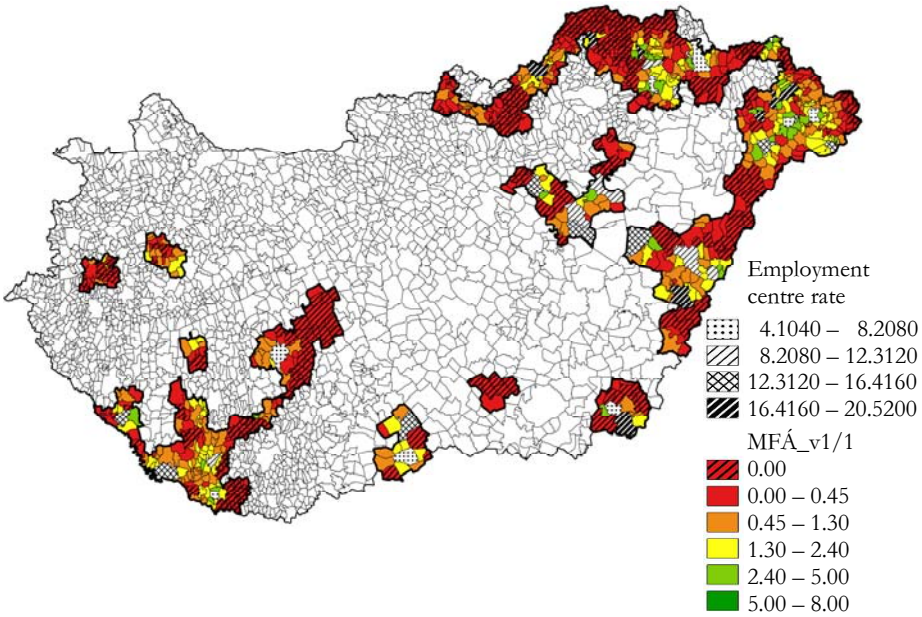
- The persons' demand for high income exceeds their qualification level.
- The limit regarding time and distance are according to the travel-related sacrifices (although, in this view, the respondents perfectly confirmed their decisions in connection to the nearest values of the exogenous model no. 2).
- The endured expenses are the biggest barriers of mobility. Members of the group for x HUF additional earning were willing to undertake more journeys in space and time to a distant workplace, whereas the budgets hardly changed.

Mobility level of the settlements, the end value model

If daily commuting was not supported by any financial allowances, the majority of the settlements in the disadvantaged areas would fall below the lowest level defined by the group (Figure 2).

Figure 2

The mobility level of the HH-area's settlements in relation to the disadvantaged groups according to three types of means of transport without any travel allowance



In about one-third of the settlements analysed, in relation to both cost and time, commuting from a certain place to the employment centre exceeds the value that applies to the most tolerant segment of the group (P_{90}=20,000 HUF, 50 minutes). In these villages and towns, even in the case of full availability of means of transport, mobility is not likely to begin automatically. The disadvantaged persons – based on the sample – are not able to endure commuting due to their current financial situations. This is in line with the model-based calculations of the values of expected income and endured expense ratio; thus, the basic conditions of commuting involve income higher than the current or a significant drop in expenses.

Nationally, within the surveyed area, five quasi-coherent, zero-mobility zones can be identified. Regarding the travel expenses, the situation in the Edelényi, Szikszói, and Encsi districts is almost entirely extremely disadvantaged. The Northern areas of the Putnoki and Gönci districts, where – in the absence of railways and locations' layouts – bus services are unfavourable and low-grade road surfaces cause extreme

peak travel times (especially in Gönci district where one-km travel time is 126% of the national average). Additionally, in cases of borderline settlements, the significant distance to the employment centres (for example, Miskolc) provides an adverse picture. The second area is the Pétervásárai district, which is significantly different compared with the previous areas because the road quality corresponds to the national average. In this area, due to the settlement layouts' special characteristics, the extremely long distances detract from the value of the index, which uplifts the expenses and travel time. It is very similar to the situation of the third area, which begins at the Sárbogárdi district and draws an arc as far as the eastern border of the Sellyei district. The difference is because railways – which are a means of transport similar to motor vehicles and buses – are present in the area but are not sufficient to reduce commuting expenses and journey time due to the absence of a nearby employment centre. In places where the employment centre could be accessed by a short distance travel (for example, in Tamási district), due to inconsistence in transport times, a bus journey to the centre can only be completed after changing buses and enduring excessively long waiting times (in some cases, over an hour). In this case, however, the situation can be enhanced by creating direct bus routes. The nature of the road network, according to the previous types, can be traced in a completely different way through the fourth zone: the Vas county sub-periphery. Here, the number of dead-end villages are small, but both the employment centres can hardly be accessed from most of the scattered, small-sized villages (the bus services in several cases operate with changes). Towards the north, the River Rába limits the commuting traffic. The fifth zone is in the Debrecen's catchment area, which forms a compact whole among the borderline settlements. In this case, there is only one employment centre, accessing which is complicated because of the sparse road network. The sixth zone is scattered, more mosaic shaped; in the view of the wrong MFÁ values, the sparse road network, other centralised characteristics and the back and forth attraction (not the nearest centre's preferred attitude) play key roles.

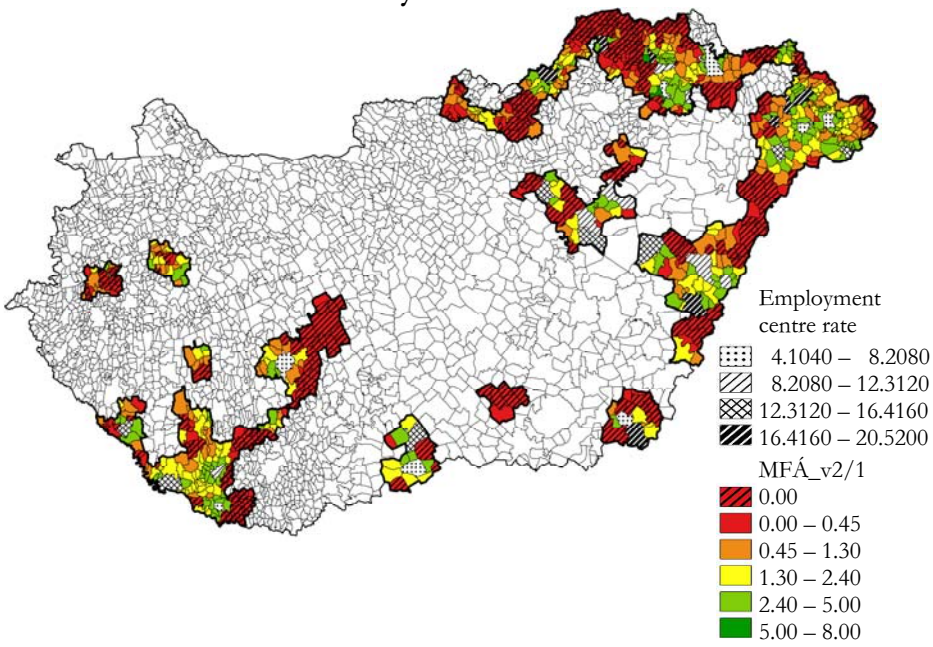
Coherent areas with a favourable mobility position can hardly be found within the surveyed areas. One area that stands out is the Szabolcs-Szatmár-Bereg county where the interaction of the centre and its surroundings is more pronounced (many dominant micro-centres are able to append their surrounding places) and powerful. Centres that are accessible by direct transport services provide a more favourable position to work-related commuting, which is also reflected in the MFÁ. Another important aspect is that here, especially in the Mátészalkai and Fehérgyarmati districts, the availability of railways make the previously shown cost saving possible; thus, it is a realistic replacement of buses and motor vehicles.

The optimised MFÁ model, discovery of the factors of the ideal commuting strategy

The picture significantly changes if it is assumed that a person only chooses the means of transport that is optimal for them to access their workplace (Figure 3).

Figure 3

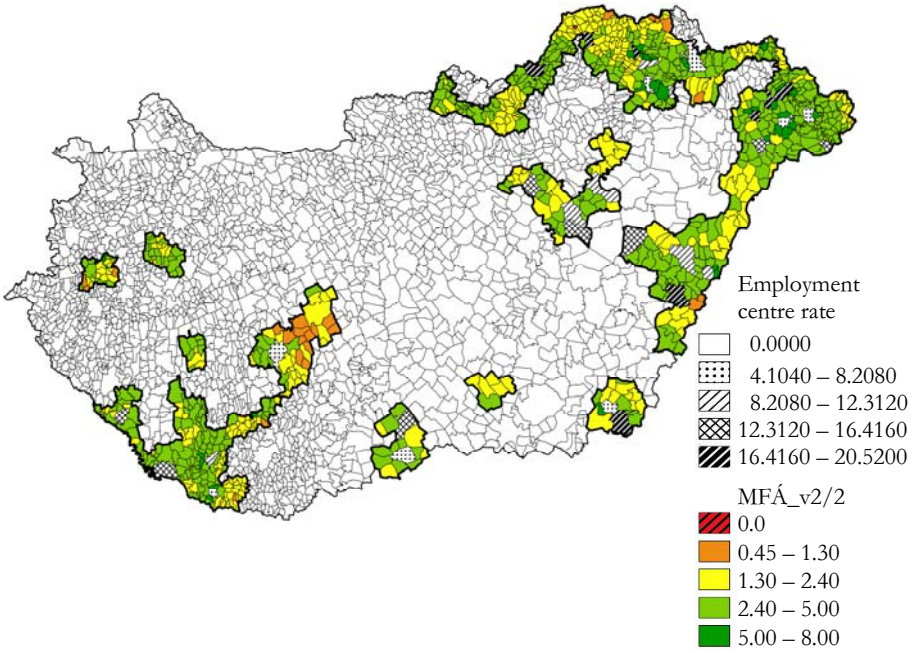
The optimised MFÁ model in relation to the disadvantaged groups according to the three types of means of transport without any travel allowance



The most striking effect is a considerable degree of mobility improvement in the areas outside of the unchanging mobility zone; in line with this the permanence of the space segment. As the asset optimisation becomes a possibility, the group of settlements with low mobility level (0.01–1.3 MFÁ) narrows or decreases by half or one-fifth; the settlements that show higher mobility potential (2.4–5 values) expand by the multiple of 3.6. The improvement, however, is isolated; it is only a solution for those settlements where the possibility of commuting was recorded as genuinely high. On the whole, a person can only ease the circumstances if they differ from being extreme, because the existing isolation, expenses and travel times can create such situations that attempts to counteract them can only increase the group's expenses. Therefore, the average of the achievable earnings should increase drastically, at least by 19,650 HUF, or there should be a drop in the travel costs. The latter is generated by realisation of the 86% employer travel allowance (Figure 4).

Figure 4

The optimised MFÁ model in relation to the disadvantaged groups according to the three types of means of transport with an 86%-rate travel allowance



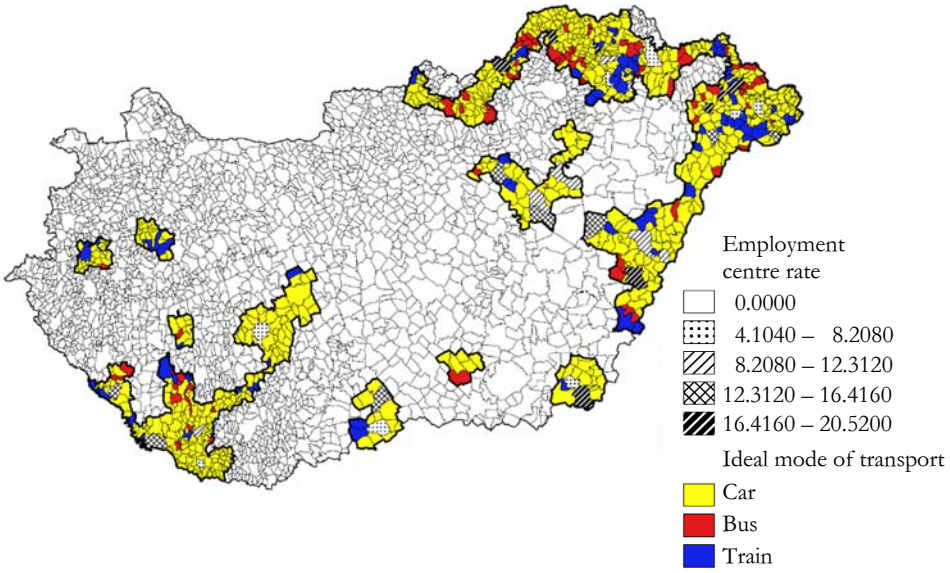
Granting full access to the travel allowance can improve the situation significantly: the original, more advantaged mobility zones can strengthen and zones with higher values may expand. The isolation is mostly limited to the border areas of the Sárbogárdi and Tamási districts, as well as to the initially very unfavourable northeastern borderland, which, in this current model, has significantly better accessibility. The tensions, therefore, seem to dissolve, but the image is somewhat overshadowed by the following objectives:

- The reimbursement of travelling expenses is realised only for people who are able to overcome other factors that are making employment difficult and can compensate additional costs by their productivity.
- The upper limit of the increasingly common category of 2.4–5 shows only moderate mobility.
- The mean increase of mobility level, compared to the model on the end limit values that carries the most powerful restrictions, is only two units, which is an outstanding and positive value; however, due to its low basis, it is not sufficient to increase commuting in the case of most settlements.
- The availability of means of transport is not comprehensive, as it depends on group specifics.

The last point raises the problem of the accessibility of means of transport. To assess the overall effects, it is necessary to have the knowledge of the type of transport chosen as an optimal strategy (Figure 5).

Figure 5

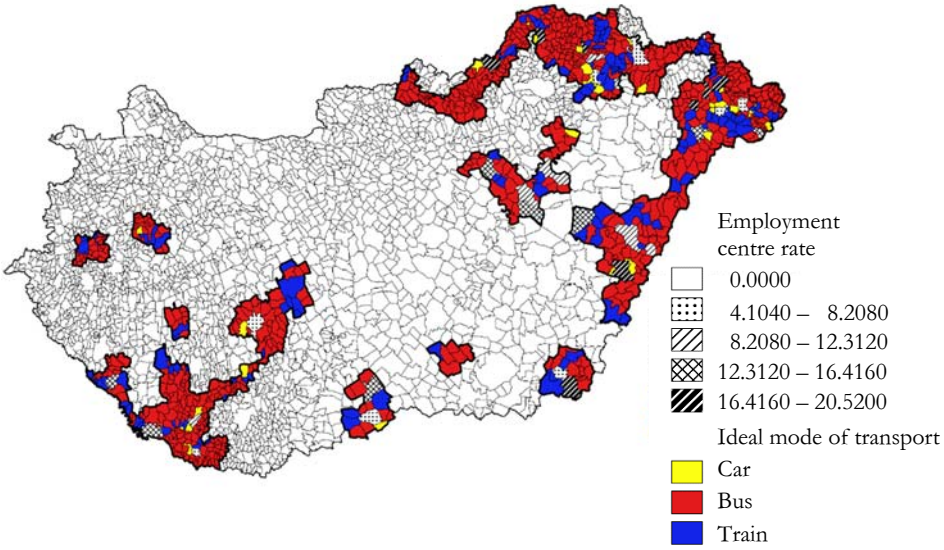
The ideal type of transport commuting in case of an optimised MFÁ model in relation to the disadvantaged groups according to the three types of means of transport without travel allowance



Without travel allowance, the dominance of motor vehicles is strongly emphasised (79%). Among the most decisive reasons are the possibility of time saving (36.3 minutes on a daily basis, expressed in money value as regards the disadvantaged job seekers and in relation to the HH-area means 21,025 HUF monthly saving), the previously quantified cost advantage in larger distances and several other convenience aspects. It is important to point out that, in the matter of motor vehicles, the model neither counts the maintenance expenses nor considers whether one single car is used by several others to commute. Bus transportation came in second, and the line was closed by railway, which far surpassed the former in its level of accessibility (37% of the railway links topped on the efficiency rank, whilst the same value in the case of the bus was 11.7%). Considering the previous travel allowance, the spatial image changes fundamentally (Figure 6).

Figure 6

The ideal type of transport commuting in case of an optimised MFÁ model in relation to the disadvantaged groups according to the three types of means of transport with an 86%-rate travel allowance



Motor vehicles lose ground, and their share drops to 17%, primarily in favour of buses whose share increases up to 68%. It is, therefore, appropriate to prioritise the means of transport in a support system framework. Another specificity is that of the available railway lines, approximately 59% are primary, which increases the realistic importance of train transport even though, because of its low accessibility, railways do not provide a significant solution to most settlements within the HH-area. The isolation of the areas with low mobility – at personal scale – can be eased to the greatest extent through the choice of bus. The role of train transport is most significant in the boundary zone between the favourable and unfavourable areas. However, there are two exceptions to the rule. In the Sárbogárdi district, when travel allowance is in use, train transport is more efficient in most parts of the settlements; this is an argument in favour of the operation of the Sárbogárd–Székesfehérvár railway line, which has been closed and reopened several times. In Szabolcs-Szatmár-Bereg county, the railway contributes the most into the higher fMFÁ values of the previously described scopes: favourable mobility microcentre-related commuting zones.

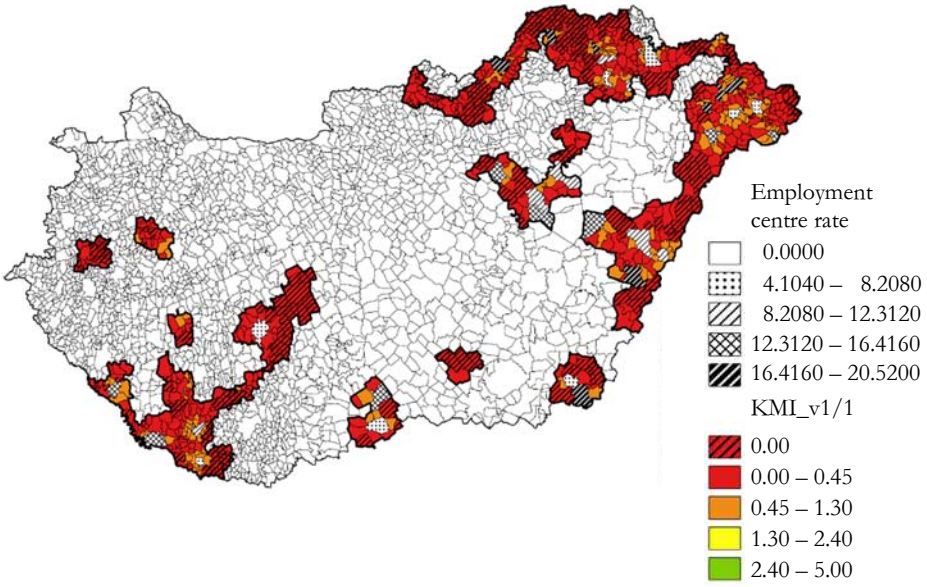
The settlements' adjusted degree of mobility

In the case of the questionees, the access probability regarding each of the alternatives comes to 12% for motor vehicles (cars), 62% for bus services and 19% for trains

where accessible. According to the KMFÁ model variant adjusted with the accessibility data without travel allowance, the group's degree of mobility is spatially average (Figure 7).

Figure 7

Adjusted degree of mobility in the case of the settlements in the HH-area in relation to the disadvantaged groups according to three types of means of transport without travel allowance



A downturn is uniform; however, it does not uniformly affect the settlement structure. The main losers are the villages and towns rated 2.4–5 according to their degree of mobility, besides which a significantly smaller downturn affects the circle of settlements with high mobility rated 5–8. Decisively, groups below the very low 0.45 MFÁ value gain strength (it nearly doubles the number of settlements in this category). As previously discussed, the above effects are caused by the pursuit of an optimal asset selection strategy without any mobility allowance; thus, the choice of motor vehicle contributes to the widening of the horizon of commuting. According to the survey's experiences, however, the car is the least inaccessible for the group's members, especially the most disadvantaged job seekers. In the case of motor vehicles, the expenditures refer to a narrow cross-section. In sum, according to those who were included in the model sample (their details are given in the chapter describing spatial structure), buying a motor vehicle (for example, a car) would require additional sacrifices that the returns of commuting could offset over many years. The competitive advantage as regards motor vehicles is the highest in locations where the employment centre is located relatively close; however, due to the organisation of public transport services, the access is limited or, because of the significant distance,

it is rationally inaccessible. In the first case, the return of investment's most significant barrier is the additional income's low-grade availability, typically in nearby, small-scale and weaker employment centres. In the latter case, the high expenses are relatively counterbalanced for the vehicle user by the extra compensation on time per kilometre. This may be a solution if several employees join forces and rely on commuting using one vehicle only. This alternative, however, has not gained mass popularity because of the low number of motor vehicles in the circle of job seekers and difficulty in synchronising the commuting, which can only be effective with smallest losses if the commuters work at same workplace during the same shift.

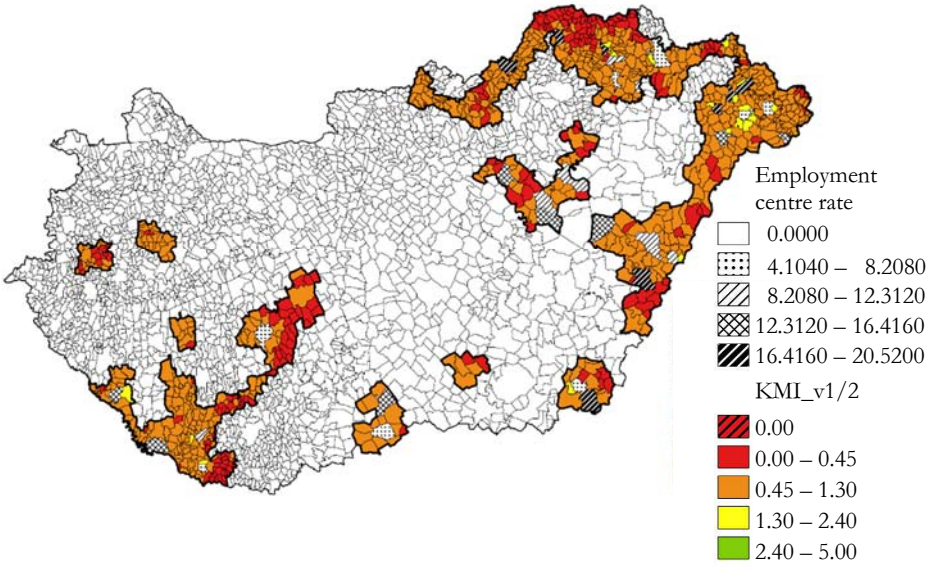
The most significant losses (about 3–5 units drop in degree of mobility) can be seen in the Kunhegyesi, Gönczi, and Devecseri districts. On the southern edge of the Gönci district, it is common that partly due to the transfer relations and partly due to the long journey distances, there are no alternative methods available besides motor vehicles. In the Devecseri and Kunhegyesi districts, the absence of railways decreases the mobility degree further by reducing the choice of transport to bus for commuters who own no motor vehicles. Because of the transport organisation, the above-mentioned districts' settlements have multiple disadvantages, and the worst conditions are due to the complete absence of direct connections.

KMI calculated with allowance

The introduction of travel allowance significantly changes the structure of the optimal commuting strategy. It increases the degree of mobility, and shifts its preference of ideal mode of transport from motor vehicle to bus. The degree of accessibility of the latter asset for the group is moreover higher, and its background effects strongly differ from the first mode, which makes a differentiated approach towards the isolation and improvement of the labour market position of the disadvantaged people possible. As an effect of the travel allowance scheme's introduction, the asset availability adjusted spatial mobility changes at a number of points, but in value and not in pattern (Figure 8).

Figure 8

Adjusted degree of mobility in the case of the settlements in the HH-area in relation to the disadvantaged groups according to three types of means of transport with 86%-rate travel allowance



The availability with adjusted-allowance calculated degree of mobility is substantially less effective in lowering the isolation than it was in the case of the model based on full availability. The primary reason for this is that even though in the case of receiving travel allowance and from the point of view of mobility, the bus is the most relevant asset, its availability to the people included in the sample hardly exceeded 68%. The availability of buses and their restrictive factors are in the first place as regards the employment-related inconsistency, which is about the same proportion as that of costs. Among the first factor's components in certain relations, bus transport does not allow for timely commuting to start a scheduled 8 o'clock shift or requires a disproportionately high sacrifice (which is hardly comparable to the additional benefits). Another aspect of this asset is the problem of higher time-value compared to a motor vehicle, which can typically be expressed only indirectly but has definitely been experienced. Regarding the scheduling of a journey, however, the principal problems are not related to travel times. This is because the travel-allowance generated improvement proves the significant role of the cost limit 'compared' to travel time. The real problem actually comes from the waiting, which in the case of a transfer can irrationally increase the time spent on travelling. This could be solved partly by increasing the number of operating services. The small number of services adjusted to the working hours can be only a partial solution; because of the diversity of workplaces, there are several different shift start timings. The problem becomes more significant due to the three-shift work pattern-related incoherence. This

practically means that the commuter – if there is no worker transport service operated by the employer – falls out of the three-shift work schedule. This is a common practice in industries whose sector is the target group's largest potential employer. Because of the increase in unequal opportunities, the accessibility of motor vehicles drops and commuters partly migrate to the bus. Lastly, one of the effects of the availability of buses on the disadvantaged groups is the possibility of additional income. If there are alternative income sources available, those will diminish the marginal utility of commuting by bus. The effect of travel allowance in this case has no pronounced spatial projection, and sporadic, occasional improvements and extreme values are common.

Conclusions

The objective of this analysis is to reveal factors that play key roles in the mobility of the disadvantaged and multiple disadvantaged job seekers, as well as evaluate the questions regarding the target group's spatial-specific degree of mobility using the fMFÁ and KMFÁ models. The analysis pointed out that the revealed factors can be broken into two distinct groups: endogenous and exogenous factors, of which exogenous factors are significant among the analysed persons. First, the limit values and parameters during the indexing process of the degree of mobility were determined using two models based on rational decision making aimed at maximising the commuting distance; the first model formulated the conclusion based on the connection between the adjusted values of local and commuting-related available income. The obtained limit values for the commuting distance evolved between 64.8 km and 261.9 km. The second model approached the question using the locally accessible and journey time-related available hourly earnings; according to this, the viable travel distance was significantly smaller and did not exceed 10 km and 31.5 km. In order to reveal the contradiction between the methods and hidden background effects, empirical testing was carried out on both models. The analysis showed that the latter model was closer to real decision making and that, in case of all the questionees, the expected value of the remaining income significantly exceeded the optimum value calculated for a rational disadvantaged person. Beyond this, there is demanded earning on one hand and lower viable travel expense on the other.

The objective of the second part of the analysis was to know the limit values in order to survey the degree of mobility as regards the specific spatial segments of settlements (taking into account the objective factors, accessibility of the means of transport, role of travel allowance schemes and person-specific subjective components). It should be noted that if daily commuting is not supported by any allowance scheme, a significant proportion of the settlements in defined disadvantaged areas would fall below the lowest mobility threshold as defined by the analysed group. Nationally, within the surveyed area, five, quasi-coherent, zero mobility zones can be identified. Moreover, regarding travel expenses, the situation

of the Edelényi, Szikszói and Encsi districts are almost entirely extremely disadvantaged. The Northern areas of the Putnoki and Gönci districts, the Pétervásárai district, the area that begins at the Sárbogárdi district and draws an arc as far as the eastern border of the Sellyei district, the sub-periphery of Vas county and the Debrecen's catchment area that forms a compact whole among the borderline settlements are similarly disadvantaged. With full access to travel allowance, the situation can improve significantly. The original, more advantaged mobility zones will strengthen, but the group's effects will further restrict the degree of mobility. The analysis of the ideal means of transport showed that without travel allowance, the choice of motor vehicles is more common; however, if there is an 87% drop in commuting expenses, the share of this asset will diminish and fall to 17%, primarily in favour of buses whose share will increase to 68%. Another specificity is that the available railway connections (about 59%) are primary, which increases the train transport's real importance, even though, due to its low accessibility, the railway does not provide a significant travel solution for most settlements within the HH-area. Considering the availability of each mode of transport, the calculated KMFÁ values pointed out that the disadvantaged groups with limited mobility possibilities reduce the degree of mobility significantly; therefore, creating a foundation for work-related commuting in the disadvantaged area is significantly more difficult.

It is apparent from the investigation that among the target groups, the degree of mobility will only increase substantially, especially if some of its components (for example, available wages, travel expenses and time and time table synchrony) as well as several other factors show simultaneous improvement. In the absence of this, some of the effects will cancel each other, and the temporary continuation of the barriers will significantly limit the viability of commuting for a major proportion of the group. The expansion of opportunities for mobility seems appropriate, on one hand, to improve competitiveness of the job seekers and, on the other hand, to strengthen labour demand in the employment centres. If there are no or only limited possibilities for improvement, then the increase in local employment may bypass the labour market gap between the sub-periphery and developed areas and may lead to favourable spatial equalisation.

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