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A new approach to transport-related social exclusion in rural Hungary

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Abstract

Accessibility to central settlements is a key issue in rural areas and, in terms of public transport services, both space and time are crucial dimensions. As part of my PhD research, this analysis aims to apply the Zimpel index to evaluate settlement accessibility in rural Hungary. This method is based on a dataset including public transport supply (no. of services in a working day, average journey times) between rural settlements and their microregion centers. The outcome of this analysis is the assessment of how public transport networks adjust to administrative boundaries. Findings may pave the way for a list of policy recommendations for service improvement, the establishment of demand responsive services to increase accessibility in (micro)regions that face unacceptable level of transport related social exclusion.

Keywords: Transport related social exclusion; public transport; rural areas; Hungary; social equity; transport poverty.

1. Introduction

Western societies face similar types of problems in the provision of public transport services in rural, sparsely populated, and peripheral areas[1]. The main reason for this seems to be that the number of people using public transport services is steadily declining as a result of the proliferation of passenger cars that better meet mobility needs (ITF 2015). However, we must not forget that serving these areas by public transport has in fact always been problematic: we need to take the scattered settlement network as well as the low population density as a given that has never generated a high level of demand (Ambrosino et al. 2003). On the supply side, in the midst of such difficulties, service providers have to operate a public transport network, which in the vast majority of cases cannot be economical.

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[1] In the present paper, the definition of public transport means scheduled rail passenger traffic as well as scheduled bus traffic.

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The demand side is characterized by strong fragmentation, as the main social groups using public transport (young people, the elderly, the disabled, etc.) have different needs, both in terms of travel time (peak hours, daytime, afternoon) and destination (employment, education, shopping, health care, etc.) (Sloman 2008). In addition, the potential number of public transport users is constantly declining: not only will there be fewer people preferring car use on a bus or train, but also as a result of emigration and a declining population due to declining natural reproduction.

2. Research Questions and Hypotheses

A fundamental research question was whether the supply side of public transport in rural areas and the development of administrative boundaries of microregions are in line with each other.

Based on my previous knowledge and the processing of the related literature, the following research questions were raised by me:

- Q1: Does the public transport supply of a municipality depend on the distance from the regional center or not?
- Q2: Is the public transport supply of the outer peripheral microregions, and the public transport between the municipalities of the microregion and the microregion center different from that of the inner peripheral microregions?
- Q3: Do the boundaries of the microregions coincide with the boundaries of the public transport catchment areas or not?

In connection with my research questions, I formulated the following hypotheses.

- H1: Based on the current situation of public transport in Hungary, the system of central location can be reconsidered in rural microregions.
- H2: Social exclusion from transport is related to whether the given municipality has a direct public transport connection with its own microregion center on workdays.
- H3: The public transport provision of the regions (microregions) located on the outer periphery of the country is worse than that of the microregions located on the inner periphery.
- H4: The boundaries of the microregions do not always coincide with the boundaries of the public transport catchment areas.

3. Research methodology

My research for the preparation of this paper is based on the following methodological bases:

a. analysis of schedule datas (in the research I only included the microregions of Hungary that I defined as rural. In my interpretation, all microregions are considered to be rural, which is not a microregion of the county seat, or does not belong to the Budapest agglomeration.)

The steps for calculating route-pair numbers rates were performed as follows:

- On the one hand, it was determined whether both modes of transport (railway and bus) are important in Hungary in relation to the given municipality and its own microregion center, or only one of the two relevant modes. Next, I examined the way in which each mode of transport affects the municipality.
- Not only the direct but also the transfer versions were recorded, in cases of both modes of transport, including the possibility of transfer to each other (from bus to train or from train to bus), but e.g. there are relatively few rail-to-rail transfers.

The process of calculating and homogenizing travel time rates

- based on the above, both bus and train journey times were calculated:

b. description of the attraction of the municipalities to the microregion center with the help of the Zimpel index (Erdősi 2000, Zimpel 1958). Zimpel was the first who applied an indicator that integrates travel time and route frequency as two important public transport availability components (Erdősi 2000). With this method Zimpel tried to determine the transport-based territorial division of Bavaria (Zimpel 1958). The formula is the following:

$$V = t_m \ \frac{1}{f_m} \quad (1)$$

Where:

- V = the transport value of investigated microregion's municipality
- t_m = the average time of access the microregion centre by public transport (in minutes)
- f_m = average daily frequency (number of route-pairs on workdays, the sum of direct and transfer options, both buses and trains)

The Zimpel indicator itself shows the attraction of the given municipality to the centre (in this case to the microregion centre) as a quotient of the journey time and the number of route-pairs. The higher the number of route-pairs and the lower the journey time, the lower the Zimpel index of the given municipality. The value of the indicator is high if the municipality is as far away from the microregion centre as possible and is connected to it by a low number of route-pairs. Based on the above, it can be said that the value of the indicator is low if there is a "close" connection between the microregion municipality and the microregion centre, and its value is high if it is "weak".

The travel time and route numbers have been derived from the Hungarian online timetable database (www.menetrendek.hu) in the period between April and November 2018.

4. Results – the Evaluation of the Hypotheses

4.1. Hypothesis No. 1: Based on the current situation of public transport, the system of central location can be reconsidered in rural microregions.

Based on the findings of the empirical research, it can be seen in some microregions, that the central place, i.e. the attractive role of public transport in the microregion center, can be observed (e.g. in most microregions of the Southern Great Plain Region or Szabolcs-Szatmár-Bereg county). At the same time, in the microregions of Gönc, Kemecse, Putnok, Sellye, or Tét, the municipalities bordering on or very close to the microregion center do not have a direct connection with the microregion center (Fig. 1.). In addition, it can be seen that the more the microregion center is located in the geographical center of the microregion (e.g. Pápa, Szigetvár, Mátészalka, Kisvárda in its own microregions), the more likely it is that the central location can be observed (e.g. concentric circles can be clearly seen around Mátészalka). If we look at the issue at the county level, one of the most heterogeneous counties is Győr-Moson-Sopron county, where there are some microregions that do not require reinterpretation (Csornai or Kapuvár microregion) and some where they clearly do (Pannonhalma or Tét microregion). In view of the above, this hypothesis was accepted.

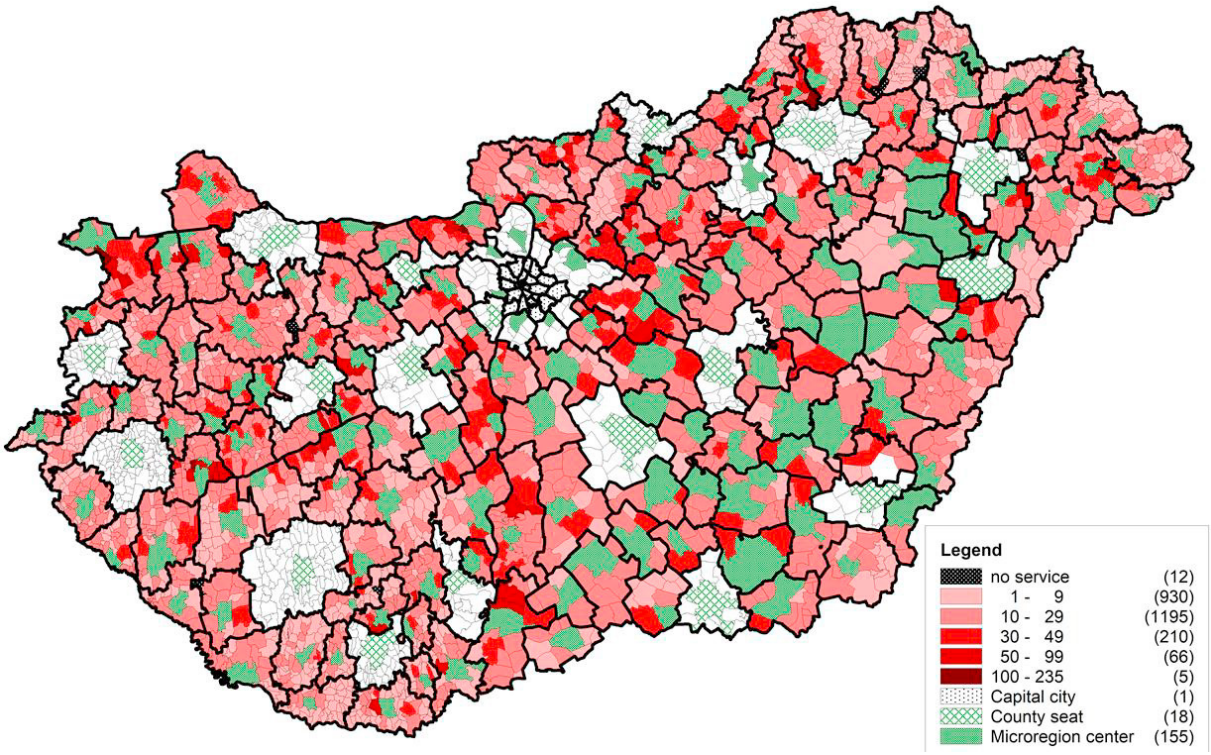

Fig. 1. No. of TOTAL (direct and transfer) services / route-pairs (bus and train) in a working day between municipalities and microregion centers in rural Hungary

4.2. Hypothesis No. 2: Social exclusion from transport is related to whether the given municipality has a direct public transport connection with its own microregion center on workdays.

Based on empirical research, it can be concluded that:

- In the case of 148 municipalities, we cannot speak of a direct connection, either in the form of bus or railway. These 148 municipalities are concentrated in Hajdú-Bihar, Baranya (Sellye and Siklós microregions) and Borsod-Abaúj-Zemplén counties (Fig. 2.). The microregions of Baranya county are worth mentioning, in the case of the former Vajszló, while in the case of the latter Villány and Pécs are the cities to which the municipalities gravitated instead of their microregion center. With regard to the Edelény microregion, the municipalities gravitate to several smaller sub-centers with the status of a village (e.g. Perkupa, Bódvaszilas, Tornanádaska), which are also railway loading points; while in the case of the Putnok microregion, the former micro-regional center, Kazincbarcika, is attractive. Other similar situations can be observed in the microregions of Balatonfüred, Tét and Tamási.
- Although 169 municipalities have a direct connection to the microregion center, it is less than 3 route-pairs (be it a bus or a train) in a workday. These municipalities are located mostly in small-village microregions of the inner peripheries (eg Marcali and Tamási microregions), where either the micro-regional centers within the microregion or the neighboring microregion capitals / other cities outside the microregion are the main gravitations; and also in the halo of the county seat microregions (e.g. Derecske, Mórahalom or Pannonhalma microregions), the centers of which do not have a public transport gravitation.

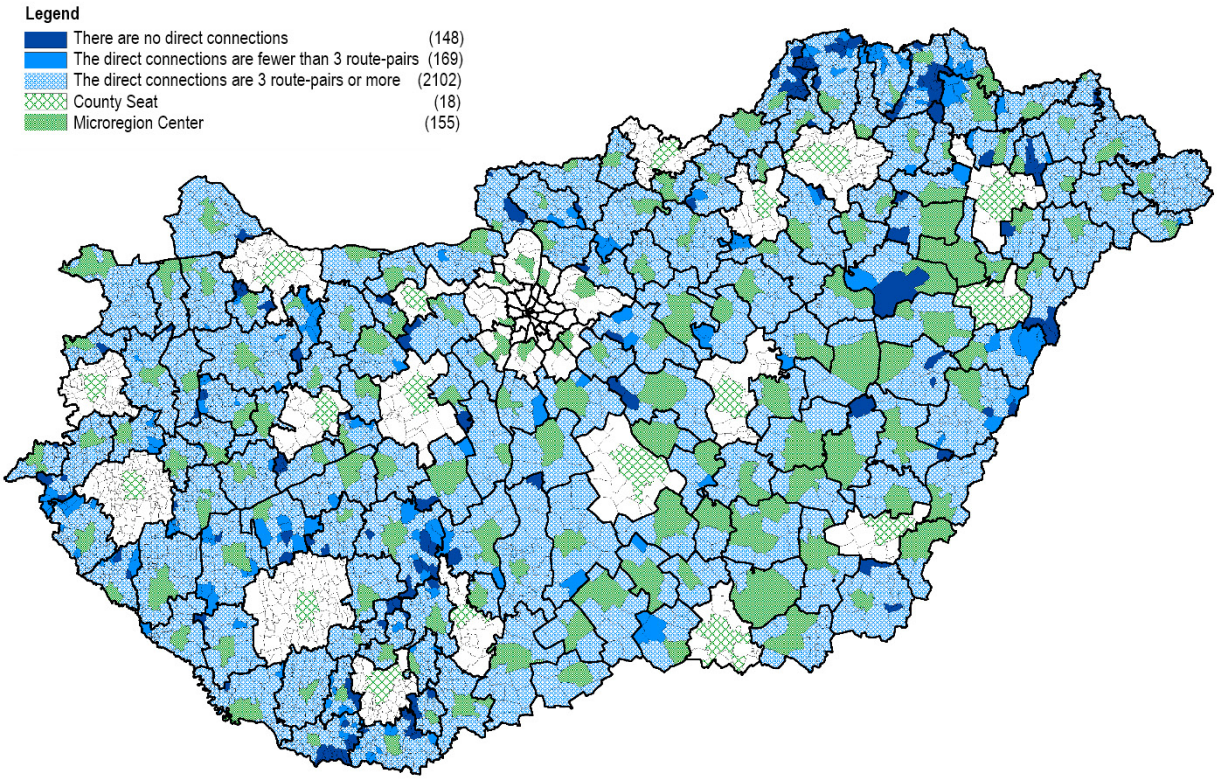

Fig. 2. No. of DIRECT services / route-pairs (bus and train) in a working day between municipalities and microregion centers in rural Hungary, regarding the type of connections (none, less than 3, more than 3).

If we look at social exclusion from transport origin according to the microregion in which the direct public connection is implemented between the given municipalityand its microregion center, then it can be said that based on the above, in the case of the socio-economically disadvantaged Edelény, Marcali, Mórahalom, Sellye, Siklós and Putnok microregions, the hypothesis is correct. However, in the case of the Balatonfüred or Pannonhalma microregions, the hypothesis is rejected, as these microregions are not socio-economically disadvantaged, however, the microregion center is not directly accessible from some of its municipalities. Thus, based on the above, we must also conclude that social exclusion from transport is a much more complex phenomenon than examining it in terms of a single factor. Based on the above, this hypothesis was only partially accepted.

4.3. Hypothesis No. 3: The public transport provision of the regions (microregions) located on the outer periphery of the country is worse than that of the microregions located on the inner periphery.

Based on the findings of the empirical research, the hypothesis was rejected, which is supported at the municipal level by the Zimpel indicator (Fig. 3.). Based on the results of the Zimpel indicator, it can be stated that there are almost the same proportion of neuralgic settlements in the outer, peripheral microregions in terms of the availability or inaccessibility of the microregion center as in the inner peripheral microregions. The comparison at the microregion level also supports the former. It is important to note that with regard to the former indicators, there is no east-west division of the country. This hypothesis was rejected.

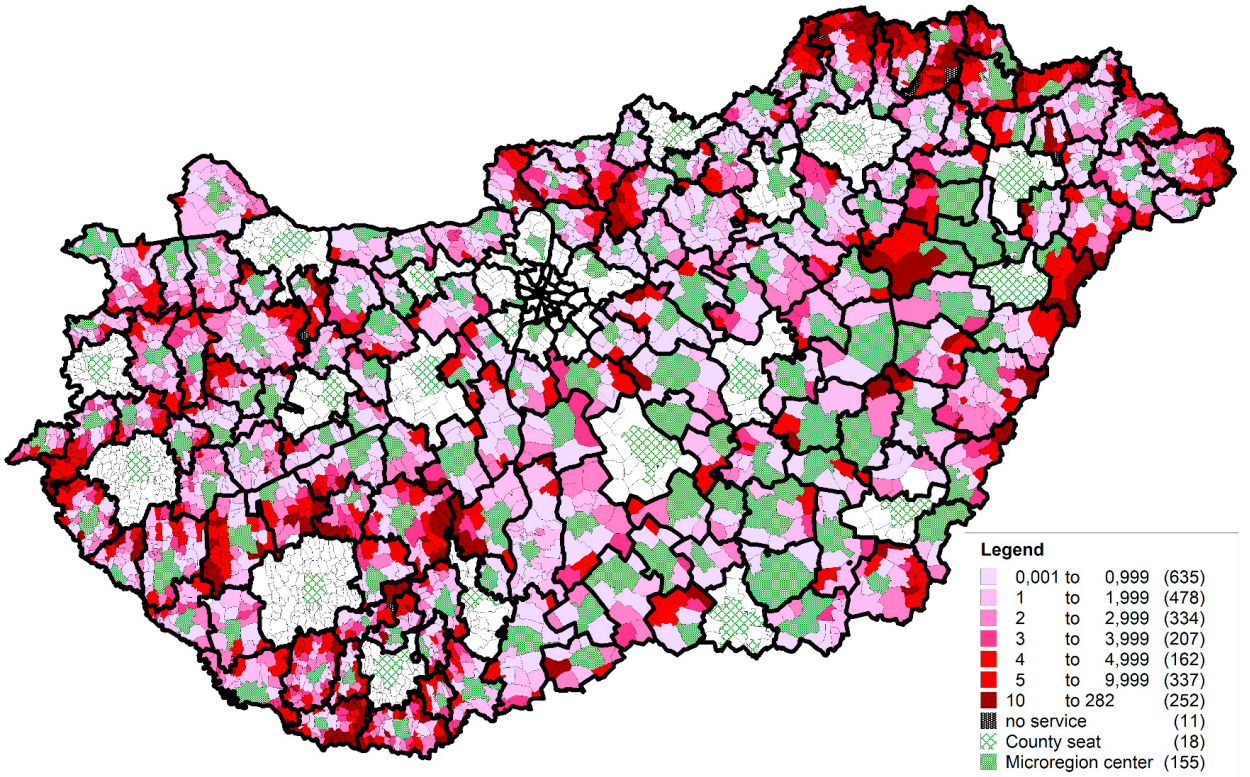

Fig. 3. Zimpel index in municipal level in rural Hungary.

4.4. Hypothesis No. 4: The boundaries of the microregions do not always coincide with the boundaries of the public transport catchment areas.

This hypothesis was accepted, as a total of 274 public transport catchment areas were detected, of which 127 were completely new catchment areas and 343 the number of the municipalities which gravitate to new catchment centre. Based on the directions of gravitation, we can state that none of the municipalities of the microregion of Balmazújváros, Hajdúnánás, Nyíradony, Kemecse, Pannonhalma, Tiszakécske or Tiszavasvár most strongly gravitate to their own microregion centers (based on direct workday routes). New catchment areas have been established mainly in the microregions of Marcali, Siklós, Edelény, Gönc, Tamási and Mezőkovácsháza, of which the microregions of Edelény and Mezőkovácsháza have several small micro-public transport gravitation centers. In addition, new catchment areas can be created not only within the boundaries of a microregion, but also by ignoring the boundaries of a microregion, even between neighboring microregions. Most of the new public transport catchment areas (23) and the municipalities classified in them (84) are located in Borsod-Abaúj-Zemplén county, both in absolute and percentage terms (Fig. 4). In view of the above, this hypothesis was fully accepted.

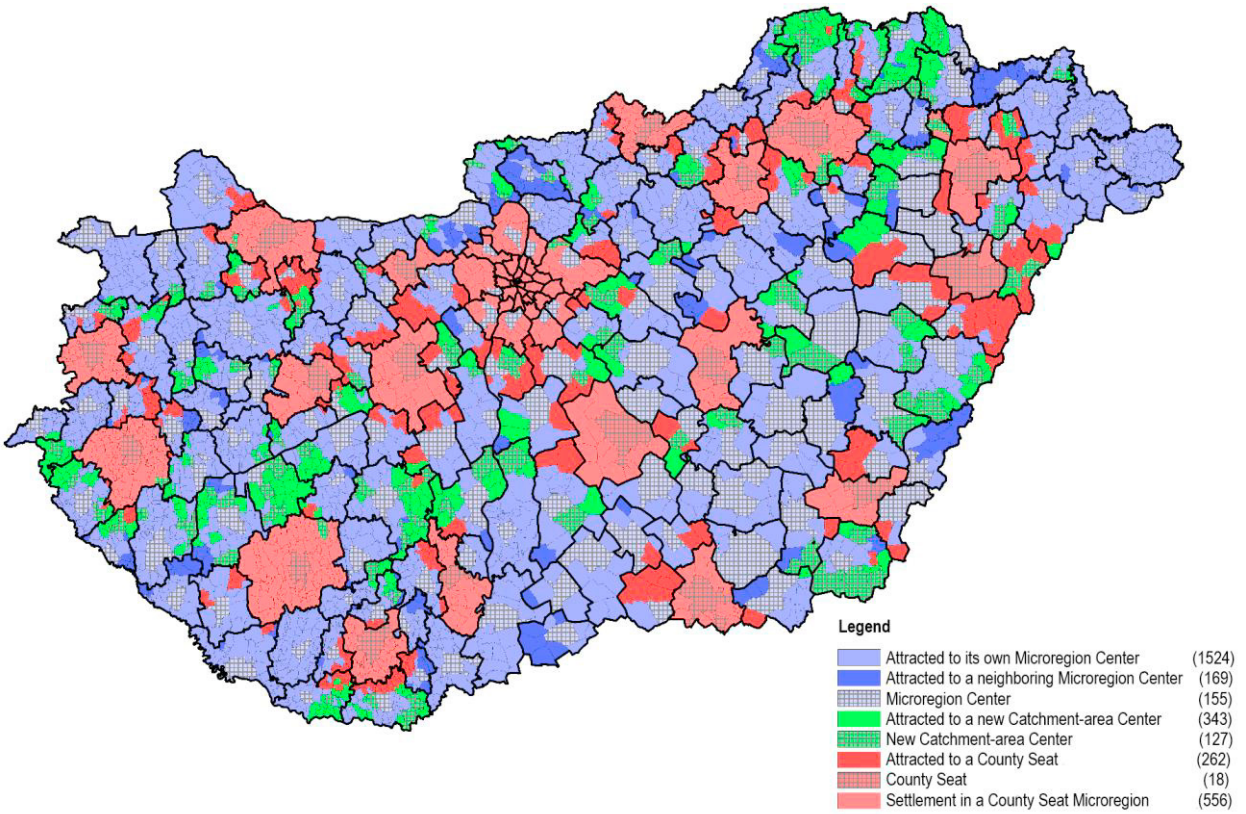

Fig. 4. Real public transport catchment areas based on direct access.

4.5. New Results of Empirical Research

In the light of the knowledge contained in Section 27 (3) of Act XLI of 2012, the microregion center relationship was also examined in terms of whether or not there are three direct public transport (bus or train) rotations in the workday. I found 169 municipalities where this condition does not exist. These municipalities are mostly found in border, small and extremely small municipalities (e.g. Encs, Edelény or Lenti), mostly in small village microregions on the inner peripheries (eg Marcali or Tamási), or in the halo of county capitals (e.g. Derecske or Mórahalom).Overall, taking into account both direct and transfer, and bus and rail connections, I found that only 11 municipalities could not reach the microregion center either directly (either by bus or train) or by transfer.

With the travel time analysis, I wanted to know how much time (in minutes) traveled by public transport between the given municipality and the microregion center. Overall, I found that almost 60% of the examined municipalities can be reached in less than half an hour, slightly more than a third are located more than half an hour away from the microregion center (but within one hour) and the other municipalities are more than an hour away. In order to get to the microregion center as quickly as possible from the given municipality, it is necessary that the microregion seat is located in the geometric center of the microregion, and at least 4-5 routes used by bus services branch out from there; in addition, the microregion must have a dense network of municipalities, most of whose members are municipalities (typically small or extremely small villages) that do not have large outlying areas (such as the Pápa, Szigetvár or Tapolca microregions). Long-distance travel can be caused, among other things, by infrastructural (railway or road) deficiencies between the municipalities of the microregion and the microregion center, or by topographic conditions (see Fonyód, Nyíradony, Tab and Tamási microregions).

Using the Zimpel index, I was looking for the answer to how the quotient of the journey time and the number of routes can be used to define the gravitation of a given municipality to the microregion center. Focusing only on the

microregions considered by the indicator to be neuralgic, it can be stated that the inner peripheries can be found mostly in Somogy and Tolna counties - with relatively more places in the former one - but they also occur in Hajdú, Nógrád and Veszprém counties. The external peripheries generated by the Zimpel indicator are typically related to the socio-economically standard-case external peripheries (e.g. the border microregions of Borsod-Abaúj-Zemplén, Hajdú-Bihar and Szabolcs-Szatmár-Bereg counties), but one example of this can also be found in Vas County.

During the preparation of this paper I was curious not only how strongly the given municipality gravitates to its own microregion center, but also to which "center" the given municipality most strongly gravitates to (if not its own microregion center, then, for example, the neighboring microregion center, an additional non-microregion city or even a non-urban municipality within its own microregion). In the course of this, I found that almost three quarters of the examined municipalities (1530 municiplaities) have the closest direct connection to their own microregion center; and another 182 municipalities as well, but their strength of the connection is shared between another (neighboring) microregion center; 535 municipalities have a direct route to their own microregion center, but the most frequent connection is not to it, but to the neighboring microregion center, to other cities inside or outside the microregion, with a non-microregion status. 119 municipalities do not have a direct public transport connection to their own microregion center, but to a neighboring microregion center; 31 municipalities do not have a direct public transport connection with any microregion center. In addition, there are 23 municipalities from which there are no direct routes to any city with urban status.

5. Conclusion

Based on the studies described above, the real public transport catchment areas can be drawn, which are independent of the microregion boundaries, and show which municipalities are attractive for public transport based on their densest workday public transport connections. A total of 274 public transport catchment areas were detected, of which 127 were completely new catchment areas. Based on the research, the new public transport catchment areas can be former micro-regional centers with stronger or weaker gravitation (e.g. Őriszentpéter and Pálháza or Csepreg and Lengyeltóti); micro-regional centers with urban status, also with stronger or weaker gravitation (e.g. Balatonlelle or Harkány, or Abaújszántó or Jánosháza); micro-regional centers with municipal status (e.g. Balatonszentgyörgy, Krasznokvajda or Szászvár); railway access points (e.g. Novajidrány, Olaszliszka – Tolcsva or Zánka – Köveskál) or "single- municipality" gravitation centers (e.g. Bükkábrány, Csökmő or Iregszemcse).

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