The transport in our time-budget

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Do we save time with our faster transport modes? The answer is, no. The authors answered this question after comparing the average daily per capita transport time-use based on the 1986/87, the 1999/00, and the 2009/10 Hungarian time-budget survey. The average time-use remained between 60 and 65 minutes, same as it was in 1977. During the period studied, the share of the motor/car time-use approximately doubled in the total transport time-use, while the other modes (walking, cycling, and public transports) decreased proportionally. In the same period, there was a wide distribution in the per capita daily transport time-use data influenced by geographical destination choice (in space and time)—and by demographic (age, gender), spatial (county, settlement status), and social (activity, qualification) variables. The paper analysed the effect of the latter explanatory variables on the heterogeneity of the transport time-use. The gender and activity variables can explain motor/car time-use differences; geography and settlement status the bicycle-, and the settlement status also the public transport time-use differences. However, all the explanatory variables analysed could only explain 10% of the divergences.

Introduction

Transport performance is traditionally measured in vehicle-km, passenger-km, and tonne-km—as a product of transported volume (vehicles, passengers, or tonnes) and distance. It is well justified by the fact that the cost, fuel consumption, or energy input of the transport are to a certain extent proportional to the combined transport performance index.

Besides the volumes, this study focuses on the time spent on transportation rather than on the distance covered by the transport. This seems to be an *anti-spatial* approach, since we do not take into account distance in our analysis. However, we will see that the time-use orientation also emphasises important spatial connections and consequences.

In a next section of the introductory chapter, we show different myths and suppositions that are related to the time used for transportation. We also present a background to the time-use approach and its application in the field of transportation. A separate section discusses the Hungarian background literature on the subject. Subsequent to this discussion, we present the subject and methodology of our study, the sources of the data, and the selected data series: time-balance data for the Hungarian transport, including the different transport modes, and the social and territorial background data for people using the different transport modes. Our aim is to analyse the variance and mutation of the consumed transport time in time series (of the past decades), on the one hand, and transport time-use by the related demographic, social, and territorial patterns, on the other hand. The following chapter reports the main results, and the summary of the main findings concludes the study.

A key-effort of the modernist transport planning: saving transit time by higher speed

People perform different mandatory and discretionary activities on a daily basis. The mandatory activities are classified further by Gerike et al. (2015). They distinguish three types of activities and trips: (1) subsistence (work, education), (2) non-discretionary or maintenance (shopping, errands, chaperoning, care, voluntary, personal care, other), and (3) discretionary (leisure). Regardless of whether we like or dislike an activity (the activities can be either pleasant or monotonous), we have to invest time in the activities we choose to perform.

Jones and Boujenko (2009) distinguish 'Place' and 'Link' functions in an urban area. As a Link, a street facilitates movement of people, thereby minimising their travel time. A Place is always a destination in its own right, where people are encouraged to spend time performing different activities[1]. Modernist planning always considered the transit spaces as a Link; in addition, people, the users, also agreed that the time spent on transportation is a loss that has to be shortened. While estimating the cost-benefit of a new transport project, the time that can be saved (e.g. by an electrified rail or new overhead crossing) is considered as part of the benefits. Time-

[1] The quoted authors underline that even an urban street can become a Place, and their main aim was to show which planning tools are necessary for facilitating this transformation. This is important, but it is not the main topic of our paper. Here, we used their expressions to describe the time-spending and the time-losing features of spaces distinguished as Place and Link.

saving was definitely considered as a social gains originating from various investments.

The existence of that social gains from time saved during a transit was questioned in the 1970s.

Current status: The transport time budget is invariant and channelize transport time-savings for transportation

Ivan Illich was one of the pioneers who realised that time-savings, which technological developments aimed at achieving in transport, do not exist for the society (Illich 1974). The speed that streamlined transport modes are able to achieve, relative to walking, 90–95% of the transport time should have already been saved.

Where is that time? The answer was shocking: we use the time saved though transport for transportation. In other words, we choose distant destinations and use expensive travel modes that entails paying the extra costs through extra work. We can learn that the destination points of the trips are not fixed in the space but rather our time budget seems to be stable: that is the time amount that a society is willing to spend with transport does not change, or change only very slowly.

This argument is justified for the people as they feel that need to spend the same amount of time on transit as in the past. However, the question is whether it can be proven with data. This issue challenged the authors of this study to focus on the Hungarian transport time budget trends.

Early time budget studies

Although there were studies that dealt with the time-use of different activities, the organised time-use surveys did not begin until the 1960s. Hungary was among the early promoters of this activity, and there is a wide consensus that one of the main starting documents of the uniform and internationally comparable time-use surveys was that of Alexander Szalai (1972). Since its first release, several other international organisations, such as International Association for Time Use Research (IATUR), Multinational Time Use Study (MTUS), Centre for Time Use Research (CTUR)[2], have collected and prepared databases and elaborated methodologies for comparable surveys. Here, it is worthy to mention about the Eurostat based, HETUS, (Harmonized European Time Use Surveys, see Eurostat 2009) project that promoted and developed similar corporations.

Even if the time-use surveys always contained *transport* data, the time-orientation thinking arrived from other disciplines into the transport sector. One starting point for time-use surveys can be traced back to a seminal paper of Hägerstrand (1970), where the author underlined the importance to raise the human factor and the time

[2] See Jara-Díaz – Rosales-Salas (2015) and http://www.timeuse.org/; http://www.timeuse.org/mtus

dimension into the regional approach. Fifteen years later, he published a whole book about time-geography (Hägerstrand 1985). The other early transport time researcher, Illich, belonged to the field of sociology. It is typical that regional and social experts recognised the importance of the time-use surveys in transportation: their approach markedly differ from the traditional transport thinking, where the origin and destination points are considered as fixed and the time appears but as the possibility of acceleration to save time during a trip. Gerike et al (2015) call this approach *trip-based* one and sharply distinguish it from the *activity-based* approach that 'conceptualise travel as an activity within an individual's daily activity schedule which creates the demand for that travel' (ibid. p. 4.). The national travel surveys focus on the movement and related information in terms of trip stages, distances, modes, and circumstances; however, they rarely link the destinations to the trips. Time-use surveys embed the trip into the daily activity in a better manner, thereby making facilitating a wider analysis.

Hungarian time-balance researches

As mentioned above, the Hungarian Statistical Office had started time balance surveys in the decade 1960s. The studies that elaborated the data focused first on the way of living and considered other social analyses. As part of the study, commuting and transport time-use results were also presented, but they were not detailed (we will use these findings in the sections below).

An exception is the detailed work of Lakatos (2013) about the time-use of the employed people during their commuting/travelling to their workplace. While the author offers a general picture about the transport time-use, the main question analysed was the manner in which the long and extra-long (> 90 minute) commuting time influences the life of the people and families, their leisure time, and other time-use. The main groups involved in the comparison were the employed and the other people, and the object of the comparison was their general (non-transport) activity influenced by their work and commuting time. In our study a significant portion of the background data will be similar as our data sources were same as that of Lakatos. We present that the employed people use about the 60% of the total transport time-use. However, as Lakatos already presented the time-use of these employed people is not representative for the whole population.

Our study: What is the difference?

While the aforementioned study by Lakatos focused on employed population, and on the social and behavioural consequences of their fixed work and commuting time, our study turns around that approach. Our study focuses on time spent with transport and with different transport modes and considers different social, demographic and spatial background as the cause, and not as consequences of the varying time-use patterns. Our first aim was to describe how the transport time varies by the following categories (explanatory variables):

– 2 genders (male, female);
– 15 age groups (10 to 84 years old divided into five-years age groups);
– 4 settlement statuses (Budapest, county seats, other towns, villages);
– 20 counties (Budapest and 19 Hungarian counties);
– 4 academic qualifications (finished primary school or less, skilled, graduate, professionals);
– 6 activity statuses (employed, student, pensioner, child-care, unemployed, and other); and at another scale:
– 3 periods of surveys (1986/87, 1999/2000, 2009/10).

Dependent variables were the *total time spent on transportation*, and/or the time spent travelling in *six different transport modes* (walking, cycling, local public transport, regional/long distance public transport, motor/car transport, and other modes).

Theoretically the whole problem can be described in an eight-dimensional space, where the axes are not independent variables: we can easily present the time-use differences by gender, but these differences are also consequences of differing activity, education, etc. patterns of the two genders. However, as a first and easily understandable step, we present here two-dimensional diagrams by single explanatory variables.

Methodology

The data for the study was extracted from the time-balance surveys performed by the Central Statistical Office of Hungary (KSH) in the years 1986/87, 1999/2000, and 2009/10. Although the time-balance surveys by the office began in 1963, the comparability of the results from the earlier surveys is relatively low. Therefore, we have taken data from the last three surveys. The detailed database of the KSH survey, comprising elementary data, is also available in the databank of the Centre for Economic and Regional Studies (CERS), which enabled us to base our analyses and calculations on elementary (people level) data, and not just on the prepared KSH publications (KSH 2012).

Concerning the description of the methodology of the time-balance surveys and data preparations, the Office issued a detailed guide (KSH 2010). Although it was important to learn and apply the entire methodology in our study, here we have reviewed those details that are indispensable to understand this paper.

The record of the previous time-budget surveys is in the form of a diary entry covering the 1440 minutes of a day. In the latest survey, between October 2009 and September 2010, a representative sample of about 10,000 people filled the diary on one random chosen day of the week, and employed people and students were allotted an extra day during the weekend to complete the survey. The 1986/87 and 1999/2000 sample also comprised 10,000 people, but they filled out four diaries: namely one day for each season. The survey was activity-based and more than 500 elementary activities were distinguished. The main activity groups include the *physiologically fixed activities,* such as sleeping or eating; *leisure-time activities,* such as sports or cultural activities; and the *socially fixed activities*, such as working, learning, housework, shopping, and transportation.

Transportations that exceeded 5 minutes appeared in the time-balance as a main activity, also pointing to the destination activity. If the transport time was shorter than 5 minutes, then it was added to the destination activity, i.e. to the reason behind the transportation activity.

Not every kind of movement is considered as transportation activity. Running, swimming, or hill climbing are leisure or sports activities, and not transportation. However, a trip to a bath or a hill (to swim or climb there) *is* transportation.

Waiting can also be considered as a possible transportation activity, (but it might not always be connected to transportation). In the survey, waiting time that was connected to transportation and exceeded 10 minutes was classified as a separate activity. However, shorter waiting periods during the transit evidently became part of the transport time.

Our study distinguishes between six transport modes[3] namely walking[4], cycling, local public transport[5], regional or long distance public transport[6], motor or car transport[7], and other[8] transport modes.

Based on the collected data series, the KSH also offers weight coefficients that adjust the representation of the used sample more accurately to the total population proportions.

As a first step these processes provide the average time spent daily on a given activity by the participants of the activity. These findings are called the 'C' value series. Besides participants of a given activity, others were not active in that case. Their time spent with that specific activity is zero. The 'B' value series show the percentage of the active participants within the given population. A third series, the series 'A' provides the time that an average member of the society spends daily on a given activity, by calculating both the participants and the non-participants in the whole population. We will also refer to it as average *social* time-use. To understand the importance of the three value series and the difference between them in a clear manner, we present the case of bicycle users by settlement status in 2009/10.

[3] While this paper uses statistical data and statistical categories as standard deviation or arithmetic mean, etc., the notion of *mode* as a statistical category is not taken into account. We use the word *mode* always in the meaning of the aforementioned transport modes.

[4] Walking includes handicapped cart use.

[5] Tram, bus, trolley bus, local train, funicular, etc.

[6] Train, coach, airplane.

[7] Motor, car, taxi, shuttle-bus.

[8] Horse-cart, waggon, van, truck, lorry, agricultural tools, and any other mode.

Figure 1

Distribution of 'C'-type values of cyclists ('users') by settlement status

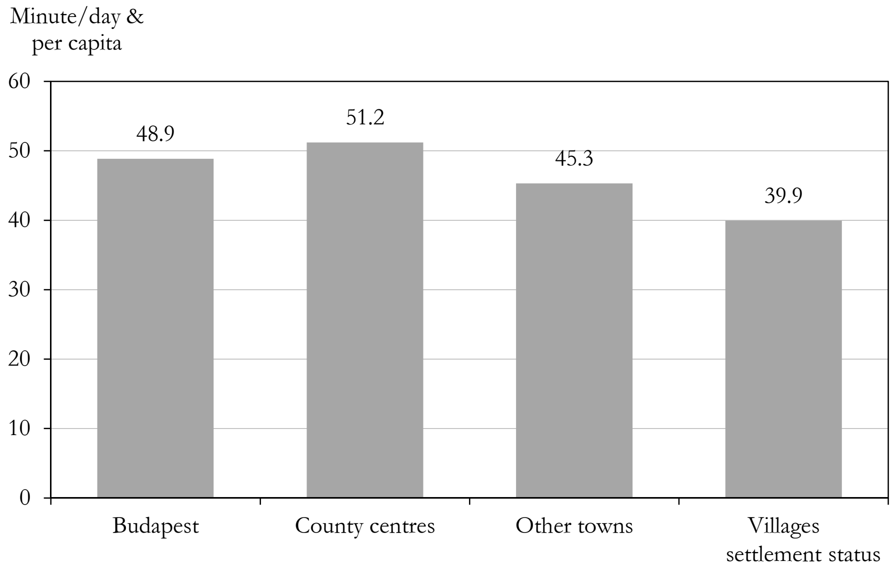


Figure 1 shows that the cyclists use their bicycles for approximately 40–50 minutes per day: 40 minutes in villages, 45 minutes in smaller towns, or about 50 minute in the county centres and the capital.

Figure 2

Percentage of users ('B'-type values of cyclist) by settlement status

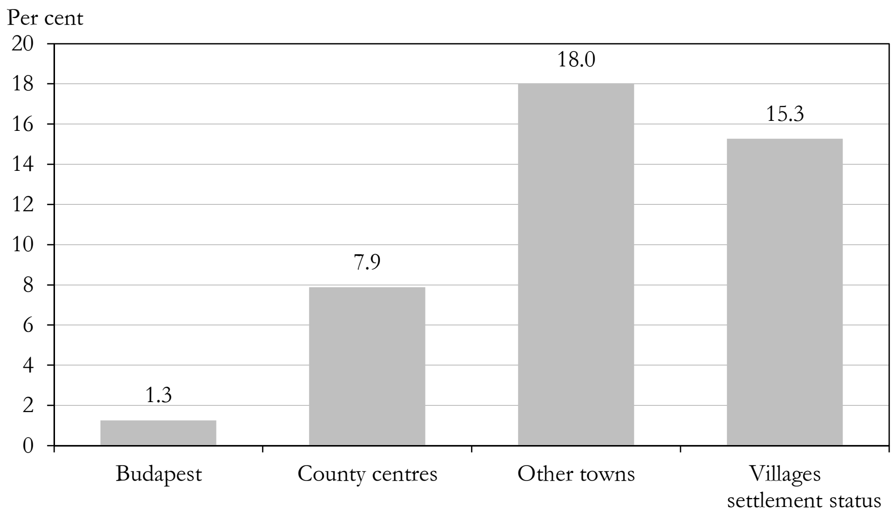
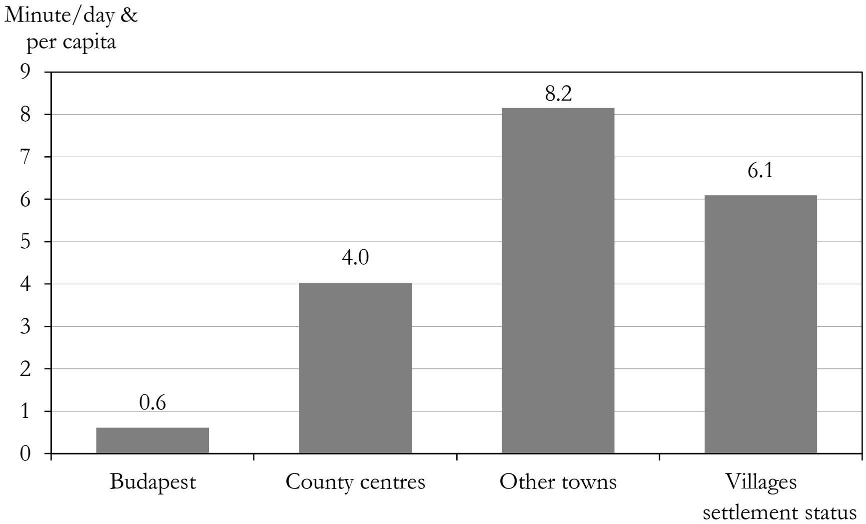


Figure 2 shows that there is much bigger difference in bike use proportions between settlement categories than between the time-use habits of the users. While the users in bigger settlements spent more time on their bikes than those in the smaller settlements, the proportion of cyclist population in the capital is still very small (1.3%), six times bigger in the county centres, 18% in other towns, and more than 15% in villages. These differences are dominant when we observe the average social time spent on bike in Figure 3.

Concerning the time spent on cycling, Figure 3 shows that 'average residents' of Budapest (biker or non-biker), county centres, villages, and small towns spend approximately 36 seconds (0,6 minute), 4 minutes, 6, and 8 minutes, respectively. A superficial observation of these values will fail to make sense, as the 'average resident' does not exist. However, only the 'A'-type social time values can be compared with the time-use of the other transport mode users; the 'A'-type diagram can show us the social proportions between different transport mode's time-use habits or provide a comparison between the social time-use of the transport and other activities.

Figure 3

Distribution of 'A'-type values of cyclist ('average resident') by settlement status

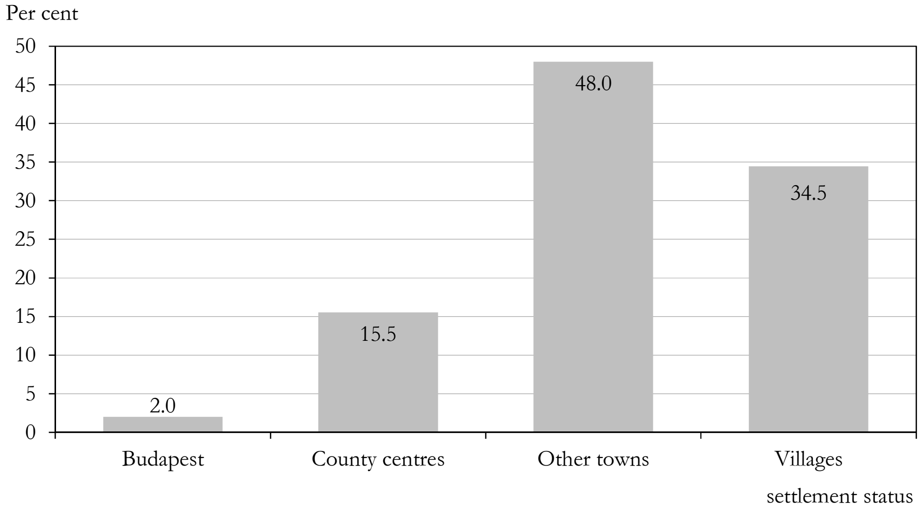


All the above values describe the behaviour of the average transport user, presenting the per capita daily time-use of the average resident ('A') or the average user ('C') of a transport mode. In certain cases, we also wanted to show the volume of the total transport time, multiplying the per capita time-use with the number of the people using the given mode(s) or belonging to the aforementioned categories. These results help us to see the composition of the daily traffic that we can encounter on a given day. Concerning the sample of the study, the population of participants between

10–84 years in Budapest, county centres, other towns, and the villages are 1 536 464, 1 802 868, 2 760 377, and 2 650 376, respectively. Multiplying the per capita cycling time of the people with these values, we get the proportions as shown in Figure 4. The differences between settlement groups have been growing even bigger than the per capita differences that were indicated in Figure 3.

Figure 4

Share of the total time the population spent cycling (100%) by settlement status (2009/10)



Out of the easily traceable diagrams, we developed the multidimensional database. We found that the distribution of the time spent on transportation is not normal, but an asymmetric one and it is the logarithm of the time spent that shows a normal distribution. We ran an ANOVA multivariance analysis for both the original and logarithmic scale to examine the extent to which the different social, demographical, and territorial variables are able to explain the deviations. The two approaches we will present in the last chapter have shown very similar results. This portion of the study would need further analysis and control before making final statements. Concerning the multivariance analysis, had to decrease the range of the variables: we classified the 20 county variables into 5 geographical groups and the 15 age groups into 4 new categories: 15–29, 30–44, 45–64, and 65+ years.

The Hungarian time budget for transport: Main trends during the period 1987–2000–2010

As mentioned above, the first aim of the study was to control the amount of time spent in transport, and the manner in which the time spent has changed over time.

The targeted population in the survey of 1986/87 was between 15–74 years of age, and therefore the comparative time series had to refer to that age group of the population. Since the age groups 10–15 and 75–84 travel less than the average, the average time spent on transit for the smaller population range shows bigger values than for the 10–84 age groups. Especially for 2009/10, the related values are the following:

Table 1

Comparison of the total transport time-budget and user share depending on the range of the age groups

Total transport time 2009/10	Average daily social transport time-use for the whole population (Series 'A') [minute/day & per capita]	Share of transport users in the whole population (Series 'B') [per cent]	Average daily transport time for the transport user population (Series 'C') [minute/day & per capita]
10–84 years	62.3	78,6	79.3
15–74 years	65.2	80,6	80.8
Difference	2.9 min	2,0	1.5 min

The stability of the total transport time budget

Comparing the data for the entire transportation activity (all modes) of the three survey period, the most stable values were identified for the share of the people using transport ('B' index) at a given day: 81.2% for 1986/87; 80,0% for 1999/00; and 80.6% for 2009/10. The standard deviation (SD) is 0.59. To make it comparable to the different dimension other indexes we used rather relative standard deviation (RSD) that is standard deviation projected to the arithmetic mean. The RSD is 0.7%.

The average daily time spent on transportation by those who used some transport mode ('C' index) was 76.2 [min/day & per capita] in 1986/87; 74.9 [min/day & per capita] in 1999/00; and 80.8 [min/day & per capita] in 2009/10. The RSD is 4.4%.

Adding to this user population those, whose transport performance was zero on the given day, the average daily social time spent in transportation by the whole population ('A' index, 'social time-use') was **61.8** [min/day & per capita] in 1986/87; **59.4** [min/day & per capita] in 1999/00; and **65.2** [min/day & per capita] in 2009/10. The RSD is 4.7%.

Although methodology, sample size, age range, etc. are different, the Central Statistical Office conducted time-budget surveys already in 1963 and 1977. In 1963, the surveyed population was between 18 and 60 years old. In 1977, the age limit was 15 and 69 years. Using the comparison of Andorka et al. (1990), for a population between 15–69 years of age, the average time spent on transport by the whole population was **63** [minute/day & per capita] in 1976/77 (74 min for male and 55 min for female). The data for the same survey conducted in 1986/87 was 61 [minute/day & per capita]. Owing to other methodical differences, this result can hardly be compared with the recent findings. However, at first sight, we can say that **the hypothesis of the relative stability of the total social time spent in transport was supported by the Hungarian surveys. The average daily per capita transportation time-budget has remained within narrow limits in the same band, since the last 35 years**.

Distribution function of the daily time-use values

Before we think about the average time spent on transportation as a characteristically symbolic value describing the behaviour of the population, it is worthwhile to see the distribution function of this value. *Figure 5a* shows the distribution curve of the per capita daily transport (all modes) time-use of the people in Hungary in 2009–10. This diagram is built on unprocessed sample data, otherwise relating to series 'A', but the average time-use here is 59.6 minute, while the relative standard deviation is 106%. The figure shows that about 22% of the people do not travel on an average day. The people who travel follow an asymmetric distribution (similar to a scale-free distribution shape): rapidly decreasing from 15–16% to extremely small values while achieving 250–300 minutes time-use. The 59.6–minute average time-use does not represent any distinguished or characteristic point on the diagram.

Figures 5a and 5b.

Distribution of the per capita daily transport time-use of the people in Hungary in 2009-10 ('A'-type values): Normal scale and logarithmic scale

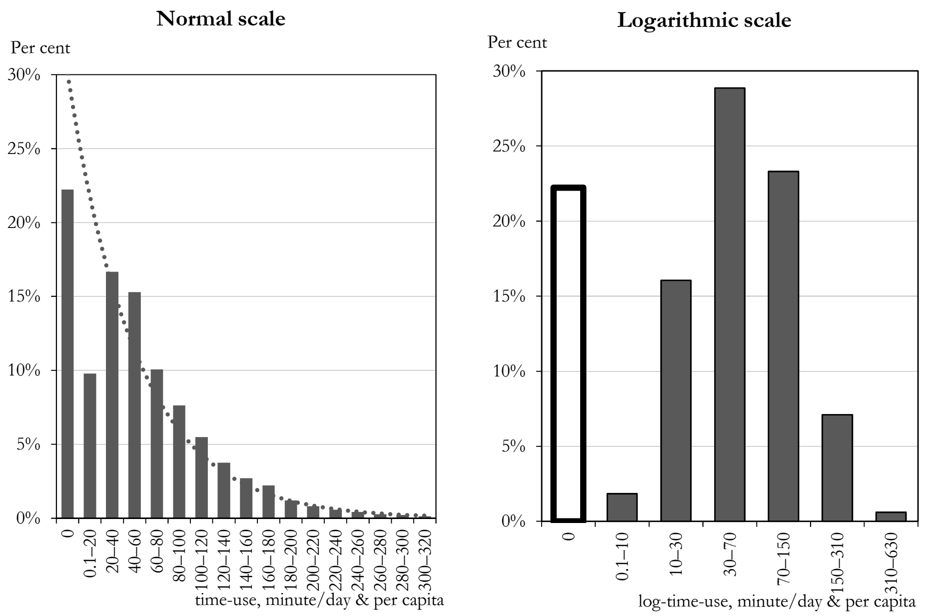


Figure 5b shows the same data, but the time-use axis has a logarithmic scale (the '0' point does not make sense at that scale, not part of the diagram). The active transport time-users present a normal distribution after such transformation.

While the study does not illustrate, but similar diagrams have also been made for the total transport time-use for 1986/87 and 1999/00. We also calculated the median values, as the distance between the arithmetic mean and the median offers a rough estimate on the steepness of the diagram. We saw earlier that the average values were relatively stable in decades, which leads to the question whether the distribution has undergone a change.

Table 2

Comparing arithmetic mean and median values of the transport time-use surveys of the 80s, 90s and 00s

Comparing survey averages and medians Surveys	Average daily social transport time-use for the whole population (Series 'A') 15–74 years [minute/day & per capita]	Median value of the daily transport time for the whole population (Series 'A') 15–74 years [minute/day & per capita]	Difference between average and median (Series 'A') 15–74 years [minute]
1986/87	61.8	50,0	11.8
1999/00	59.4	45,0	14.4
2009/10	65.2	50,0	15.2

Table 2 shows that even if there is a tiny increase in the differences between averages and medians, the main conclusion is that the definite asymmetric distribution of the transport time-use function is a permanent feature; in addition, a very big share of the heterogeneity follows from that character: people prefer short trips that need little time. **The frequency of the daily travel is more-or-less inversely proportional to the duration of the trips**.

While this function would be clearly an important part of the transport time-use analysis, a detailed study should connect the trips to the geographical location of the destinations and would lead out from our time-budget statistics domain. Our study does not analyse this problem further and focuses on the effects that can be discussed within the frame of the time-budget statistics.

In the next section, we have continued with a detailed analysis of the components of the time-budget using the previous, 2009/10, survey data series. Occasionally, we have referred to the time series data in case of specific topics, but otherwise the study focuses on the modal differences in transport time-use and on the effects of the social, spatial, and demographic differences on the time-use.

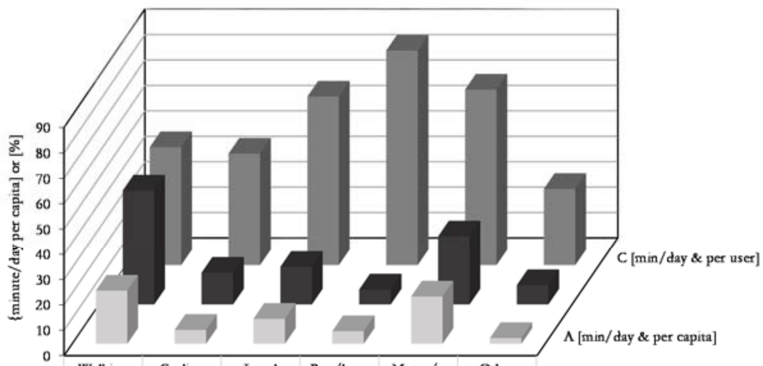
The Hungarian time budget for transport: Detailed study of 2009/10 focussing on the main causes of the deviations

Even if the average total transport time-budget does not change much in time, we know that this average covers very different patterns of time-use.

Composition of the transport time-use from different transport modes

Figure 6/Table 3

Transport time-use composition of the different transport modes



	Walking	Cycling	Local public transport	Reg/long distance public transport	Motor/car use	Other modes
A [min/day & per capita]	21.0	5.5	9.9	5.0	18.6	2.3
B [user % of the population]	45.0	12.5	14.8	5.9	26.9	7.6
C [min/day & per user]	46.6	44.0	66.4	84.6	69.2	30.1

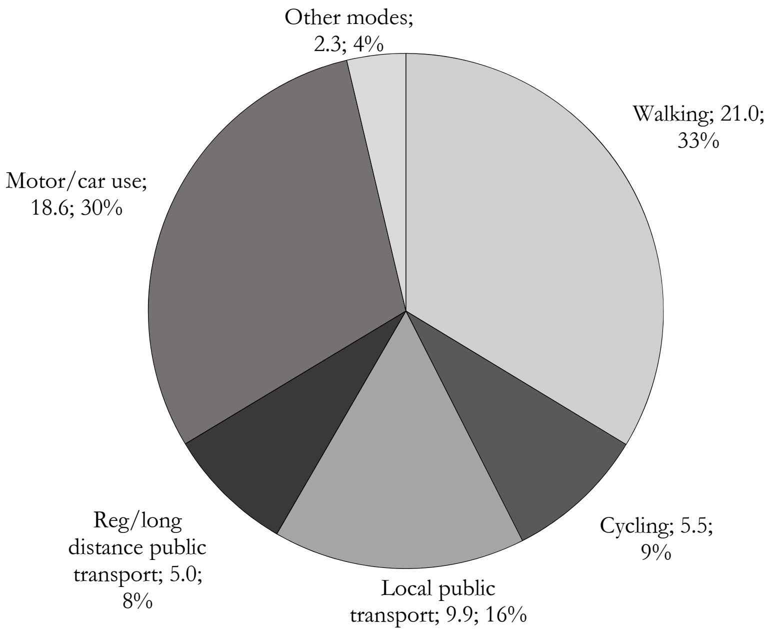
As seen above, 78.6% of the population uses transport on an average day. Row 'B' in Table 3 shows in detail that 45% of the population walks on an average day, 26.9% uses car or motorcycle, 14.8 + 5.9% uses public transport, 12.5% uses cycle, and 7.6% uses other transport mode. We can also see that the shares of the modes-use are overlapping, and they cannot be added.

While only 5.9% of the population uses regional or long distance public transport, those who use the mode spend maximum amount of travelling time, i.e. an average 84.6 minutes a day per head (see row 'C'). Car users and local passengers spend 69.2 minutes and 66.4 minutes a day, respectively, travelling in their modes. Concerning people that choose to walk, on an average people walk 46.6 minutes a day, while bikers spend 44 minutes cycling. These time-use data overlap more than four times and they cannot be added.

Row 'A' shows the amount of time that a person in the society (that is users and non-users together) spends with each transportation mode. The highest time is spent on walking, which totals to 21 minutes per day and per capita, closely followed by car use (18.6 minutes). Public transport, cycling, and other modes total to 9.9 + 5,0 minutes, 5.5 minutes, and 2.3 minutes respectively. On the one hand, these values enable us to compare time-use in other areas of the society spanning 1440 minutes in a day. On the other hand, an addition of these values gives us the total transport time that average people spend on transport (Figure 7 shows that it was 62.3 minutes in 2009/10).

Figure 7

Dividing the average per capita daily transport time-use (62.3 minutes) between different transport modes in 2009/10

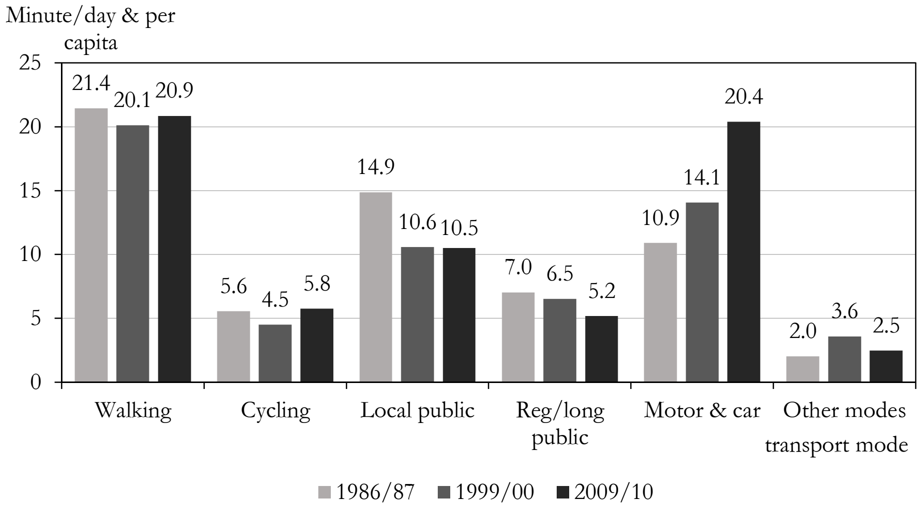


Here, it is useful to look back and examine how these modal shares have been changed over time. As the data here refers to the 15–74 years age range, the numbers differ slightly from the above data in the case of the period 2009/10.

The most characteristic change seen in Figure 8 is an increase in the car-use time: the time almost doubled from a daily 10.9 minutes in 1986/87 to 20.4 minutes in 2009/10. During the same period, both local public time-use and regional/long distance public time-use decreased from 14.9 minutes to 10.5 minutes and 7,0 minutes to 5.2 minutes, respectively. There was no significant change in the rest of the transport modes: walking and cycling both showed the same time-use as earlier (about 21 minutes and about 5.5 minutes, respectively).

Figure 8

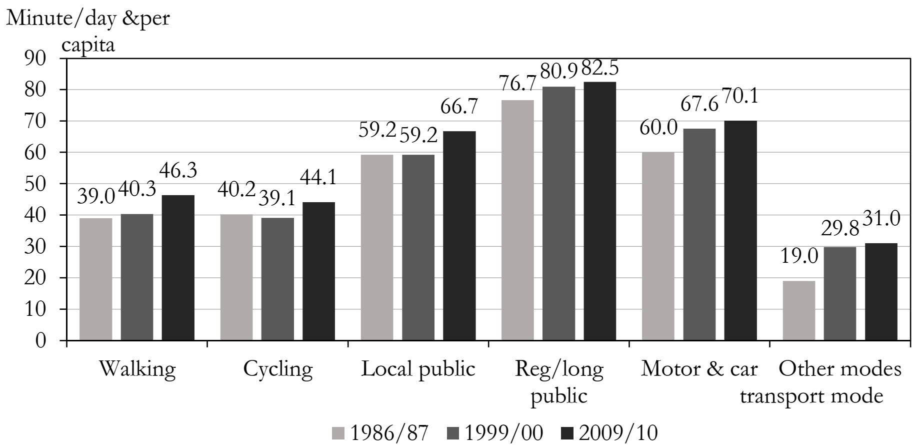
Manner in which the social time spent on different transportation modes has changed in the past two decades



It is interesting to note how these changes were based on the behaviour of the users and on the changes in the share of the users of the different modes. Figure 9 helps us to understand that the users of each mode spend more time on their respective modes now as compared to the time spent earlier. Even in the case of public transport, the time spent by the users of local public transport increased to about 10% and only little less for the distance public transport users.

Figure 9

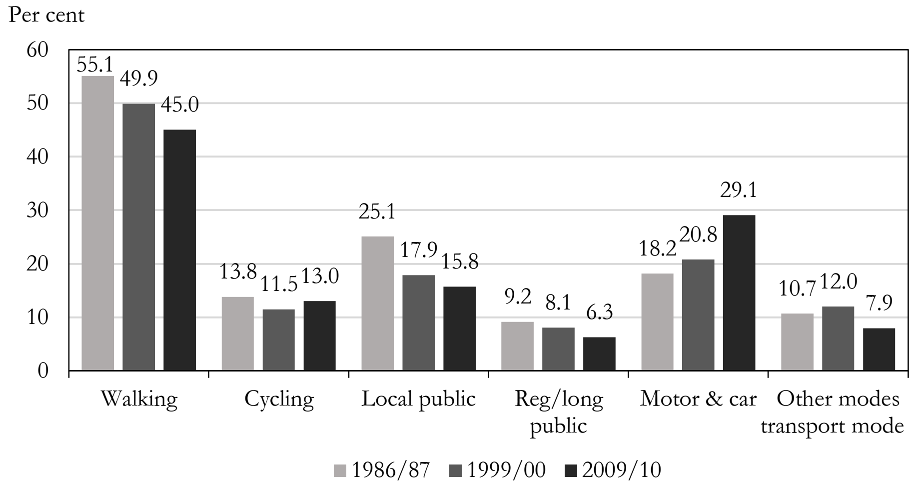
Manner in which the time spent by each transport mode user has changed in the past two decades



During the same two decade period, the share of those using the given transport modes (Figure 10) increased only in the case car (from 18.2% to 29.1%), while at the share for all the other modes decreased (e.g. from 25.1% to 15.9% for local public transport and 55.1% to 45,0% for walking). As a result, the sometimes reversed tendencies produced relative moderate change in the modal time-use of these modes as presented above in Figure 8.

Figure 10

Manner in which the share of each transport mode users has changed in the past two decades



Time-use bias by demographic, spatial, and social background

Time-use bias by gender in 2009/10

Turning back to the 2009/10 survey, the gender share of 62.3 minutes of average daily transport time-use ('A') comes from an average of 67.7 minutes time-use by males and 57.3 minutes time-use by females. This produces an 11.8% RSD value. The significant share of the 10 minutes difference comes from car use, where the daily car-use by males totals to 25.1 minutes, while the daily use by females totals to 12.8 minutes. There is also a similar directional difference in distance public transport and cycling (5.3 minutes versus 4.7 minutes and 6.2 minutes versus 4.9 minutes, respectively). Reverse directional difference is observed in case of walking and local public transport (19.3 minutes for male versus 22.4 for females and 9.5 minutes for males versus 10.2 for females, respectively).

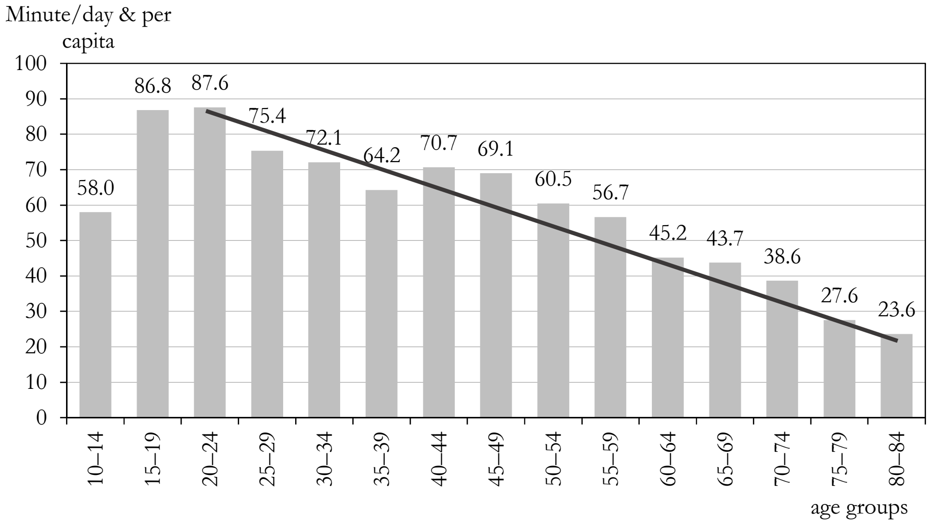
The share of users by gender (percentage, 'B') and the average time spent by the users themselves (min/day & per capita 'C') presented parallel directional asymmetry for the modes: they together contributed the described 'A' results.

Time-use bias by age group in 2009/10

For **transport activity as a whole** and for the total population ('A' type data), Figure 11 presents the average daily social time-use values by five-years long age groups. The youngest (10-14 y) group spends 58 minutes on transportation and the value quickly increases to close to 90 minutes. From the 20-24 years age, there has been an almost monotonous decrease in the average time-use. The black line below depicts the change in the sampled 60 years, between ages 20 and 80, which shows a decline in daily transport time-use from about 90 minutes to about 30 minutes, i.e. a one-minute social time decrease per age-years.

Figure 11

Social time spent on transport by age group in 2009/10



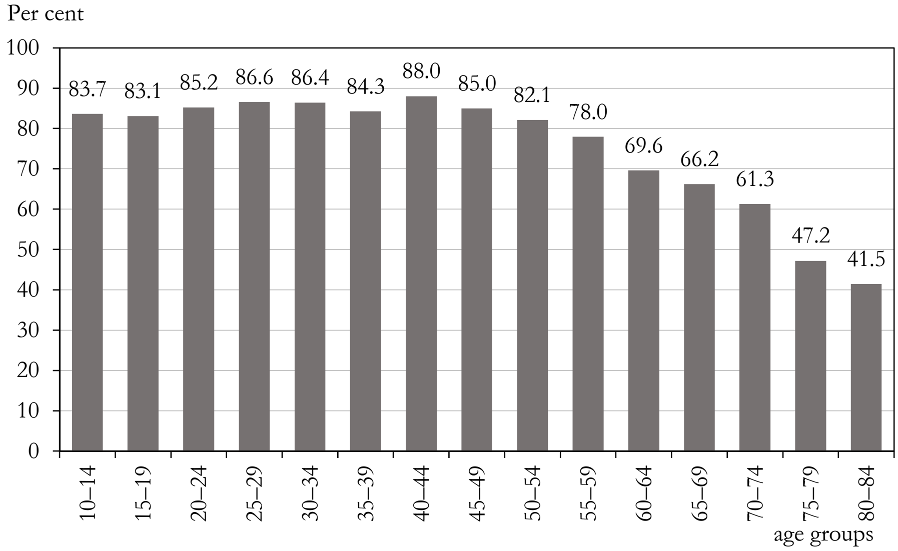
A more detailed observation reveals that nearly 90 minutes of time-use in young users aged 15–24 years, is followed by a plateau-shaped curve with a time-use of 70 minutes in users aged 30–49 years, following which started the smooth decrease in time-use.

This age group based time-use shows a high RSD of 31.5%.

It is also worthwhile to study the 'B' and 'C' components of this change by age group. Concerning the share of users within the population ('B'), it stays almost constant around 85% until age 50 and from this point it decreases to 45% along the next 30 years (Figure 12). The RSD of this 'B' component is 19% and an additional 18% RSD is explained by the 'C' component. The actual users daily spend 103-105 minutes on transport at age 15–24 years, which reduces to 87 minutes from 25 years of age and decreases further to 57 minutes in the next 60 age-years.

Figure 12

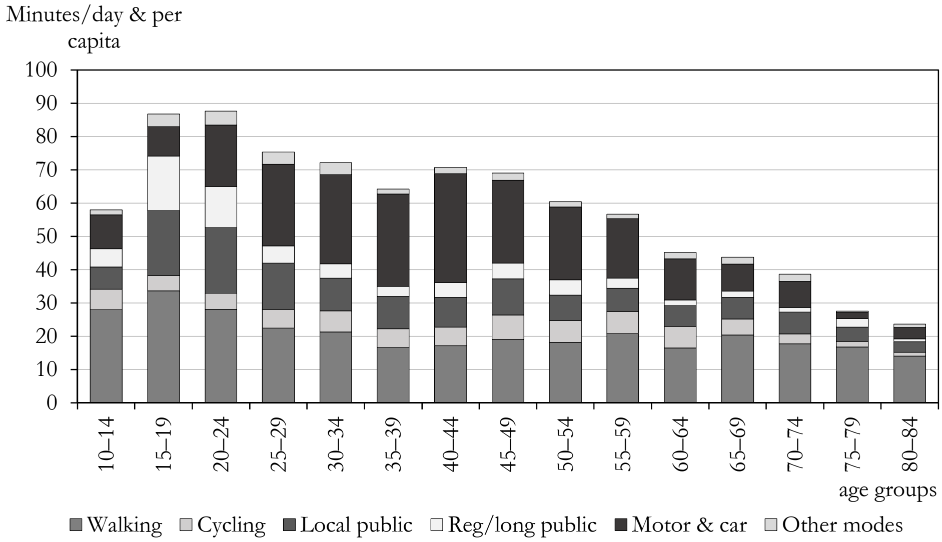
Share of the transport user population by age group in 2009/10



As for the modal share of the age-based time-use, the results can be easily presented (for the 'A' type data) through a single figure (Figure 13).

Figure 13

Social time spent on transport by age group and by transport mode in 2009/10



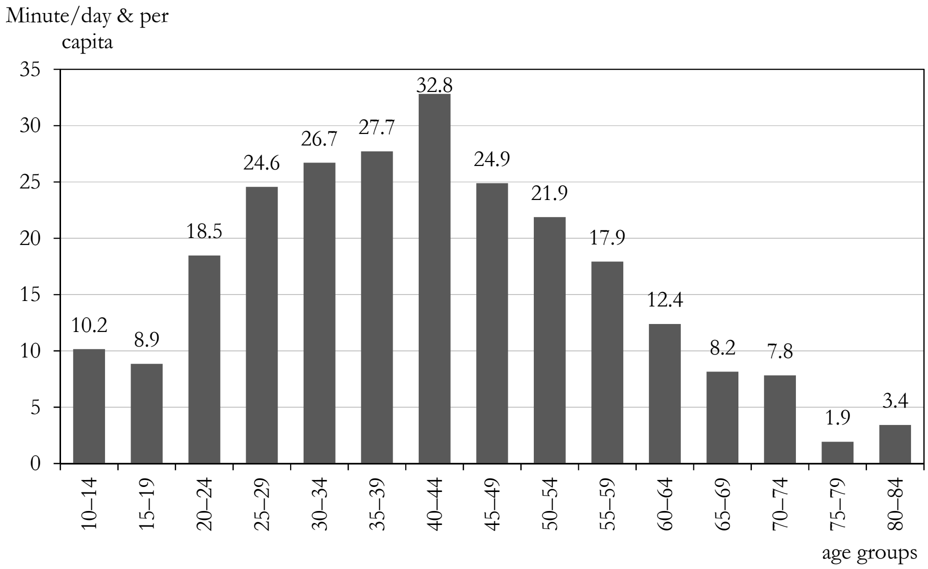
While the contour of Figure 13 is identical to Figure 11, it again shows the extent to which walking and car use dominates the transport time-use. As already shown in

Figure 7, the third notable time user is the local public transport. However, here we can also follow that car use time increases with increasing age and pushes down all the other transport modes until the early forties; while car use time begins to decrease from the forties, the proportion—sometimes even the value—of all the other modes increases.

It is worthy to highlight the biggest time-users and present them separately. Figure 14 shows the average social time in car and motor use ('A').

Figure 14

Social time spent on motor/car transport by age group in 2009/10



Until the age 19, the average daily car use is 10 minutes. This time-use increases from 20 to 33 minutes in the age group of 20–44 years; however, this time goes back below 10 minutes from 45 years onwards until the succeeding 30 age-years. The RSD is 52%.

The deviation in the time-use among the car users ('C') is much less. The users below 19 years, 20–59 years, 60–74 years, and above 75 years spend daily 55 minutes, about 70 minutes, 60 minutes, and lesser, respectively, in car. The RSD of this component is 16.8%. The main cause of deviation of time-use along the age years is the share of the users. The shape of this 'B' diagram is quite similar to that of Figure 14. The share of the car/motor users below age 19 is 17%. This percentage rises from 25% to 42% in users aged 20–44 years, while this percentage goes back to 13% and then reduces to 5% in the successive 30 age-years. The RSD is 44.3%.

Figure 15 points to the fact that the characteristic time-use rise in the middle age-years originated more from the male population than from the females. Males spend about two times more time on motor/car transport in their active years than females.

Figure 15

Social time spent on motor or car transport by age group and by gender in 2009/10

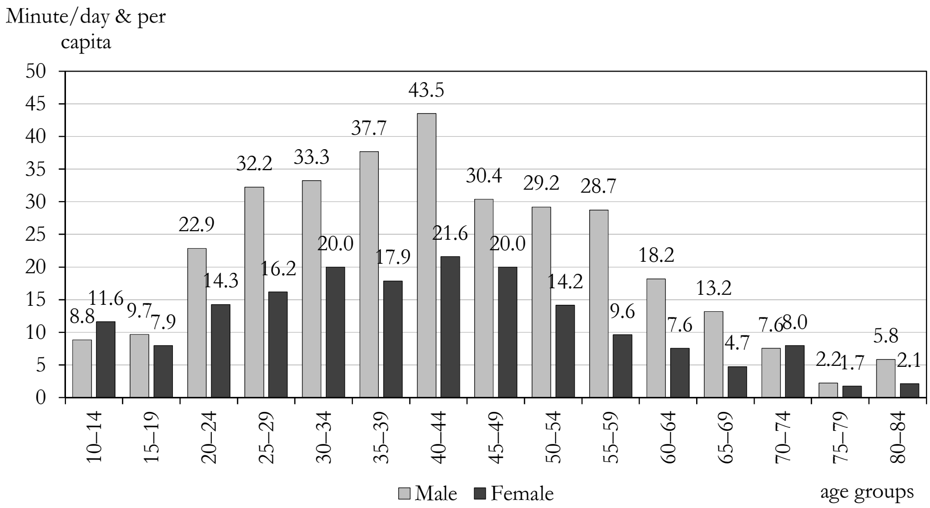
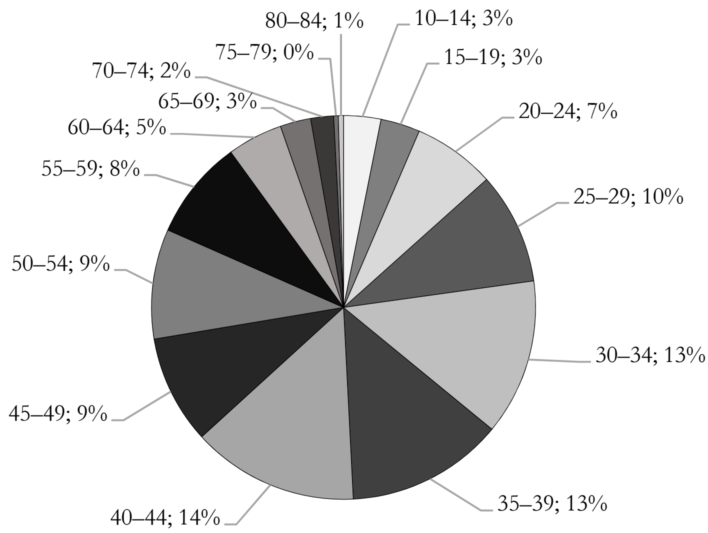


Figure 16

Share of the total social time spent on motor or car transport by age group in 2009/10

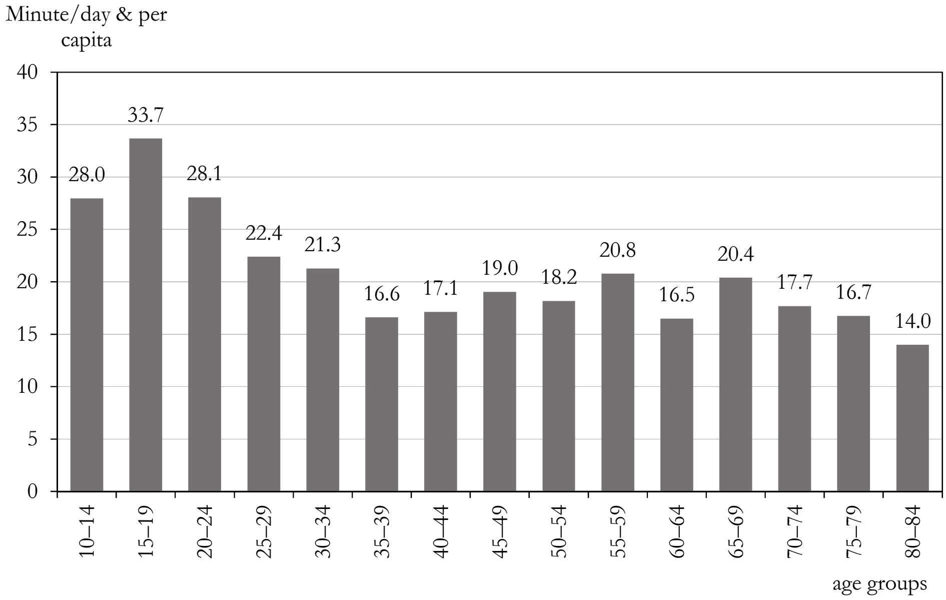


In concluding this section, it is meaningful to look at Figure 16, wherein a pie diagram presents the share of the age groups appearing in cars or motorcycles on an average day. To get these proportions, the per capita time data used in Figure 14 had to be weighed by the population share of the given age group. The Hungarian census was held in 2011. During this period, the people involved in the time-budget survey had become a year older, and hence the census age groups fitted to the time-use data were 11–15, etc. instead of 10–14, etc. Figure 16 shows that **motor/car-users aged 25–44 years** (who represent 33.2% of the 10–84 years old population) **give half (49.8%) of the time that the population spent with this mode on an average day**.

In case of **walking,** an average of 40–50 minutes a day is spent by people who walk ('C'), almost independent of their age (RSD = 7.2%). Concerning the share of people who walk ('B'), about 60% of the people in the youngest age group spend time on walking. This value goes down to 40% until 35 years of age and stays at that level until the age of 50. At this point, another peak is observed as the value rises to 45%, declines back to 40% by the age of 70, and to 30% over 80 years. This 'B' deviation is dominant at a RSD value of 19%. The shape of the diagram with the social time spent on walking ('A'; *Figure 17*) is similar to that described for the 'B' component (RSD = 25.6%).

Figure 17

Social time spent on walking by age group in 2009/10

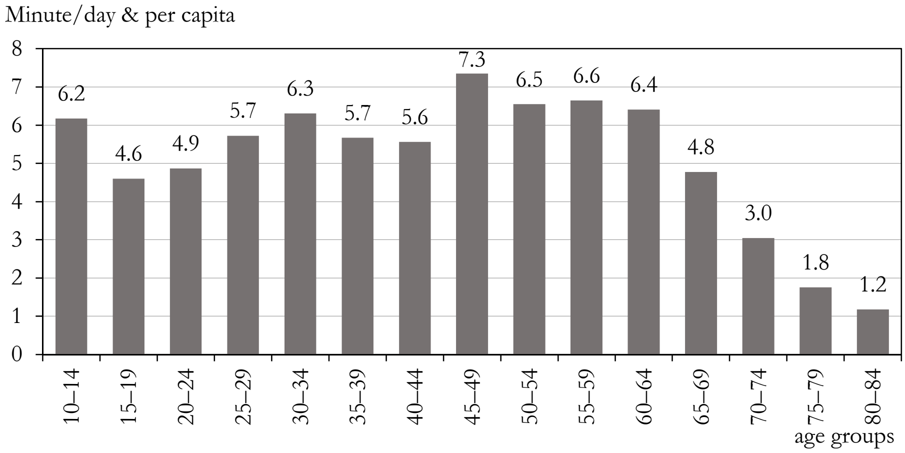


People who use **bike** ('C'), cycle for an average of 40–50 minutes a day, almost independent of their age (this value is quite similar to the people who walk). The RSD is 6.5%. The 'B' value in the diagram shows that, apart from the youngest age group, where 14% use bike, the value starts at 10% and increases to 17%. arriving to the age group 45–49. At this point, the value declines slowly (14%, age 64) and then continues to decline rapidly (~2%, age 80–84). The RSD is 33.9%.

Putting together the picture ('A'), Figure 18 shows that, contrary to the case of walking, the groups that spend most time with this mode are not the younger groups, but the groups between age 45 and 64. The RSD is 33%.

Figure 18

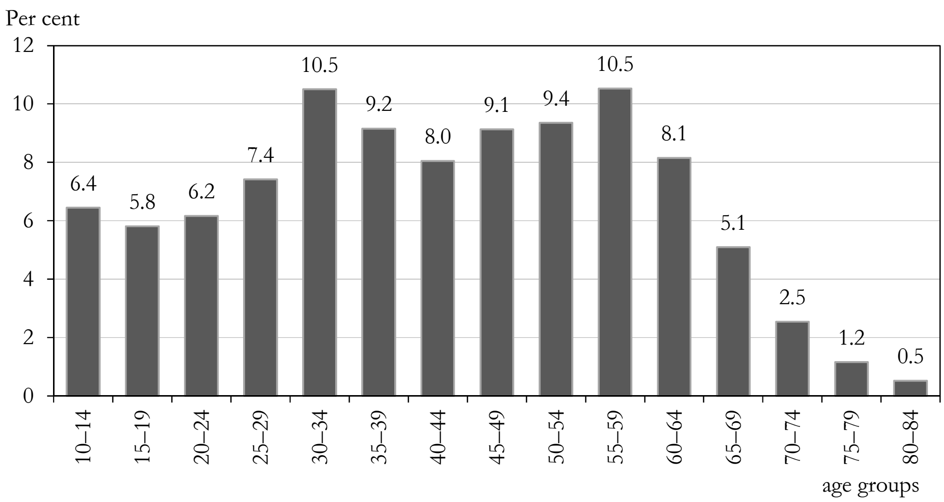
Social time spent on cycling by age group in 2009/10



To obtain the amount of time that an age group spends on cycling, we also have to calculate the headcount of the given cohort, beside the per capita time-use. Figure 19 shows the real share of the time between age groups in the total daily biker time-use (per capita time-use multiplied by the headcount of the age group). The total volume of the users increases the relative significance of the 30s age cohort'.

Figure 19

Share of social time [percentage] spent cycling by age group in 2009/10 (the total cycling time used by all members of all age groups is 100%)

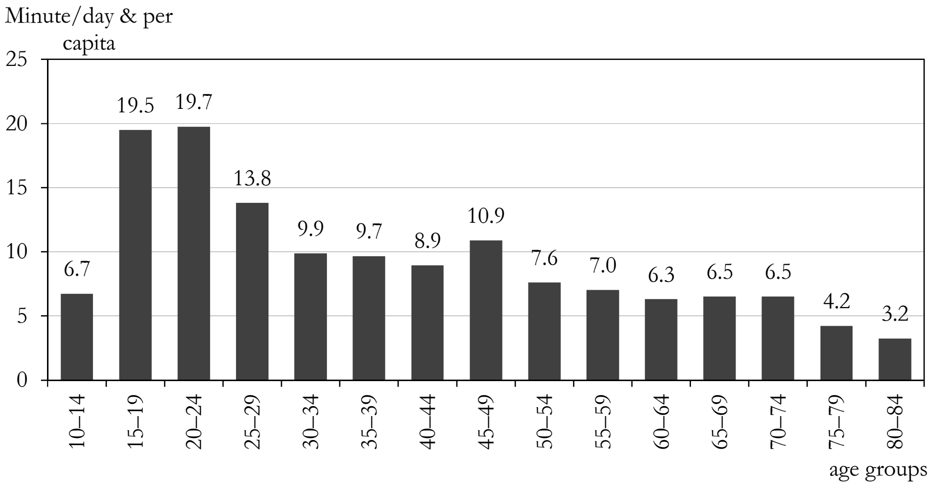


The users of the mode **local public transport** ('C') travel for an average of 55–75 minutes a day. The RSD is 9.6%. Concerning the share of the users ('B'), it is high in ages 15–29, decreasing from 30% to 20%. At this point takes the form of a plateau between the ages 30–64 at about 14%; followed by another plateau at 10% until the age of 74. The RSD is 46.5%.

The share of users with its high RSD value is the dominating factor and the contour of the 'A' type diagram (Figure 20.) follows that of 'B'. Apart from age 10–14, the main users of the local public transport are the young people (age 15–24) with almost 20 minutes of daily use. The successive age groups witness a significant and monotonous decline from 14 minutes to 3 minutes. The RSD is 49.6.

Figure 20

Social time spent on local public transport by age groups in 2009/10



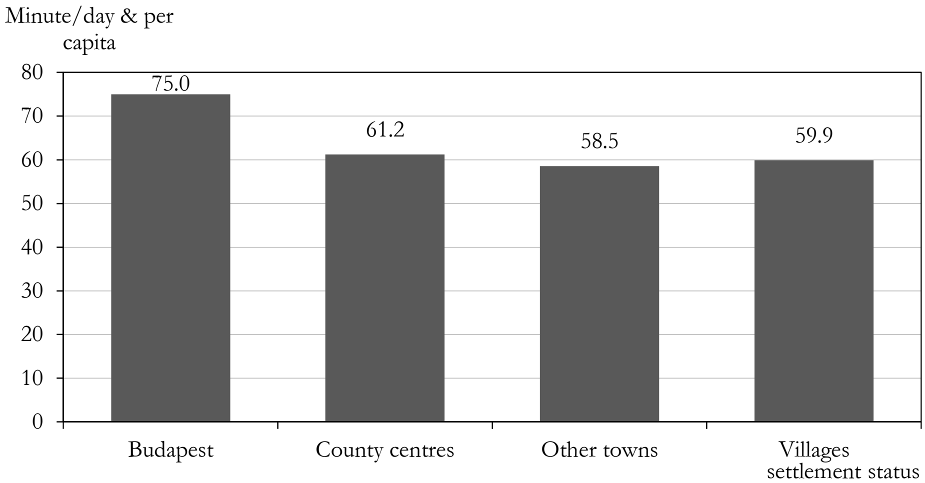
The main characteristics of the **long distance public transport** are similar to the local public transport, but the time-use values are smaller (an average of 5 minutes versus 9.9 minutes in case of local public transport) and the RSD values are bigger (84% versus 49.6% in the 'A' series).

Time-use bias by settlement status in 2009/10

We distinguished four categories by settlement status: Budapest, county centres, other towns, and villages. Considering **all the transport modes,** the social time-use (for the whole population, 'A') in Figure 21 shows that Budapest markedly differs with its average 75 minutes daily time-use, while all the other places use about 60 minutes (RSD = 12.3%). This is caused by the high travel time-use of 95 minutes by people in Budapest as opposed to the 75-77 minutes of time-use in other places ('C') (RSD = 12%). The share of the users ('B') is almost the same (77–80%) in each site (RSD = 1.7%).

Figure 21

Social time spent on transport by settlement status in 2009/10



As the above spatial units cover different volumes of population aged 10–84 years, the per capita time-use expresses the behaviour of the residents, but not the share of the total time the society spends on transport. The Table 4 shows that the share of the population in the groups varies from 17.6% (Budapest) to 31.5% (other towns), and this difference dominates the total time-use shares. The villages and smaller towns each use 29–30% of the transportation time, while the county seats and Budapest use 20% and 21% of the total transport time, respectively.

Table 4

Per capita and total social time spent on transport in different settlement groups in 2009/10

'A'	Time-use/cap [minute/day & per capita]	Population [head]	Population [per cent]	Total time-use [minute]	Total time-use [per cent]
Budapest	75,0	1 536 464	17.6	115250930	21.1
County centres	61.2	1 802 868	20.6	110302223	20.2
Other towns	58.5	2 760 377	31.5	161556649	29.6
Villages	59.9	2 650 376	30.3	158754230	29.1
Total		*8 750 085*	*100*	*545 864 032*	*100*

Concerning **walking**, no difference was observed between the places: people walk for 20–22 minutes ('A') per capita per day. In this case, Budapest shows an average time-use of 21 minutes.

The difference is also small in case of **motor/car transport** use: 20 minutes ('A') in Budapest and in county centres and 18 minutes in the other two settlement groups

(RSD = 6.8%). A speciality of the settlement status case is that the variables, share of users ('B') and time spent by the users ('C'), show an inverse-shaped deviation for almost each mode.

Figures 22 b and c

Percentage of population using motor or car transport [%, 'B'] and time spent on motor/car transport by users ['C'] by settlement status in 2009/10

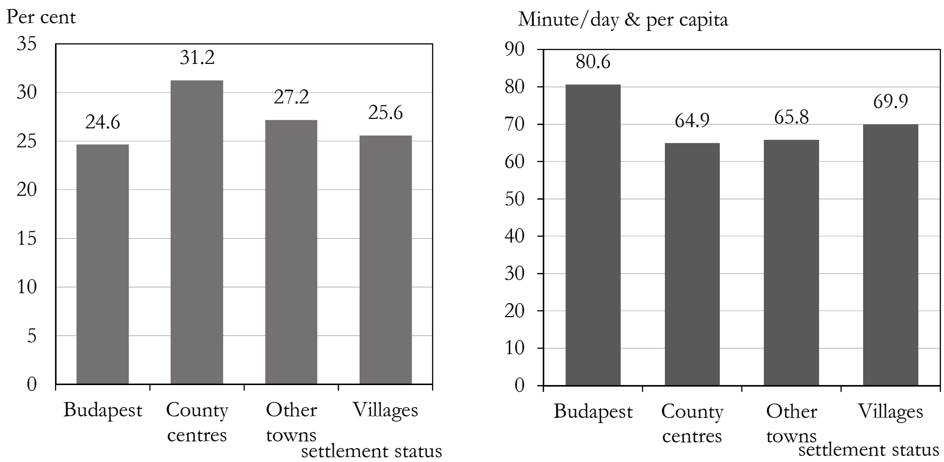


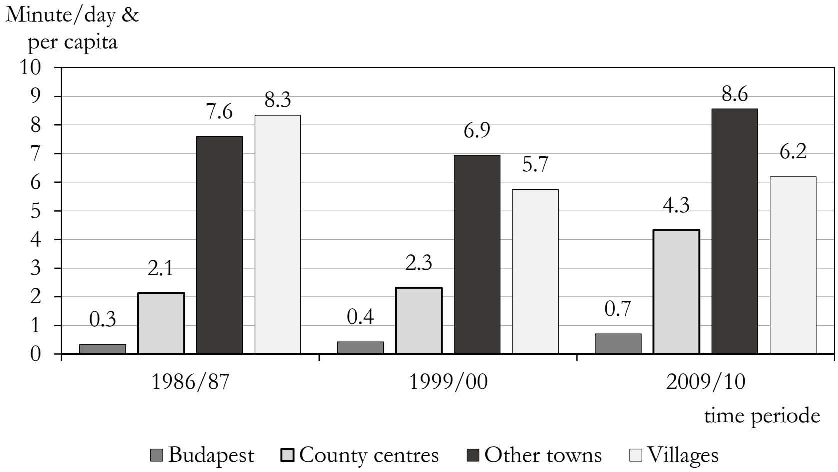
Figure 22 shows that while the share of the motor/car users ('B') in the county centres is significant (33.2%) followed by other towns, villages, and Budapest (24.6%), the average daily time-use by motor/car users ('C') shows a totally reverse ranking. Especially, even the RSD of 'B' and 'C' cases of the motor or car transport mode was almost the same (10.8% versus 10.4%), while at cycle and public modes the RSD show that the share of users ('B') became dominant.

In the case of **cycling,** the time used by bikers ('C') varies between 40 and 51 minutes, which is more in the bigger cities including Budapest – as it was seen in Figure 1. The share of users ('B') vary between 1.3% (Budapest) and 18% (other towns), as we already presented in Figure 2; in addition, the social time used by the whole population ('A') also follows the contour of Figure 2 (see Figure 3).

Considering the small values seen in cycling for Budapest and county centres, it is worthwhile to examine the earlier periods. Figure 23 presents three survey periods together. (The different (15–74) age ranges used for comparison led to higher values for 2009/10, relative to Figure 3.) We can see that the social time spent on bicycle has more than doubled in the past two decades in Budapest and the county centres. The share of the people who cycle tripled during the same period in Budapest: from 0.5% to 1.5% (for users aged 15–74 years). One fact is that there has been a revolutionary change in cycling over the past few years in Budapest; however, both the share of cycle users and the social time an average resident spends on cycling in Budapest is one tenth or less than tenth of those in villages or in smaller towns.

Figure 23

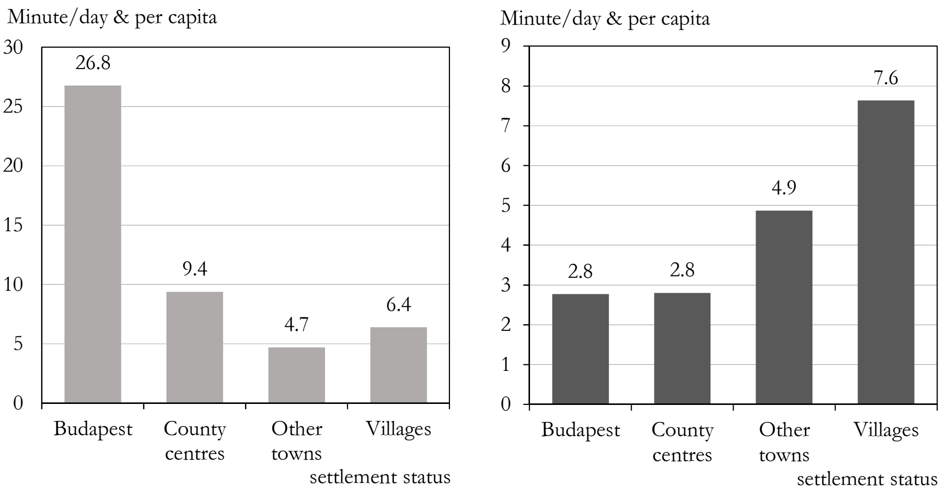
Social time spent on cycling by settlement status in 1986/87, 1999/00, and 2009/10 (people aged 15–74 years)



In the case of **public transport,** the situation of local and distance transport is quite different. Figure 24a presents 'A'-type local transport time-use: daily 27 minutes in Budapest versus 5–9 minutes in other places (RSD = 102%). Naturally, this is significantly determined by the availability of local public transport slowly followed by the necessity to use the mode.

Figures 24 a and b

Social time spent on local (a) and regional or long distance (b) public transport by settlement status in 2009/10



The Figure 24b presents 'A'-type regional or long distance public transport time-use. The range is between 2.8 minutes and 7.6 minutes (RSD = 46%). Evidently, the necessity to use the transportation mode affects the differences between the places largely.

Time-use bias by counties in 2009/10

While settlement status aggregates settlements in a virtual space, studying county level differences connects us with the geographic space.

Figure 25 shows the differences between social time-use of people by counties (**all transport modes** together). The range of the average per capita daily transport time-use spreads from 50 minutes (Békés county) to 75 minutes (Budapest) (RSD = 9.9). Figure 25 ranked the counties by their growing per capita time-use, and also presents a diversified range of modal components of time-use.

Figure 25

Social time spent on transport by counties in 2009/10

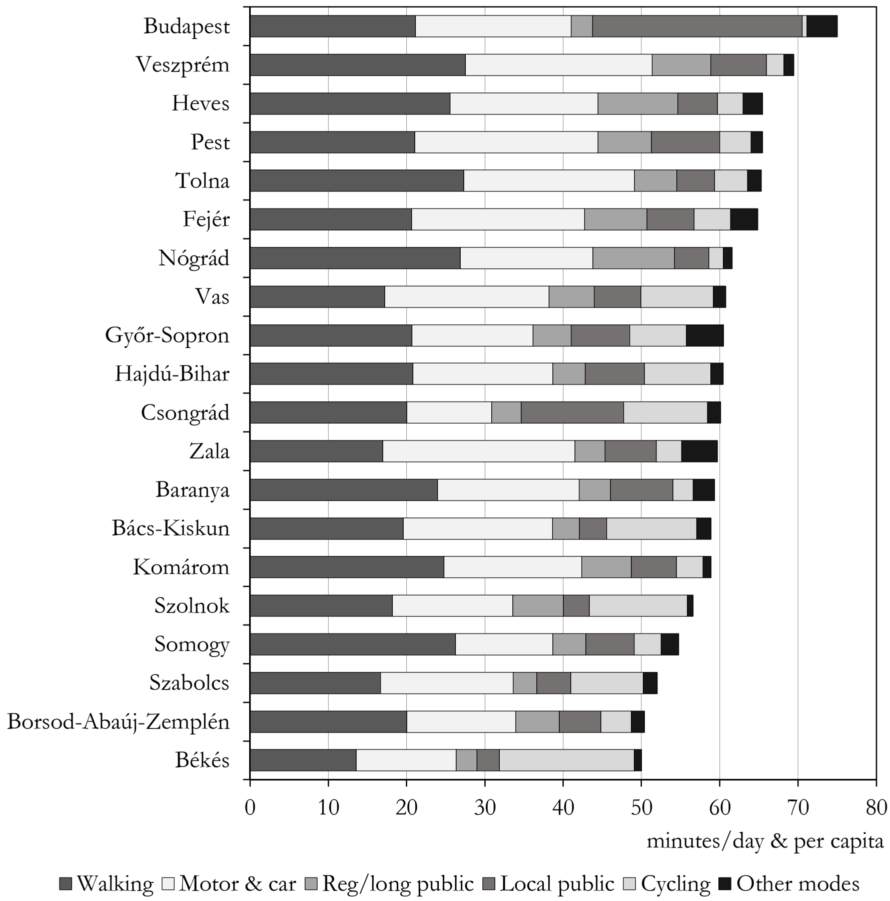


Figure 26

Per capita average daily social time spent on transportation in minutes Hungarian counties in four quadrilles in 2009/10

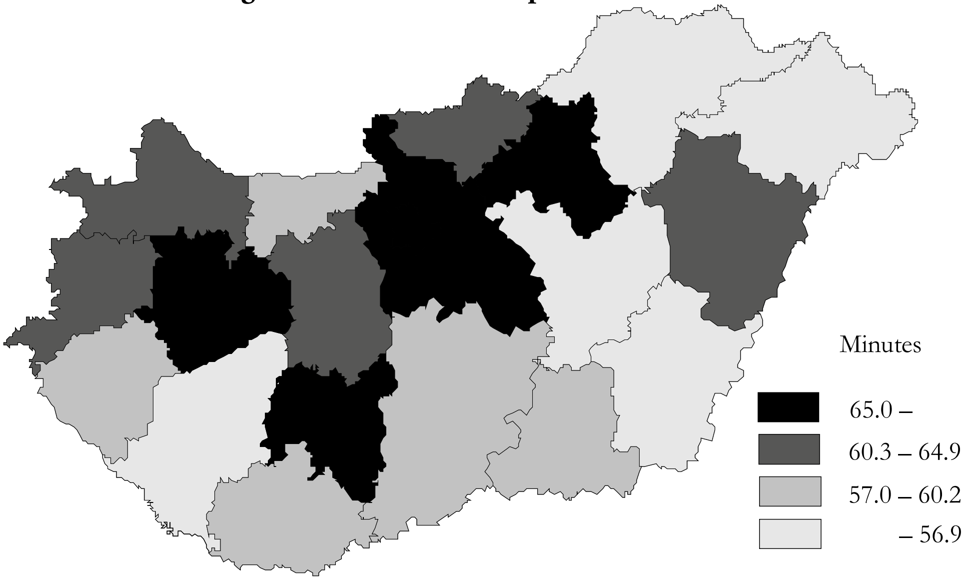


Figure 27

Time spent on different transportation modes by counties in 2009/10

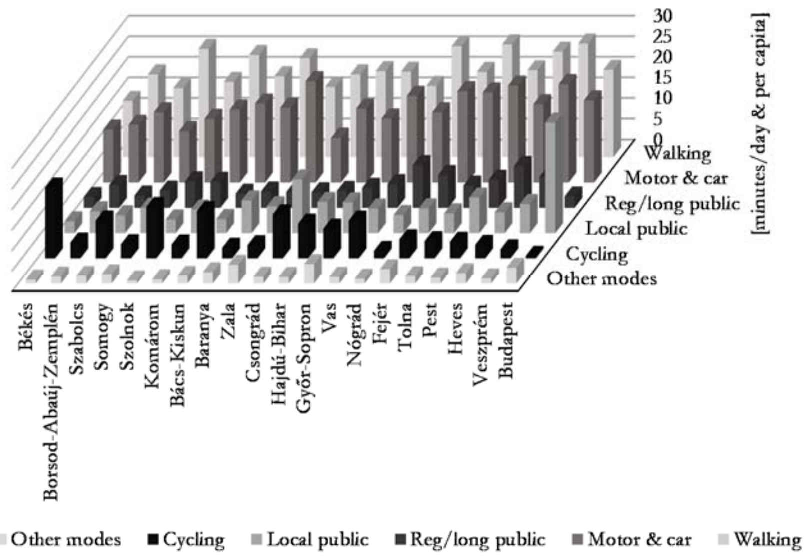


Figure 26. interprets the same social transport time data on a map. The 20 spatial units were classified into four quadrilles by the rank of their average per capita daily transport time-use. The quadrilles do not seem to form any salient spatial structure.

Figure 27 attracts attention to the fact that the main components of the time spent on transportation are walking and motor/car transport in each county, while other modes of transport like local public transport in Budapest or cycling in Békés County peaked at certain locations. Relatively high local public transport and cycling together seem to have led to a significant decline in motor or car transport in Csongrád County.

The overall picture indicates that **bicycle** transport, with its amplitude variance, is also worthy of a countywide study (RSD = 79.5%).

Figure 28

Social time spent cycling by counties in 2009/10.
Ranked by increasing average daily per capita time-use values

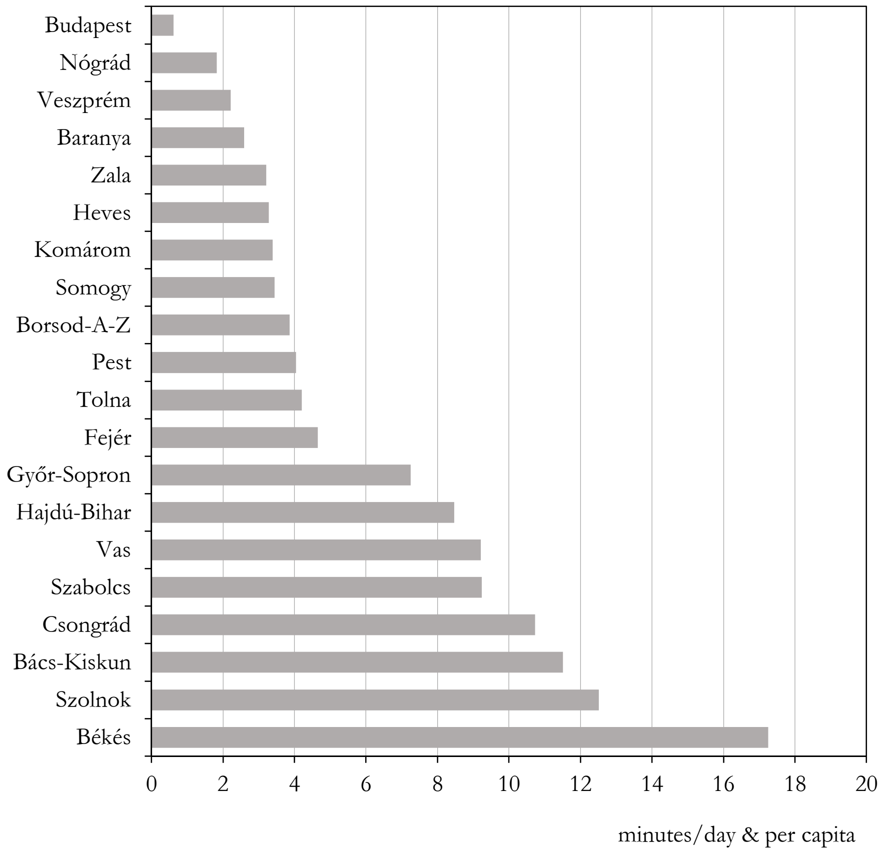
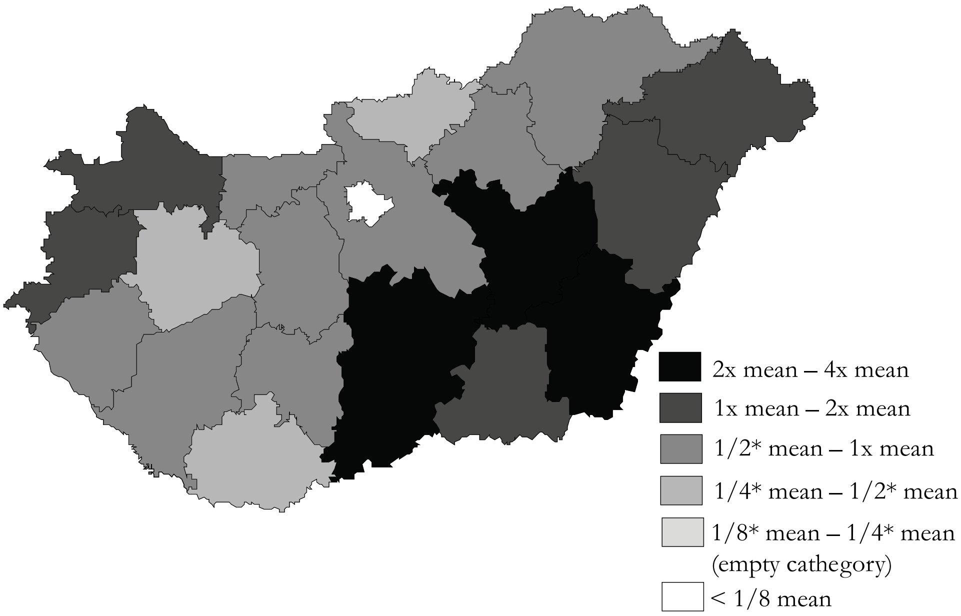


Figure 28 presents the social time spent on cycling in different counties, ranked by the increasing per capita time-use values. While the average cycle time-use in the country is 5.5 minutes/day, it is interesting that just around that average there is a gap in the values and the counties present characteristically lower or higher per capita cycle use times.

Figure 29

Per capita average daily social time spent cycling by counties in 2009/10



The differences can be well studied on the map of Figure 29. As it was mentioned above, average cycling time-use for the whole country is 5.5 minutes per day per capita. There are three counties in the southern part of the Grand Plain/Alföld where people use bike between twice to four times more than the average; and five counties (three in the east and two at northwest Kisalföld) use cycle between 1–2 times the average time. Eight counties along the hilly north-east/south-west line use bike between half and one time the average, while three others, Nógrad, Veszprém, and Baranya, use it between one-fourth and half of the average time. Bike use between one-eighth and one-fourth of the average time is empty and in Budapest, the per capita daily cycling time-use is less than one-eighth of the country average. This geographical pattern follows the varied topography of the country—at least at the countryside.

Time-use bias by activities in 2009/10

This section first presents the **transport time-use** differences by activity status of people that is divided into six categories. Figure 30 shows that students and employed people spend a significant amount of time ('A') on transport, namely 80 and 73 minutes per capita, while the rest of the categories lead to less transport time-use than the 62.3 minutes country average. . (RSD = 24.3).

Figure 30

Per capita social time spent on transport by activity groups in 2009/10

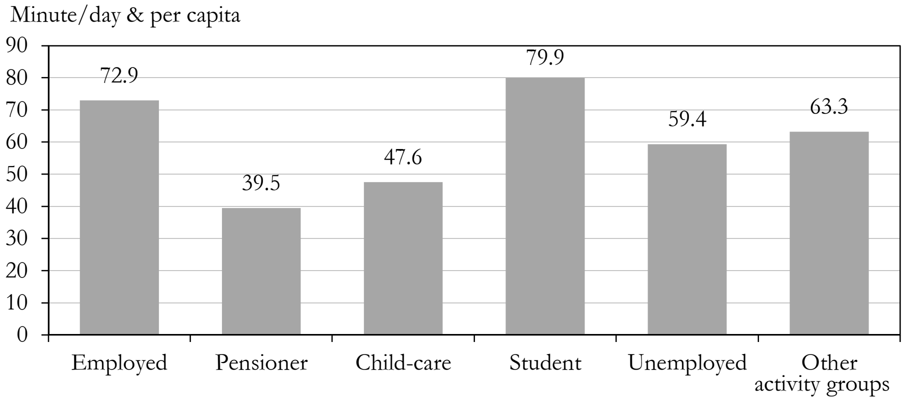
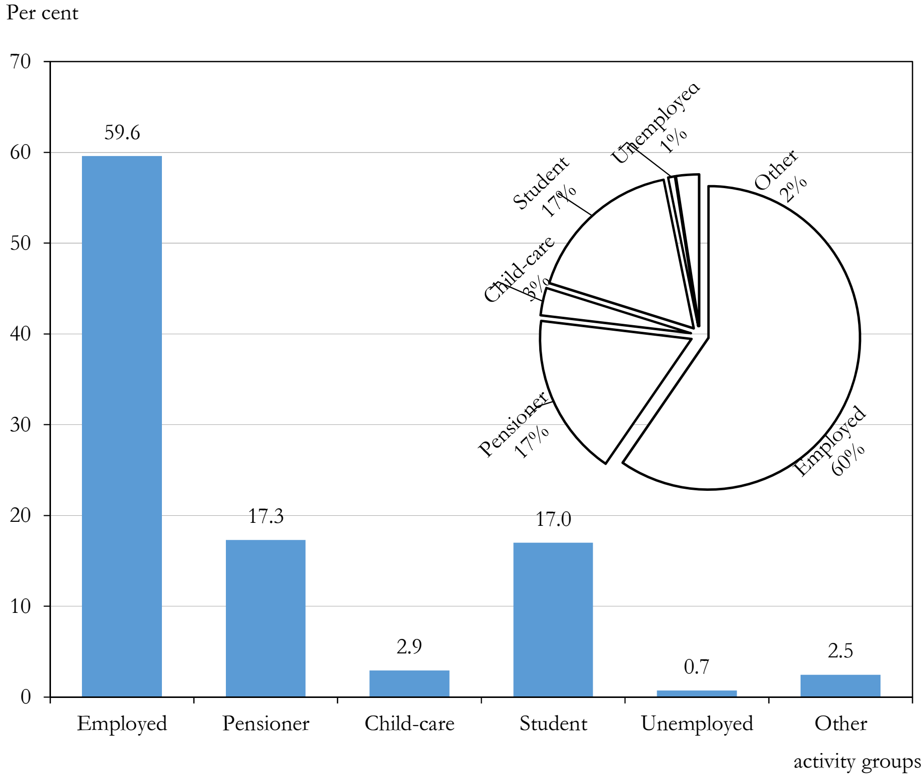


Figure 31

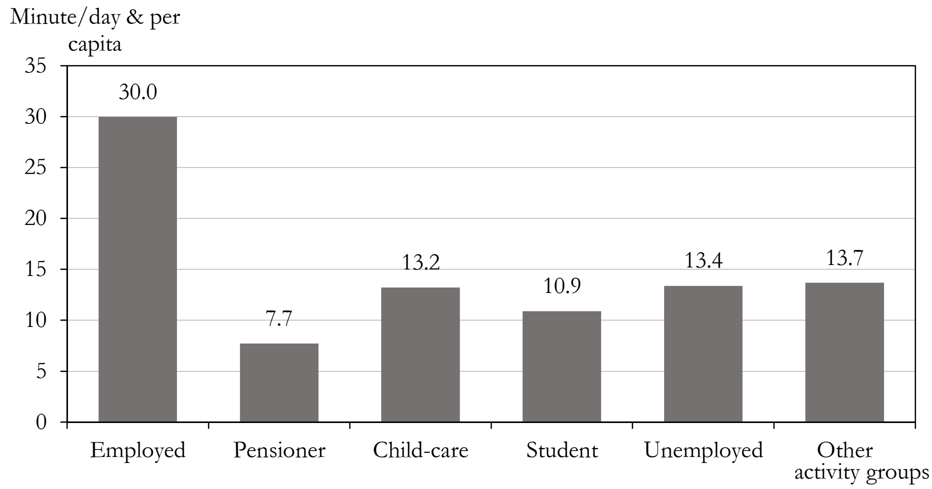
Share of the total time spent on transport by activity groups in 2009/10 (100% is the total time that the population spends on transport)



Since there are big differences in the number of people belonging to different activity groups, the per capita time-use fails to represent their real share that appears as daily traffic. The real traffic share can be presented by multiplying per capita values with the volume of the given activity group. As 51.7% of the 8 750 000 people in the 10–84 age group are employed, 27.7% pensioners and 13.4% students, Figure 31 shows quite a different share of the total transport time-use between the activity groups. The employed people use 60% of the total transport time.

Figure 32

Per capita social time spent on motor or car transport by activity groups in 2009/10



In the case of **motor or car transport** mode, Figure 32 shows that the weight of the employed group is even bigger; the employed people at an average use motor/car transport two-and-a-half to three times longer than people in any other activity group, in the case of the per capita social time-use. Multiplying the per capita use with the population share, it can be inferred that **employed people use 77.3% of the total time used for motor/car transport**.

In the case of **walking,** the per capita social time used by employed people ('A' series) is 17.4 minutes, while other activity groups spend more time walking, especially students who spend 31.6 minutes. Multiplication of per capita time used for walking by different activity groups with the respective population data reveals that employed people, pensioners, and students use 44.4%, 26.4%, and 21% of the total walking time respectively (Table 5).

Table 5

Per capita and total social time spent on walking by the activity groups in 2009/10

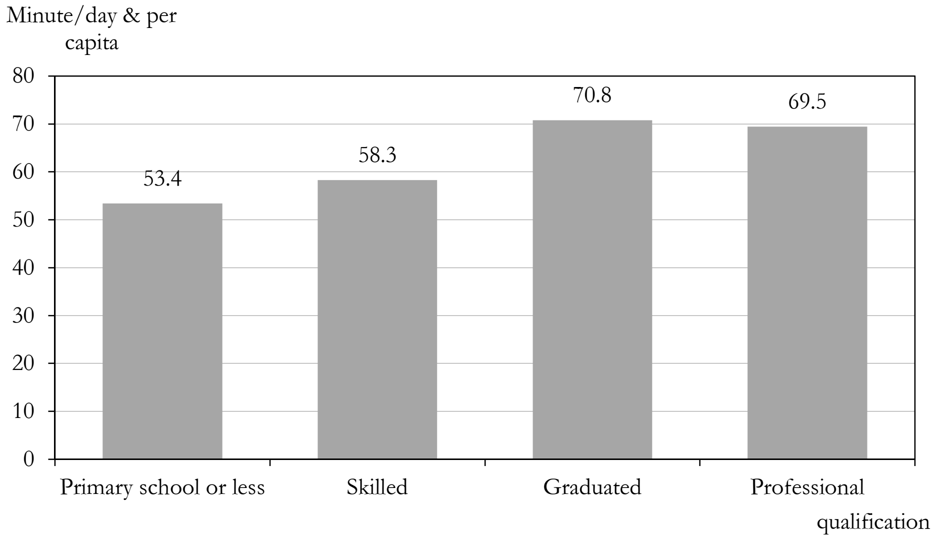
A	Daily time-use [minute/cap]	Population [11–85y range/2011]	Total time-use [minute]	Total time-use [per cent]
Employed	17.4	4,524,603	78,599,176	**44.4**
Pensioner	19.2	2,425,217	46671606	**26.4**
Child-care	22.7	340,669	7,722,523	**4.4**
Student	31.6	1,176,502	37,180,406	**21,0**
Unemployed	26.1	68,111	1,780,852	**1,0**
Other	22.7	214,983	4,882,532	**2.8**
Sum		*8,750,085*	*176,837,094*	*100.0*

Time-use bias by educational qualification in 2009/10

The last series of the explanatory variables present **transport time-use** differences by four educational qualification categories. *Figure 33* shows that people with more education generally spend more time ('A') on transport. While those with finished or unfinished primary school use daily 53 minutes for transportation, skilled personnel use 58 minutes, and graduate or professionals use about 70 minutes. (RSD = 13.6).

Figure 33

Per capita social time spent on transport by qualifications in 2009/10



As there are differences in the number of people belonging to the different qualification groups, the per capita time-use fails to represent their real share that appears as daily traffic. The real traffic share can be presented by multiplying the per-capita values with the volume of the people with the given qualification (Table 6). In the age range 10–84 years, 34% of the 8 750 000 people have a primary school certificate or less; 28.5% of them are graduates; 20.6% skilled personnel; and 16.9% are professionals. Figure 34 shows the share of the total transport time-use between the above groups, where the results are close to the above proportions. People with a primary school certification and graduates use around 30%–30% of the total transport time, while professionals and skilled personnel use close to 20%–20%.

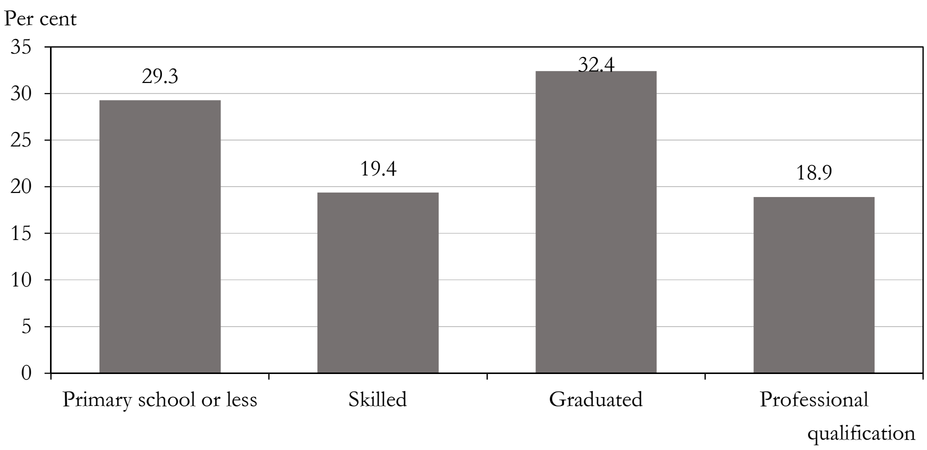
Table 6

Per capita and total social time spent on transport by educational qualification differences in 2009/10

'A'	Daily time-use [minute/cap]	Population [11-85y range/2011]	Total time-use [minute]	Total time-use [per cent]
Primary school or less	53.4	2,977,507	159,022,049	**29.3**
Skilled	58.3	1,805,051	105,266,263	**19.4**
Graduated	70.8	2,489,424	176,201,523	**32.4**
Professional	69.5	1,478,103	102,669,416	**18.9**
Sum		*8,750,085*	*543,159,252*	*100.0*

Figure 34

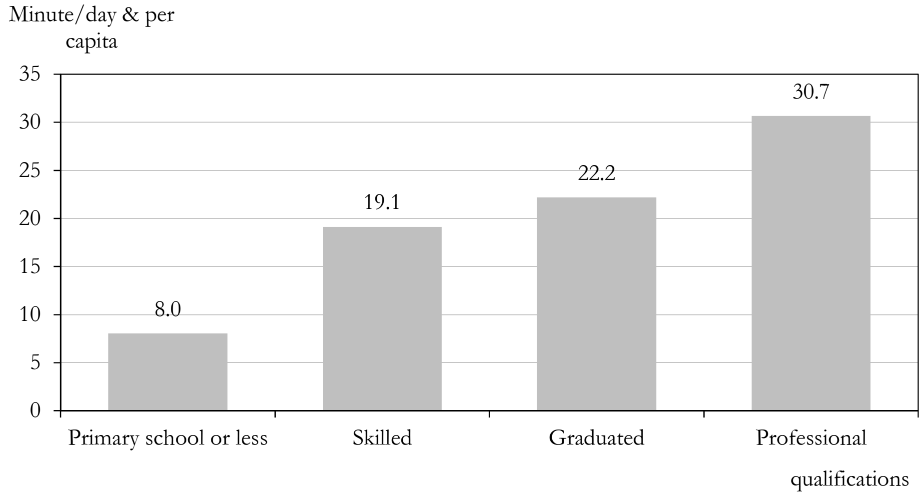
Share of the total time spent on transport by people's qualifications in 2009/10 (100% is the total time that the population spends on transport)



In the case of the **motor/car transport** mode, Figure 35 shows that the bias due to the qualification level is much more definite: the per capita daily social time-use varies between 8 minutes and 31 minute (RSD = 50.2%).

Figure 35

Per capita social time spent on motor or car transport by qualifications in 2009/10



Multiplication of per capita social time spent on motor or car transport with population share owing to bigger population ratio reveals that the graduates occupy a significant share of social car time-use: 34.7% as it is presented in Table 7. This group is followed by professionals with 28.5% time-use; skilled population covers 21.7% of the time; and those not educated after primary school use 15.1% of motor/car time.

Table 7

Per capita and total social time spent on motor/car transport by qualifications in 2009/10.

'A'	Daily time-use [minute/cap]	Population [11-85y range/2011]	Total time-use [minute]	Total time-use [per cent]
Primary school or less	8,0	2,977,507	23,957,051	**15.1**
Skilled	19.1	1,805,051	34,546,757	**21.7**
Graduated	22.2	2,489,424	55,231,968	**34.7**
Professional	30.7	1,478,103	45,316,047	**28.5**
Sum		*8,750,085*	*159,051,823*	*100.0*

Concerning **cycling,** the per capita social time ('A' series) is more-or-less the inverse of the motor or car transport case. While people with primary school education and skilled personnel cycle for an average of 7 minutes daily, graduates and professionals cycle for 4 minutes and 3 minutes, respectively (RSD = 38.3%). These are average estimations; those who really use their bicycle use it for about 45 minutes, independent of their level of education (RSD = 7.4%).

As for **walking**, the differences are relatively small: the skilled personnel and professionals walk for 18–19 minutes on an average daily ('A'), and graduates and people with primary education walk for 21 minutes and 24 minutes, respectively (RSD = 12.1%).

Comparing time-use bias between explanatory variables in 2009/10

Standard deviations (SD values)

If we want to see the extent to which the time-use of the people deviated at the different transport modes, then we have to use the total standard deviation values (SD).

After reviewing the time-use characteristics by two demographic (gender and age), two spatial (settlement status and county), and two social (activity and qualification) variables, we **compared the standard deviation (SD) values** (in Table 8 and Figure 36) that was produced by different variables in time use of transport as a whole and in time-use of each transport mode. The presented values relate to 'A' series, i.e. to the per-capita average daily social time-use values.

Table 8

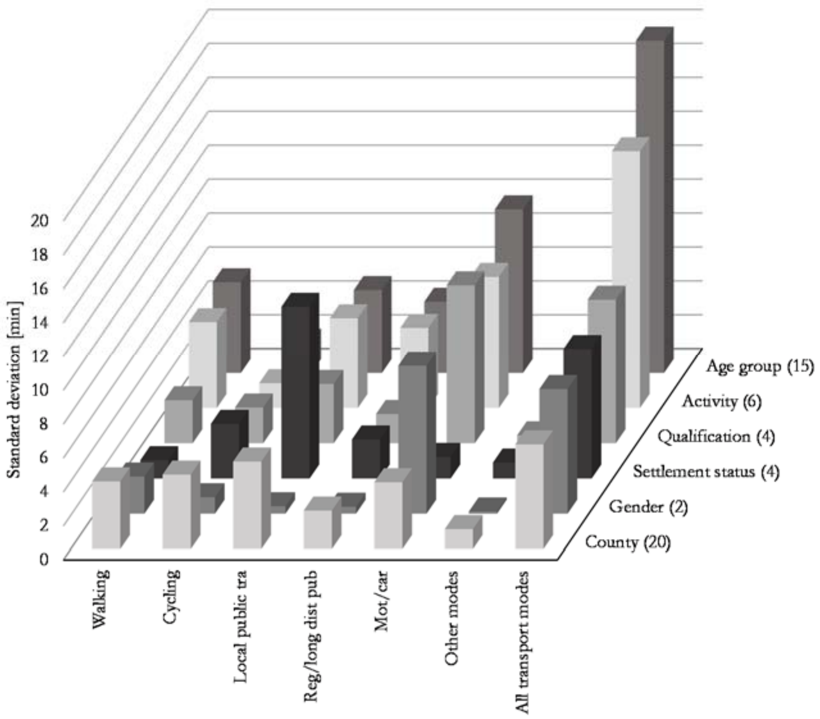
Comparing standard deviations [minute] caused by social, demographic, or territorial differences (based on average per capita daily transport time for the whole society [A] in 2009/10)

A	Walking	Cycling	Local public tra	Reg/long dist pub	Mot/car	Other modes	All transport modes
County (20)	3.98	4.38	5.15	2.26	3.93	1.17	6.16
Gender (2)	2.19	0.97	0.44	0.41	8.73	0.13	7.35
Settlement status (4)	1,08	3.22	10.15	2.30	1.27	0.94	7.65
Qualification (4)	2.54	2.11	3.50	1.73	9.34	0.47	8.49
Activity (6)	5,09	1.47	5.32	4.75	7.76	0.88	15.17
Age group (15)	5.37	1.81	4.91	4.22	9.67	1.11	19.61

The last row on the right side of Figure 36 relates to the time-use of **all transport modes**. We can see here that the biggest deviation values of the total time-use are produced by age and the activity. Almost all modes produce relatively big deviations in these two categories. Out of that, specific big deviations were produced in the case of motor/car transport by the qualification and the gender; in the case of local transport by the settlement status (and also by county); and in the case of cycling by county and settlement status.

Figure 36

Comparing standard deviations (SD) [minute] caused by social, demographic, or territorial differences (based on average per capita daily transport time for the whole society [A] 2009/10)



Important Annex: Multidimensional variance analysis: ANOVA

Concerning the recommendations of this study, we were able to explain a significant portion of the potential heterogeneity in the transport time-budget with selected independent variables. However, we studied two-dimension section planes of a multidimensional system and did not answer the main question about the percentage of the total transport time-use heterogeneity that was explained by the selected variables.

There are problems with the multidimensional handling of the selected system. The three most important difficulties are as follows: (1) the six explanatory variables we used are not independent, i.e. the interactions between the variables is significant (the activity or education or settlement positions influence the results seen in the gender case, etc.); (2) the variables are mainly quality and category variables (activity, counties, genders) demanding special treatment; and (3) as presented in Figure 5, the independent variable does not follow a normal distribution, but a characteristically asymmetric one. The first two problems were handled by choosing different ANOVA processes, while for the third one, we ran both the original values and the logarithmic transformed values (where the distribution was normal) and obtained very similar results. As a technical step, the ages were reduced to four groups and the counties to five geographic units.

Studying the whole transport time-use together ('A') and filtering the cross-effects of the variables, the E^2 variance showed that **only 9.7% of the heterogeneity was explained by the six explanatory variables**.

Looking at the effects of the explanatory variables separately, Table 9 presents the results.

Table 9

Factor summary to present the effect of the explanatory variables on the variations in transport time use (per capita daily social time-use in 2009/10)

Factor Summary			
		Eta	Beta
			Adjusted for Factors
Transport	age4	0.24	0.11
	qualification4	0.119	0,064
	activity6	**0.274**	**0.18**
	gender2	0.086	0.055
	settlement status4	0.092	0.046
	county5	0.099	0.057

Beta shows the partial effect of an explanatory variable: the percentage to which the given explanatory variable is able to explain from the heterogeneity of the dependent variable, if the other explanatory variables are fixed. By that calculation, the *'activity'* group shows the biggest effect, where the Beta-square is 3%, more than the sum of all the Beta-squares belonging to the five other variables.

The findings on the single modes support the proportions presented in Figure 36. In the case of the bikers, the geographical situation (*county*) shows the biggest effect (Beta = 0.195). For the motor and car transport *activity* (Beta = 0.143) and *gender* (Beta = 0.135); for the local transport the *settlement status* (Beta = 0.216), etc. The difference is that here it is also visible that even these 'high' values explain only several percentages from the total heterogeneity. Here, we must refer back to Figure 5 where it was presented that a decisive part of the deviations within the time-use patterns is regulated by a strict connection between the expected time-distance and the choice of the destinations.

Conclusions

Based on the last three Hungarian time-budget survey data and on the international and domestic experiences, the authors analysed the Hungarian transport time-use trends and distributions. An important starting point was that—opposite to the traditional general idea—developed transport technologies do not seem to save time for the society. In this regards, the time-budget used for transport is quite stable. A first and simple control supported this view: the average Hungarian citizen in the age group 15–74 has spent 61.8, 59.4 and 65.2 minutes on transport on an average day in 1986/87, in 1999/00, and in 2009/10, respectively, while the similar data for 1977 was 63 minutes (for population aged 15–69 years). Otherwise, one-third of the hour-long average daily transport time is covered by walking, 30% by motor/car transport, 16% by long distance public transport, and 8–9% by cycling and by local public transport each. The share of the motor/car transport almost doubled in the last 25 years, while the share of other modes proportionally decreased. It is also interesting that, at each mode, those using the given mode spend more time with that transport than they did earlier—the decrease comes from the fact that less people use the given modes.

Unlike the relative trend-stability of the averages, the personal time-use values show huge variance even in a single survey. The biggest diversity originates from the fact that the daily transport activity of the people consists of numerous short motions and much less longer trips. The daily travel durations show a very asymmetric distribution, resembling a scale-free function. To study this function and its principles is a great challenge, but it needs a wider, transport destination based survey than just the statistical background of the time-budget surveys. We did not examine this wider subject further at the moment.

The authors focused on two secondary but important relations. The first was the effects of different demographic, social, and spatial backgrounds on the transport time-use variability. The second was the specialities in the time-use character of the different transport modes.

Considering the social background, it was important to learn that the six explanatory variables together (age, gender, activity, qualification, county, and settlement-category) could explain only 10% of the heterogeneity of the time-use values. It was the *age* and the *activity* status that influenced the time-use pattern best. As for the age groups: between age 20 and 80 years the average daily transport time-use decreased from 90 minutes to 30 minutes. Looking at the activity, 60% of the time-use of the population is produced by the 51.7% employed people.

Concerning the modal specialities, *motor/car users* of the age group 25–44 years (33.2% of the people) produced half of the total traffic time; the men in 25–44 age group (16.5% of the people) produced 33% of the related traffic time. Looking at the activity, 77% of the total motor/car traffic time-use was produced by the employed group.

In *bicycle use,* there are huge time-differences. An average resident of the plain counties uses the bicycle daily for 6–17 minute, which is 10–25 times more than the cycle use by an average Budapest resident. The bikers use the bicycle for 40–50 minutes a day, when they use it. The difference in average cycle use comes mainly from the share of the users. While 15% of the people use bicycle in villages, only one-tenth of that share uses cycle in the capital. In addition, this almost 1.5% share is still three times more than a similar share 23 years earlier.

As for public transport, apparently, *local public transport* is used first of all by those living in cities, where there is access to local transport. An average Budapest resident spends 27 minutes on this mode daily, 4–5 times more than the capacity of a village or small town resident to avail of this mode. Contrarily, in case of *long distance public transport*, village residents spend almost three times more time on this mode than the residents of Budapest or of the county centres do.

The final part of the paper use an ANOVA model to filter out the cross dependencies among the explanatory variables. The beta factor shows that, within the 10% explanatory effect of all variables, *activity* is the only variable that is worth mentioning due to its own partial effect on the transport time-use heterogeneity.

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REFERENCES

ANDORKA, R.–FALUSSY, B.–HARCSA, I. (1990): Időfelhasználás és életmód In: ANDORKA, R.–KOLOSI, T.–VUKOVICH, GY. (eds.) *Társadalmi riport 1990* pp. 192–207. TÁRKI, Budapest: http://www.tarsadalomkutatas.hu/kkk.php?TPUBL-A-288/publikaciok/tpubl_a_288.pdf (downloaded in March 2016)

EUROSTAT (2009): *Harmonised European Time Use Surveys 2008 Guidelines* Office for Official Publications of the European Communities, Luxembourg. http://ec.europa.eu/eurostat/documents/3859598/5909673/KS-RA-08-014-EN.PDF/a745ca2e-7dc6-48a9-a36c-000ad120380e?version=1.0 (downloaded in March 2016)

GERIKE, R.–GEHLERT, T.–LEISCH, F. (2015): Time use in travel surveys and time use surveys – Two sides of the same coin? *Transportation Research Part A: Policy and Practice* 76: 4–24.

HÄGERSTRAND, T. (1970): What about people in regional science *Papers in Regional Science* 24 (1): 7–21.

HÄGERSTRAND, T. (1985): Time-geography: focus on the corporeality of man, society, and environment In: SHŪHEI, A. (ed.) *The science and praxis of complexity: contributions to the symposium held at Montpellier, France, 9–11 May, 1984*. pp. 193–216. United Nations University Press, Tokyo.

ILLICH, I. (1974): *Energy and Equity. Harper & Row* Calder & Boyars Ltd., GB https://www.uvm.edu/~asnider/Ivan_Illich/Ivan%20Illich_Energy%20and%20Equity.pdf (downloaded in March 2016)

JARA-DÍAZ, S.–ROSALES-SALAS, J. (2015): Understanding time use: Daily or weekly data? *Transportation Research Part A: Policy and Practice* 76: 38–57.

KSH (2010): *Időmérleg-módszertan* Központi Statisztikai Hivatal, Budapest. http://www.ksh.hu/docs/hun/xftp/idoszaki/pdf/idomerleg_mod.pdf (downloaded in March 2016)

KSH (2012): *Időmérleg 2009/10: Összefoglaló adattár* Központi Statisztikai Hivatal, Budapest. http://www.ksh.hu/docs/hun/xftp/idoszaki/idomerleg/idomerleg0910.pdf (downloaded in March 2016)

LAKATOS, M. (2013): *A foglalkoztatottak időfelhasználása az ingázás és a munkába járás idejének tükrében* Műhelytanulmányok 3. Központi Statisztikai Hivatal. Budapest. http://www.ksh.hu/docs/hun/xftp/idoszaki/pdf/muhelytanulmanyok3.pdf (downloaded in March 2016)

JONES, P.–BOUJENKO, N. (2009): *'Link' and 'Place': a New Approach to Street Planning and Design* Australian Transport Research Forum, Sydney. http://atrf.info/papers/2009/2009_Jones_Boujenko.pdf (downloaded in March 2016)

SZALAI, A. (ed.). (1972): *The use of time: daily activities of urban and suburban populations in twelve countries* Publication of the European Co-ordination Centre for Research and Documentation in the Social Sciences Mouton, The Hague-Paris.

WHITELEGG, J. (1993): Time Pollution *Resurgence & Ecologist* 23 (4): 131–134.