The part-time-society's activity and mobility patterns

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Abstract

In his article '*What about People in Regional Science?'* Hägerstrand (1970) identifies time and space constraints as dominating determinants of each individual's activity pattern.

The paper at hand follows this idea, but considers the whole society's accumulated time budget instead. Based on a socio-economic input-output table (SIOT) in time and monetary units, activity patterns of three age groups (<18 years; 18-65 years; >65 years) are analyzed in further detail.

Since the applied concept allows for a simultaneous analysis of time use and time receipts, inter-generational linkages can be identified as well. Care activities, for example, often require time inputs from the middle age group (18-65 years). However, the beneficiaries belong in the majority to the young and the old age group.

Obviously, the age groups' activity patterns come along with specific mobility needs. Therefore, the second aim of the study is to identify mobility patterns – at an aggregated level – as well.

Finally, the paper gives a first insight into potential changes of activity patterns and mobility patterns in particular, that could be initiated by the realization of a so-called *"part-time-society"*. Activity changes that occur in the part-time-society are mainly driven by a strong reduction of individual (paid) working time and a strengthening of social activities.

1 Introduction

The quality of life was never higher in most European countries than today. People all around Europe live better in material terms, are healthier and enjoy longer life expectancy than their parents and grandparents. They have as a rule more leisure time for personal activities, are traveling around the world, enjoy more culture and so forth and so forth.

Simultaneously and curiously it seems that many more people than in the past feel insecure, uneasy, even somehow trapped in their life environment and life planning. A widespread feeling that enormous changes are under way and that many things we know (and enjoy) come to the end, can particularly be observed in (often large) European societies. The past and up till very recently common life styles, life patterns, family structures, social interactions, all this is perceived as endangered and the future looms for many as an threatening unknown.

What are the reasons for this incongruity between the objective wellbeing on the one hand and the feeling of uneasiness on the other? Obviously there is a great number of factors which can be thought about in this context. However, three of them are outstanding, as the underlying forces shape the social perceptions:

(1) technological change,

(2) economic, social and cultural globalization and

(3) demographic evolution in Europe.

Technological change results in new products and higher efficiency of production thus enhancing (as a rule) the quality of life and creating new work opportunities. But it also makes, or at least seems to make, many people redundant, reducing as a tendency many workplaces - increasingly also in the hitherto “safe” activities.

Globalization, international trade, foreign direct investments, outsourcing trends, etc. lead, on the one hand, to higher economic efficiency and permit, at least potentially, to raise the living standards in many lagging parts of the world. On the other hand, trends of globalization also increases pressure on the modern societies’ labor markets. This is also true for areas which have been in the past considered as being protected from such impacts. No job, regardless of the level of qualification seems to be safe anymore.

Finally, demographic evolution manifesting itself mainly by aging of population in most European regions enforces deep restructuring of social security systems in all their aspects.

The three above mentioned forces of change are interwoven, connected by multiple feedback relationships. But they all lead obviously to dramatic evolutions of family structures, activity patterns, the ways people organize their time, their social interactions, their mobility and their intergenerational relations. This is, in our view the underlying reason for the psychological uneasiness of many people mentioned at the outset of this contribution.

For social science one of the challenges, posed by this societal changes, is the need for search for new analytical concepts and approaches, which would permit to grasp, describe and ideally also to influence the future societal organization and activities.

In the first part of our paper we develop some concepts and analytical measurement frameworks which, in our view, evidently in a very modest manner, is a step in this direction. In the second part we offer a less rigorous reflection of some aspects of the *"part-time-society"* society, as one of the potential answers for the demands to design new arrangements of social and economic life.

2 Main concepts and ideas

Since the early 1970s, when Torsten Hägerstrand published his article *What about People in Regional Science*, time constraints have become an important element for the description of activity patterns. This is particularly true for the so-called Hägerstrand prisms, which show possible individual daily time use patterns and, in a simplified version, the corresponding distance traveled. However, the prisms, which point to the 'time' as a resource equally important as income, do not only illustrate daily activity patterns but at the same time identify the individual's mobility needs.[1]

In contrast to Hägerstrand's micro perspective, the paper at hand aims to analyze activity patterns and the corresponding mobility needs from a macro perspective. Therefore, the study subdivides the German society of 1998 into three age groups and identifies the respective activity and mobility patterns. Consecutively, the paper discusses potential activity and mobility patterns of a *part-time-society*[2] which is characterized by a strong reduction of individual (employed) working hours.

In order to analyze the age groups' activity patterns, the study relies on a socio-economic input-output table (SIOT) in time units, which has been developed by Stahmer et al. (2004) (section 3). The SIOT subdivides:

(1) economic activities, based on paid work,

(2) non-market productive activities, defined as activities that could be carried out by a third party (Reid, 1934), and

(3) non-productive activities such as qualification and personal activities.

Since the categories cover all activities of daily life, the socio-demographic groups' yearly time budget must equal the individuals' time budget of 8760 hours (=24h/d*365d) multiplied by the size of the relevant age group.

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[1] A detailed description of space-time prisms is given by Hägerstand (1970, 1978) and Carlstein et al. (1978).

[2] The part time society is presented in further detail by Stahmer et al. (2004) and Schaffer/ Stahmer (2004).

The concept simultaneously considers the production of activities, defined by the time use pattern, and the consumption of activities, which is given by the age groups' time receipts. Sometimes, e.g. for personal activities, producer and consumer of an activity are equal. However, considering e.g. child- or elderly care, care provider and beneficiary are often assigned to different cohorts. Similarly, only employed persons spend time to produce goods while all individuals act as consumers of products and thus benefit from others' working hours. Consequently, time use is not necessarily equal to the age groups' received time. This yields negative account balances if more time is received than used and vice versa.

According to the SIOT, time used for trips related to the activities, is included in the activities' time budget. However, the time budget surveys accomplished by the Federal Office of Statistics as well as the German Mobility Panel allow for a separation of time spent for the activities themselves and the related mobility needs. Once mobility is separated from the activities, the concept enables the differentiation of the age groups' 'produced' and 'received' mobility (section 4). E.g. trips to work are produced by the employed persons. However, it's the consumer of employment activities, who 'receives' (and eventually benefits from) these trips.

Due to the close relation to space-time theory, the study aims to illustrate the age groups activity patterns and mobility needs by using modified Hägerstrand prisms (section 5).

Finally the paper discusses potential changes of mobility needs in a *part-time-society* (introduced by section 6) which is mainly driven by a strong reduction of paid work and an emancipation of productive non-market activities and qualification (section 7).

3 Socio-economic input-output table (SIOT) in time units

Conventional input-output tables provide a detailed picture of the economic structure and therefore focus on the economic sectors' in- and outputs. In contrast to the traditional accounting schemes, the SIOT considers the different socio-demographic groups as producers and consumers of activities. In doing so, the approach covers the whole range of human activities and is not limited to economic procedures. Since some activities can hardly be expressed in monetary terms, the concept is mainly driven by the time use of the population. In this context, the concept clearly benefited from the pioneering work of Gary Becker (1965) and Graham Pyatt (1990).

The study classifies the German population of 1998 into the following three socio-demographic groups:

- Young persons (< 18 years), in the following also referred to as *young generation*;
- Adults except seniors (18 to 64 years), also referred to as *middle generation*;
- Aged persons (> 64 years), also referred to as *old generation*.

Time budgets of the different cohorts are determined by the permanence of a 24-hour-day leading to a 8760-hour-year as well as by the size of the groups. In 1998, the youngest age group included approximately 15.5 million children and teenagers. The number of seniors amounted to slightly less than 13 million persons. Finally, the middle generation included 53.4 million adults. Thus, the young, middle and old generations' time budgets amounts to approximately 136 (=8760*15.5), 468 (=8760*53.4) and 114 (=8760*13) billion hours respectively (table 1, last column).

Since the SIOT aims to cover the complete set of human actions, the model distinguishes between 15 activities which can be summarized in the following way:

- Non-productive personal activities undertaken for their own purpose, enclosing regeneration, eating and leisure activities;
- Qualification;
- Unpaid productive activities, including housework, child- and elderly care as well as voluntary work;
- Paid employment activities that aim at producing market goods and services, including investments and exports.

In order to analyze the production side defined by the cohorts' time use patterns, the study falls back on two time budget surveys which were accomplished by the Federal Office of Statistics for the years 1991/92 and 2001/02. The surveys provide detailed data for the unpaid activities considered and also record the totals of the employment figures. The allocation of working hours to the three age groups and the different categories of final uses is based on an input-output model. According to the Eurostat Input-Output-Manual (2002) directly and indirectly necessary working hours to produce output of different final use categories (T_{dom}^{prod}) can be estimated by the following equations:

$$(3.1) \quad T_{dom}^{prod} = T_{SAM} B_{dom} Y_{dom} \quad \text{with}$$

$$(3.2) \quad T_{SAM} = \begin{pmatrix} t_1 \\ . \\ . \\ t_n \end{pmatrix}$$

$$(3.3) \quad B_{dom} = (I - A_{dom} - D_{dom})^{-1}$$

t_i: row vector of labor hour coefficients of the socio-economic group i (= 1,...,n) related to the monetary sectoral gross output;

A_{dom}: coefficient matrix of (monetary) intermediate inputs of domestic products related to (monetary) gross output by product group and branch;

D_{dom} : coefficient matrix of (monetary) consumption of fixed produced assets (domestic production) related to (monetary) gross output by product group and branch;

Y_{dom} : matrix of (monetary) final uses of domestic products by product group and category of final uses.

In addition to the input coefficients, the Leontief inverse in formula (3.3) includes coefficients of depreciation as well. Since this extension enables an endogenization of the utilization of capital goods, time values cover both current and capital costs.

Besides the time use patterns given by rows 1 to 3 of table 1, the SIOT provides detailed information about the time receipts of the age groups. While the time use pattern can be interpreted as the production side of activities, the cohorts' received time stands for the consumption side.

Personal activities and qualification are per definition performed for private purposes only. Thus, producers are consumers at the same time and consequently, used time equals received time. With regard to unpaid productive activities, producers may also be beneficiaries, but it is likely that other members of the same or of other households benefit as well (e.g. cooking and cleaning). This holds for the majority of household production in non-single households and is particularly true for social activities. No matter whether additional beneficiaries belong to the same or to other households, producer and beneficiary of household production will often belong to different socio-demographic groups.

While the time budget surveys again allow for the allocation of time receipts in case of unpaid activities, the distribution of paid working hours (T_{dom}^{cons}) must, according to Stahmer (2002), be estimated by the following equations:

(3.4) $T_{dom}^{cons} = t\, B_{dom} Y_{SAM}$

(3.5) $Y_{SAM} = (C_1 ... C_n\ inv'\ ex')$ (in contrast to $Y_{dom} = (C\ inv'\ ex')$)

(3.6) $t = \sum_{i=1}^{n} t_i$

(3.7) $C = \sum_{i=1}^{n} C_i$

C_i : matrix of (monetary) final consumption of the socio-economic group i by product group and category of final consumption;

inv' : column vector of net fixed capital formation by product group;

ex' : column vector of exports of goods and services by product group.

In addition to the absorption of domestic products, economic sectors and private households also consume imported goods and services. Thus, foreign labor hours necessary to produce the imports must be included into the analysis. Based on the assumption of the same input coefficients for producing domestic and imported products, the labor hours can be estimated according to the following assumptions:

$$(3.8) \quad T_{imp}^{cons} = t\ B\ A_{imp}\ B_{dom}\ Y_{SAM} + t\ B\ Y_{imp} \text{ with}$$

$$(3.9) \quad B = (I - A_{dom} - D_{dom} - A_{imp})^{-1}$$

A_{imp}: coefficient matrix of (monetary) intermediate inputs of imported products (including consumption of imported investment goods) related to (monetary) gross output by product group and branch;

Y_{imp}: matrix of (monetary) final uses of imported products by product group and category of final uses.

Based on the above-mentioned time use surveys and taking into account equations (3.1) to (3.9), the SIOT in time units can be generated.

Table 1 shows time use and time receipts by age group and activity. Total time spent for the production of any activity must - by definition - match the total time receipts attributed to this activity. However, producer and consumer might belong to different socio-demographic groups.

The young generation spends slightly more than 136 billion hours for the production of activities while it receives approximately 162 billion hours. With regard to the cohort's size, time receipts exceed time use by almost 1700 hours per person and year. Seniors' time receipts also exceed their time use. In total, this group spends more than 114 billion hours on diverse activities but receives approximately 126 billion hours. Thus, the received time of the average member of this group comes to 9450 hours per year which contrasts with 8760 hours spent on the production side.

Adults (except seniors) consume 423 billion hours but spend almost 468 billion hours on the production of activities. Consequently, time receipts per person and year fall below time use by more than 800 hours.

Account balances for the socio-demographic groups are equalized in row 18 of table 1. Considering the cohorts, positive account balances occur if the groups' time use or time deliveries are bigger than time receipts. Due to the paid work and the unpaid household production from which other groups clearly benefit, adults (< 65 years) show positive account balances. Vice versa the younger and the older generation, which hardly participate in working life but consume goods and services anyway, show negative account balances.

Table 1: Socio-economic input-output table in million hours, Germany, 1998 (Activities include related trips)

Nr	Time Use / Received time	Personal activities			Qualification		Unpaid productive activities				Employment activities								Total uses
		Young persons <18 years	Adults between 18 and 65 years	Aged persons >65 years	Schooling	Perm. education	Household production	Childcare	Elderly care	Voluntary work	Private consumption	Services of NPISH[1]	Education services		Health services	Other public services	Net fixed capital formation	Export of products	
													Schooling	Perm. education					
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
1	Young persons < 18 years	116 614			14 602	82	3 233	204	59	94	980					133		121	136 122
2	Adults aged 18 to 65 years		319 791		4 378	827	67 075	8 338	1 668	3 036	23 038	1 123	3 574	416	5 091	7 636	5 874	16 041	467 906
3	Aged persons > 65 years			88 730		180	22 399	460	512	850	1 083				167	112			114 493
	Qualification																		
4	Schooling	14 602	4 378																18 980
5	Permanent education	82	827	180															1 089
	Unpaid productive activities																		
6	Household production	11 672	58 636	22 399															92 707
7	Childcare	9 002																	9 002
8	Elderly care			2 239															2 239
9	Voluntary work	754	2 591	635															3 980
	Employment activities																		
10	Private consumption	3 152	18 017	3 932															25 101
11	Services of NPISH[1]	213	731	179															1 123
	Education services																		
12	Schooling	2 435	1 139																3 574
13	Permanent education	37	298	81															416
14	Health services	525	2 847	1 886															5 258
15	Other public services	1 496	5 129	1 256															7 881
16	Net fixed capital formation																		0
17	Imports of products	1 651	8 721	2 003													2 132	5 530	20 037
18	Balances	- 26 113	44 801	- 9 027													- 8 006	- 1 655	0
19	Total supply	136 122	467 906	114 493	18 980	1 089	92 707	9 002	2 239	3 980	25 101	1 123	3 574	416	5 258	7 881	0	20 037	

[1] NPISH: Non-profit institutions serving households

Source: based on Stahmer et al., 2004, Annex, Table 3

The cohorts' different role regarding unpaid productive activities adds to the different account balances. While members of the middle age group act, by the majority, as net-producers of housework and social activities, young and old generations can be identified as net-beneficiaries. This is particularly true for the youngest age group, which spends a rather limited time budget on producing housework or social services. In contrast, seniors' elderly care is often carried out by members of the same age group, which affects the individuals' but not the cohort's accumulated balance. Therefore, the difference of used and received time is less significant for this group.

From the social point of view, time spent from adults for children and teenagers can be seen as an investment into future generations. Bearing in mind the importance of qualification, investments into educational services and increasing time budgets for schooling and permanent education define investments into human capital.

Traditional economic investments are characterized by the extension of production facilities. Net-investments approximately came up to 8 billion working-hours in 1998. Thus, the negative account balance (of -8 billion hours) shows the balance of current employees (who invest time in order to produce investment goods and thus to increase the production potential) with future workforces (who may realize the potential).

The balance of approximately -1.7 billion hours in row 18, column 17 refers to the surplus of German exports versus imports in 1998. Based on the assumption of similar labor productivity, the negative balance shows that the German workforce spent more time producing goods and services for foreign countries than the other way round.

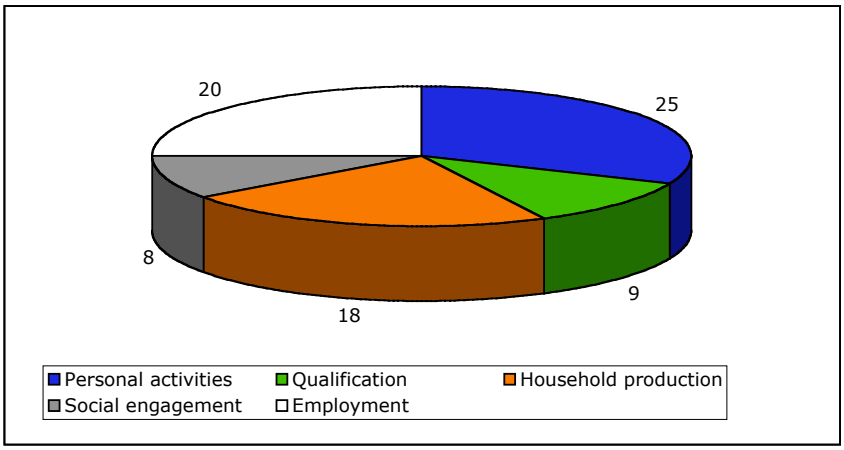
Considering unproductive activities, young persons dispose of the highest time budget for personal activities and for qualification. Seniors hardly participate in qualification activities, but dispose of a time budget for personal activities which is below the youngsters' but well ahead of the younger adults' budget. In total, time used for personal activities clearly dominates all cohorts' time use pattern. Shares range from 68% of the whole time budget for the members of the middle age group to almost 86% for the youngest age group.

4 Travel time and distances related to the activities

Within the frame of the SIOT, time used for trips is included in the time budget of the corresponding activity. In order to show mobility pattern in further detail, additional information from the time use surveys, accomplished by the Federal Office of Statistics, and the German Mobility Panel must be taken into account. Since both data sources rely on micro data, the analysis on activity-related travel-time and -distances starts at individual level.

The realization of human activity pattern requires a certain level of mobility. Figure 1 shows the average mobility needs (in minutes per day) of the considered activities.

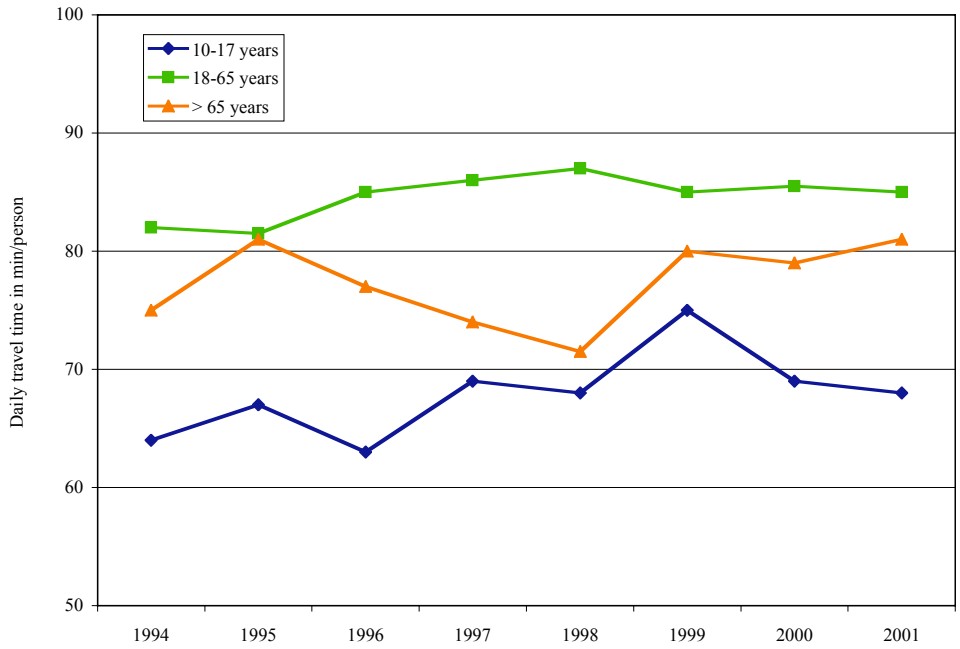
Figure 1: Travel time by activity, 1998



Source: Time Use Survey, 2001

On average the German population spent approximately 80 minutes for mobility purposes in 1998, with the highest time budgets for personal activities (25 min.), employment (20 min.) and household production (18 min.). In fact the daily travel time has remained rather constant since more than two decades. According to the German Mobility Panel, the constant travel time can particularly be observed for the *middle generation*. Figure 2 shows the development of the daily travel time by age group. Interestingly enough, increasing mobility needs of one age group often compensated decreasing travel times of another age group.

Figure 2: Development of travel time by age groups



Source: German Mobility Panel

With regard to the average travel time by activities (figure 1) and by age group (figure 2) and taking into account the information about the total time budgets by activities and age group (table 1) average travel time by activities and age groups can be derived. Figure 3 shows a possible (and plausible) allocation.

While mobility patterns of the youngest age group are characterized by relatively high time budgets for education and personal activities, seniors' mobility needs are dominated by personal activities and household production. The middle generation shows highest mobility demands for household production, employment and personal activities.[3]

Figure 3: Travel time by age groups and activities in 1998 (min. per day and capita)

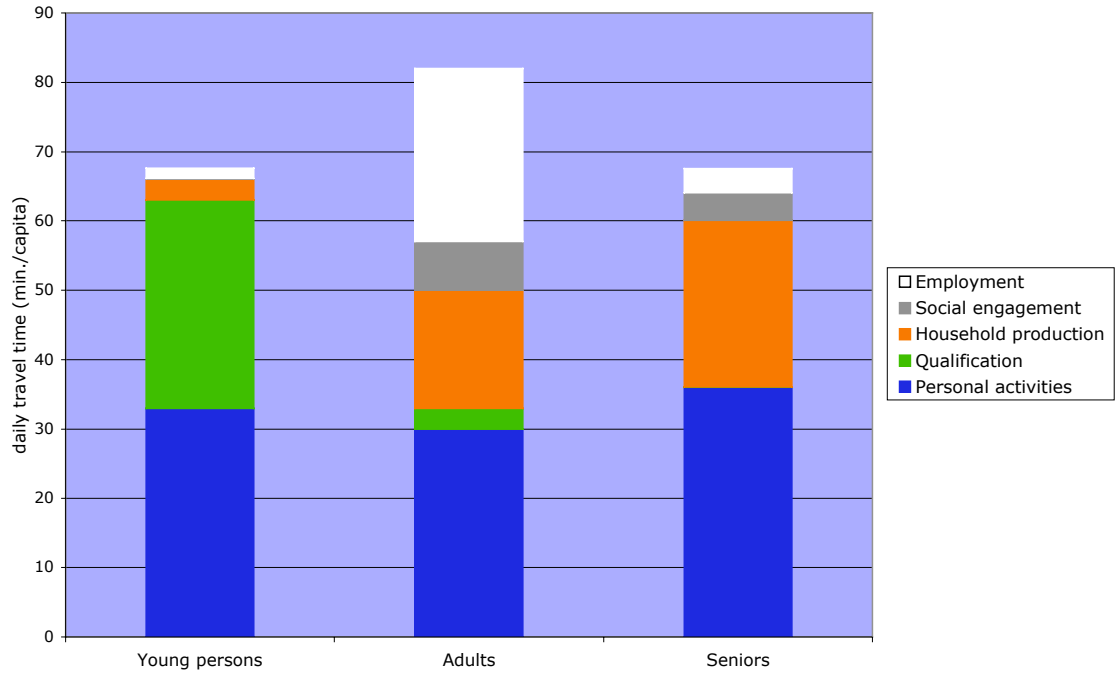


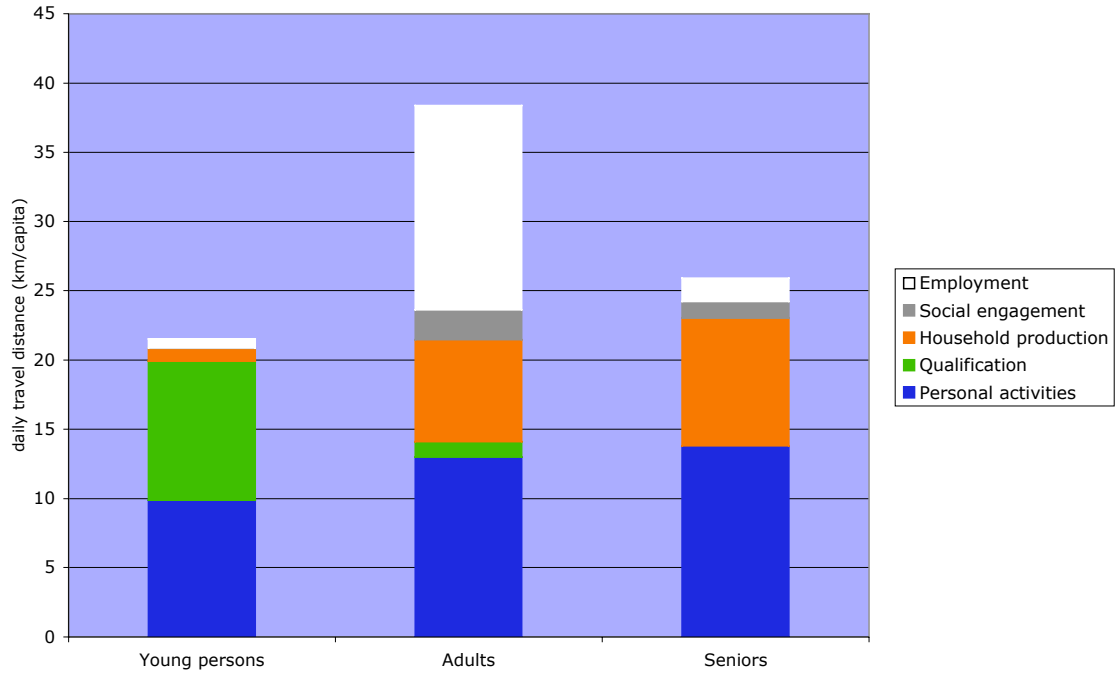
Figure 3 gives a first idea of the age groups different mobility pattern. However, the figure refers to the time used for mobility and neglects travelled distances. These can be estimated if the travel speed v_{ij} of age group *i* and activity *j* is known.

According to the German Mobility Panel, members of the middle age group show, at constant niveau, the highest average travel speed (ca. 33 km/h in 1998). The increasing motorization level of the oldest generation resulted in constantly increasing travel speeds for this group (ca. 22 km/h in 1998). Finally travel speed of the youngsters has decreased continuously between 1996 and 2001 and fall below seniors' average travel speed recently (21 km/h in 1998).

[3] A further disaggregation of the socio-demographic groups would be interesting. But while time survey and panel data would allow for a deeper analysis, the SIOT is not yet available in a more disaggregated version.

Based on the average speed by population group and taking into account results from the passenger transport model VACLAV[4], travel speed and thus travel distances, can be estimated by activity and age group. Figure 4 shows the results of the first estimations.

Figure 4: Travel distances by age groups and activities in 1998, (km per day and capita) ——



5 Mobility patterns of the society

Based on the estimations of time spent for mobility and distances travelled by day and per person, the following step aims to implement the results into the socio-economic framework of the SIOT. Therefore the transition from the micro to the macro perspective must be addressed first. Considering the time use this is done in a rather simple way. Results presented by figure 3 and 5 are multiplied by 365 and by the size of the corresponding age group. The results show time efforts and travelled distances necessary to meet the mobility needs of the corresponding time use patterns. According to the SIOT concept, the results point to the age groups' production of the activity 'mobility', which leads to the notation 'produced mobility' in the following.

In contrast the notation 'consumed mobility' is used for the mobility which comes along with the consumed activities. Considering e.g. elderly care, the beneficiaries' consumed mobility corresponds to the accumulated travel time by the producers of this activity.

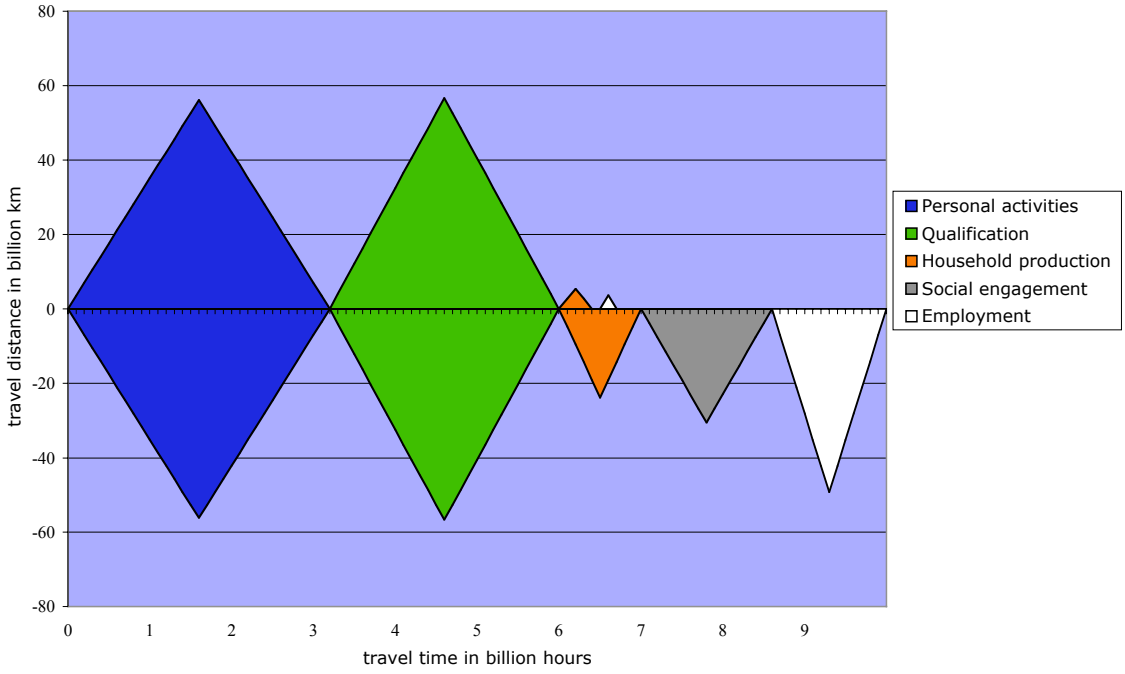
[4] The transport model VACLAV shows time use and travelled distances by modes and trip purposes. However, the model does not differentiate age groups. A detailed description is given by Schoch (2004).

Assuming a 90 year old grandmother is visited by her son over lunchtime, and by her granddaughter, who comes for tea, the sum of the son's and the granddaughter's produced mobility (related to this activity) defines the consumed mobility of the senior lady.

The example shows that the calculation of the consumed mobility requires more detailed information about the composition of the producers. This is particularly true, if producers of different groups show different travel time and speed. Therefore the age groups' linkage matrix, presented in detail by Stahmer et al. (2004)[5], must be taken into account in this case.

In order to illustrate the age groups' mobility patterns, the work has largely been inspired by Hägerstrand's time-space prisms. However, in contrast to Hägerstrand, time use for mobility and distances are considered at an aggregated level, which in turn makes it impossible to care about the chronology of activities. Furthermore the graphics (figure 5-7) aim to show the age groups' produced and consumed mobility. Produced mobility is shown at the graphics' upper part. Consumed mobility is given below and distances are marked with a negative sign. While produced mobility equals per definition consumed mobility for personal activities and for qualification[6], quite significant differences occur for the other activities.

Figure 5: Accumulated travel time (in billion hours) and travel distances (in billion km) by activities, young generation

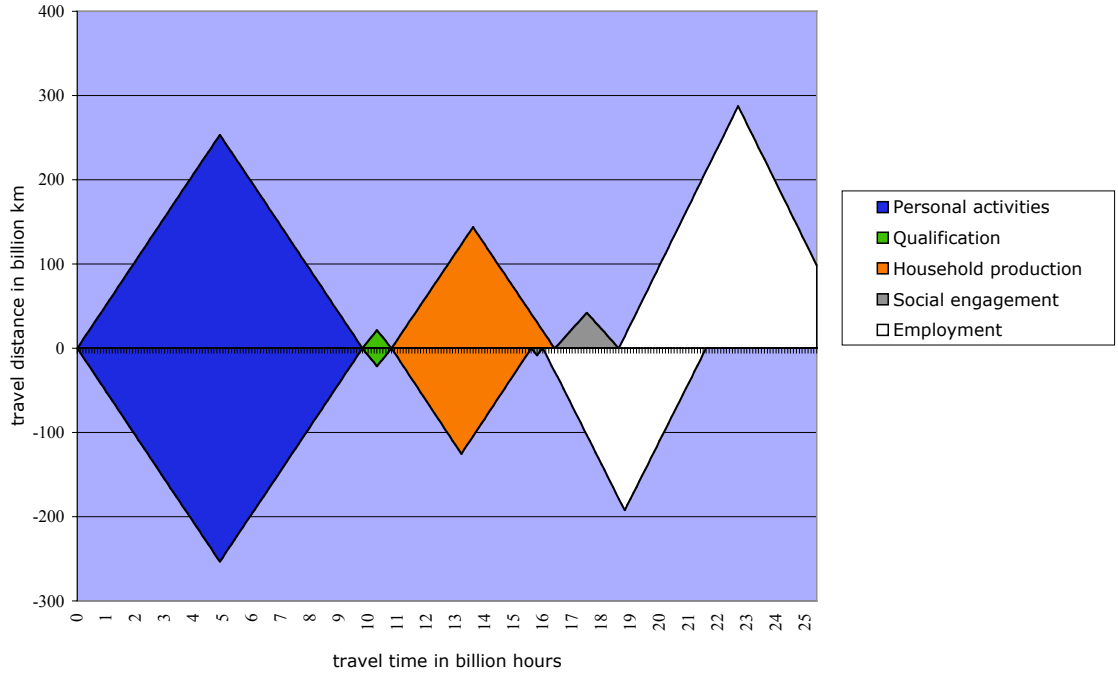


[5] Stahmer et al. show the received time by age groups and activities, and additionally give an insight into the composition of producers. Elderly care, for example relys on 59 million hours spent by the youngest age group, 1668 million hours spent by the middle generation and 512 million hours spent by seniors themselves.

[6] It is assumed that any member of the age groups is producers and beneficiary of these activities at the same time. Thus related mobility is the same. (See also chapter 2.)

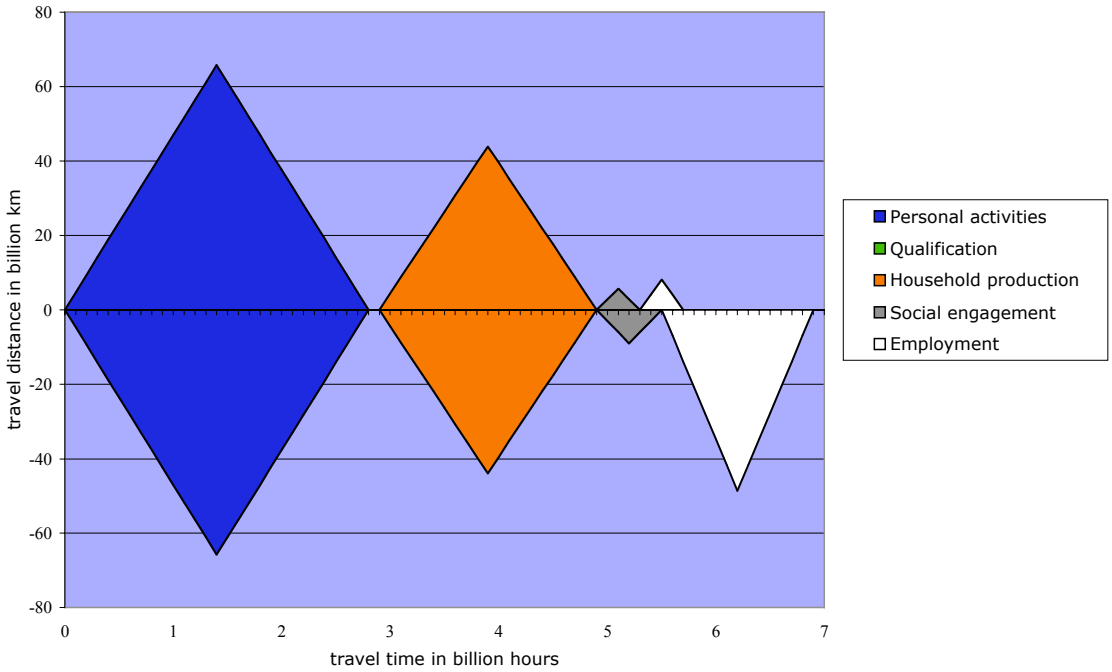
Considering the production-side, the young generation's mobility pattern is dominated by transport activities related to personal activities and qualification. Though the related mobility is also important at the consumption-side, the youngest age group benefits from the other age groups' transport performances related to household production, social engagement and employment. In total the members of the young generation travelled distances amounted to 122 billion km per year. At the same time the young persons' consumed mobility added up to 216 billion km per year. On average each member's produced mobility was approximately 7850 km and consumed mobility 13950 km per year.

Figure 6: Accumulated travel time (in billion hours) and travel distances (in billion km) by activities, middle generation



The mobility pattern of the middle generation is characterized by significant activities for personal activities, household production and employment. Though time investments are clearly higher for personal activities, travelled distances are highest for trips to work (which points to the relatively high travel speed in this case). As producers the middle generation shows a performance of almost 750 billion passenger-km, which results in an annual distance of more than 14000 km per person. Consumed mobility amounted to 600 billion km per group or 11240 km per person and year.

Figure 7: Accumulated travel time (in billion hours) and travel distances (in billion km) by activities, old generation



Similar to the pattern of the young generation, seniors' mobility pattern is characterized by two peaks at the production side. However, in contrast to the young generation transport activities related to qualification are replaced by transport activities related to household production. Since seniors household production is generally consumed by themselves or by their (also senior) partners, produced and consumed mobility is almost equal. The accumulated transport performance amounted to 124 billion km per group on the production- and 167 billion km on the consumption-side. This corresponds to a produced mobility of 9460 km per person and a consumed mobility of 12800 km per person and year.

6 The part-time-society

Concept

The SIOT gives an idea of the different cohorts' current activity patterns. With regard to further analysis, effects caused by changing time use pattern and demographic changes are of specific interest. Both issues have become particularly relevant for highly developed economies that face the challenge to ensure today's quality of life for an aging society by simultaneously following the path of sustainability.

Taking into account the integrated system of socio-economic input-output tables, it is of particular interest how a significant reduction of paid employment could affect the activity

and mobility patterns of the German society. Central ideas of the concept are a) the reduction from approximately 1600 (net) working hours to 1000 hours per employee and year, b) the strong enhancement of qualification and c) an increase of unpaid social services by 50 percent. Clearly effects can be expected for the social, economic and the ecological sphere. These are intensively discussed by Schaffer and Stahmer (2004) and by Stahmer et al. (2004). The paper at hand will focus on the changes of time and activity patterns.

The reduction of working time is accompanied by a higher flexibility of the work pattern such that periods with high workload could be followed by longer periods of recreation, i.e. employment is not characterized by shorter workdays but by a smaller number of full workdays per year. Thus the number of trips to work decreases as well.

In addition to the net reduction of 4.7 billion working hours, time used for trips to work would decline by 0.8 billion hours. Consequently, the gained 'free time' adds up to 5.5 billion hours. Since the SIOT considers the whole set of the cohorts' activities, the free time cannot vanish but must be used for other activities.

With regard to the *part-time-society*, the concept foresees a significant shift of free time towards qualification activities. This can partly be explained with the generally growing importance of human capital as a production factor. More specifically, the *part-time-society* requires higher qualification levels for currently not employed persons, whose qualification level is in average much lower compared to the momentary employees. The improvement of the not employed persons' qualification could then be seen as a major incentive for the companies to compensate the decreasing work time of current employees by the employment of momentarily not employed persons.

The refinement of the qualification level is achieved by a two-pillar qualification-offence. First, the personal qualification activities rise by 2.1 billion hours. According to the concept of life-long learning, the major part, 1.8 billion hours, is allocated to the permanent education of workforce members, which equals an average increase of qualification activities of 34 hours or 26 percent per person and year.

The second pillar of the concept is the strengthening of the relevant employment sector. While all other sectors would be affected by the general decrease of working time, educational services would increase by 0.7 billion hours.

While the general reduction of working time and the additional time for qualification activities have been defined to -5.4 billion hours and +2.1 billion hours respectively, various options arise to attribute the remaining time potentials of 3.4 billion hours.

Clearly, an egoistic variant where the members of the different age groups would maximize their utility and therefore strive for an extension of their personal activities could be seen as a plausible option. However, in practice, altruistic voluntary work has become an important fundament in many Western market-oriented societies. Rifkin (1995) points to the fact that more than 50 percent of America's adults accomplished voluntary work in the late nineties and, in doing so, invested more than 20 billion hours of their time budget for personal

activities year by year. In Germany, clubs and societies heavily rely on voluntary services, and all over the world, not only Christian churches strongly depend on unpaid voluntary work. Consequently, a less egoistic behavior can be assumed as well. Based on the assumption of a constant time budget for housework and personal activities, the remaining time of 3.4 billion hours could be used for social engagement.

Individuals may even be willing to invest in qualification at the cost of their budget for personal activities, which in turn would allow for a further extension of social activities. While the willingness to invest in higher qualification, at the cost of personal activities, might come along with the manifestation of life-long learning, the relatively strong increase of social engagement must be supported by exogenous incentives.[7]

Since the gained 'free time' results from the reduction of working hours, changes of time use patterns could mainly be expected for the working generation. Indeed, adults (except seniors) would increase their annual engagement by almost 100 hours, which in turn would result in slightly more than 340 hours spent for social activities per year and person. Contrarily, young and old generations, which barely participate in working life, would not dispose of 'free time' and would therefore change their time use pattern only marginally. In the end, social services could increase by 36 percent if qualification activities are extended at the cost of personal activities and consequently, the free time gained from the reduction of paid working hours is fully invested for child- and elderly care and other voluntary services.

However, in order to fulfil the defined target - increasing unpaid social services by 50 percent - young and old generations must be integrated more actively. In doing so, both cohorts would have to extend their time used for social services at the cost of their time budget for personal activities.

Thus, the time spent by the young generation for social activities would raise from slightly more than 20 hours to almost 100 hours per person and year. Seniors would extend their efforts by 140 hours such that the production of social services would account for 230 hours per person and year.

Based on these changes of time use patterns and taking into account equations (3.1) to (3.9), the changes of the SIOT in time units can be calculated.

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[7] Schaffer and Stahmer (2004) refer to three types of incentives. First, higher productivity can be paid off in the reduction of labour time instead of income. Second, the distribution of a complementary time currency could compensate for the time investments (see e.g. Sikora, Hoffmann, 2001). Third, special taxes could add to the introduction of a complementary time currency. These taxes would have to be paid by persons employed full-time, who do not spend any time for care services or other voluntary work.

Table 2: Changes of activity pattern in million hours, Germany, 1998

Nr	Time Use / Received time	Personal activities			Qualification		Unpaid productive activities				Employment activities								Total uses
		Young persons <18 years	Adults between 18 and 65 years	Aged persons >65 years	School-ing	Perm. edu-cation	House-hold product-ion	Child-care	Elderly care	Volun-tary work	Private consump-tion	Services of NPISH[1]	Education services		Health services	Other public services	Net fixed capital for-mation	Export of pro-ducts	
													School-ing	Perm. edu-cation					
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
1	Young persons < 18 years	- 1 171			29	82	0	295	295	590	- 94					- 13		- 13	0
2	Adults aged 18 to 65 years		- 1 817		990	827	0	1 309	1 309	2 618	- 2 328	- 114	294	399	- 512	- 765	- 592	- 1 618	0
3	Aged persons > 65 years			- 1 244		180	0	299	299	597	- 104				- 16	- 11			0
	Qualification																		
4	Schooling	29	990																1 019
5	Permanent education	82	827	180															1 089
	Unpaid productive activities																		
6	Household production	0	0	0															0
7	Childcare	1 903																	1 903
8	Elderly care			1 903															1 903
9	Voluntary work	721	2 477	607															3 805
	Employment activities																		
10	Private consumption	- 317	- 1 813	- 396															- 2 526
11	Services of NPISH[1]	- 22	- 74	- 18															- 114
	Education services																		
12	Schooling	7	287																294
13	Permanent education	35	286	78															399
14	Health services	- 53	- 286	- 189															- 528
15	Other public services	- 150	- 513	- 126															- 789
16	Net fixed capital formation																		0
17	Imports of products	- 151	- 836	- 189													- 215	- 558	- 1 949
18	Balances	- 913	472	- 606													807	240	0
19	Total supply	0	0	0	1 019	1 089	0	1 903	1 903	3 805	- 2 526	- 114	294	399	- 528	- 789	0	- 1 949	

[1] NPISH: Non-profit institutions serving households

Source: Stahmer et al., 2004, Annex, Table 3

Due to the reduction of paid labor inputs, the consumption of market products and services must decrease as well. This is true for the SIOT in time units but also holds for the monetary tables. However, if labor productivity continues to increase rapidly the produced (and finally consumed) value added might decrease only marginal or even increase slightly.

The relatively strong focus on social services, accomplished by all socio-demographic groups, results in a higher consumption of these services. Since household production (besides social services) is assumed to remain constant, absorbed hours related to this activity also remain also constant. With regard to personal activities and to qualification, the individuals' used and received time is per definition equal. Consequently, time receipts increase for qualification and decrease for personal activities.

Effects on peoples' well-being

Though life satisfaction certainly depends on individuals' subjective judgements, peoples' well-being is also affected by exogenous variables (Sen 1987, 1992). But while agreement has been achieved on the existence of considerable exogenous impacts, potential variables and their weighting factors are still discussed vividly. Based on the European Social Survey 2002/2003 (ESS), Lelkes identifies six outstanding variables that mainly define peoples' well-being: income, employment, health, social interaction, education and neighborhood conditions (Lelkes, 2004).

Within the concept of the *part-time-society*, the reduction of working time might come along with income losses. Therefore, the effect on peoples' well-being could be negative in this case. However, rising productivities will soften or, if the growth of productivity exceeds the reduction of working hours, could even reverse the effects.

In any case positive effects with regard to employment and social interaction such that decreasing unemployment and extended social interactions could compensate for slight income losses. However, the effects of deeper social interactions should be scrutinized more closely. While time for friendships or childcare is positively related to life satisfaction, the situation is unclear for elderly care and voluntary work.

Based on full-time education of the young age group, Lelkes found a positive correlation of education activities and life satisfaction. However, this result can hardly be transferred to the intended strengthening of permanent education, which will predominantly affect the working population. Thus, the effects on peoples' well-being are ambiguous. On the one hand, the foreseen adaptation of 'life-long learning' requires the abandonment of personal activities. On the other hand, higher qualification levels will broaden peoples' horizon and multiply their career opportunities.

Effects on health are manifold. First, a declining working time reduces stress, which would affect peoples' health in a positive way. The estimated decline of emissions is correlated positively with peoples' health conditions in the long run.

Neighborhood conditions are partly associated with all mentioned variables. But since the SIOT does not include other important variables, e.g. safety aspects, potential effects initiated by the part-time-society remain unconsidered.

Though mobility is not mentioned by Lelkes, it can be seen as a basic need of people. Therefore the following section analyzes the effects of the part-time-society in further detail.

7 The part-time-societies mobility patterns

Changing activity patterns automatically change the needs for mobility. According to the main idea of the part-time-society, the reduction of working time should result in a reduction of full workdays rather than in a reduced daily working time. Therefore trips to work decrease significantly for already employed persons. However, the concept also foresees to employ more people, which in turn comes along with new trips. Considering all age groups the net reduction of time use for trips to work amounts to approximately 0.8 billion hours .

Contrary net increases can be expected for social engagement. Since the share of time for transport is even higher for this activity, additional time for mobility more than compensates for the decreases of employment related travel time. However, travel speed is significantly higher for trips to work. Consequently the changes of traveled distances tell a different story. In this case, the reduced transport performance (in passenger-km) assigned to employment clearly exceeds the distances related to social engagement. In fact current social activities are characterized by many short trips. The critical question is, whether the strong increase of social engagement would change the shares in this field. On the one hand, it could be assumed that parents will take their kids to the playground for 3 hours instead of 2 hours. In doing so time use for mobility would remain constant in absolute terms (and would decline in relative terms). On the other hand, it could also be assumed that they take their kids twice instead of once a week to the playground. In this case time use for mobility would increase in absolute terms (and would increase or remain constant in relative terms).

Figure 8 shows the changes of travel time after the implementation of the part-time-society. The results are based on the ‘heroic’ assumption of constant shares of travel time. Finally, figure 9 provides a first insight into the changes of transport performance (in passenger-km).

Figure 8: Changes of travel time by activity and age group

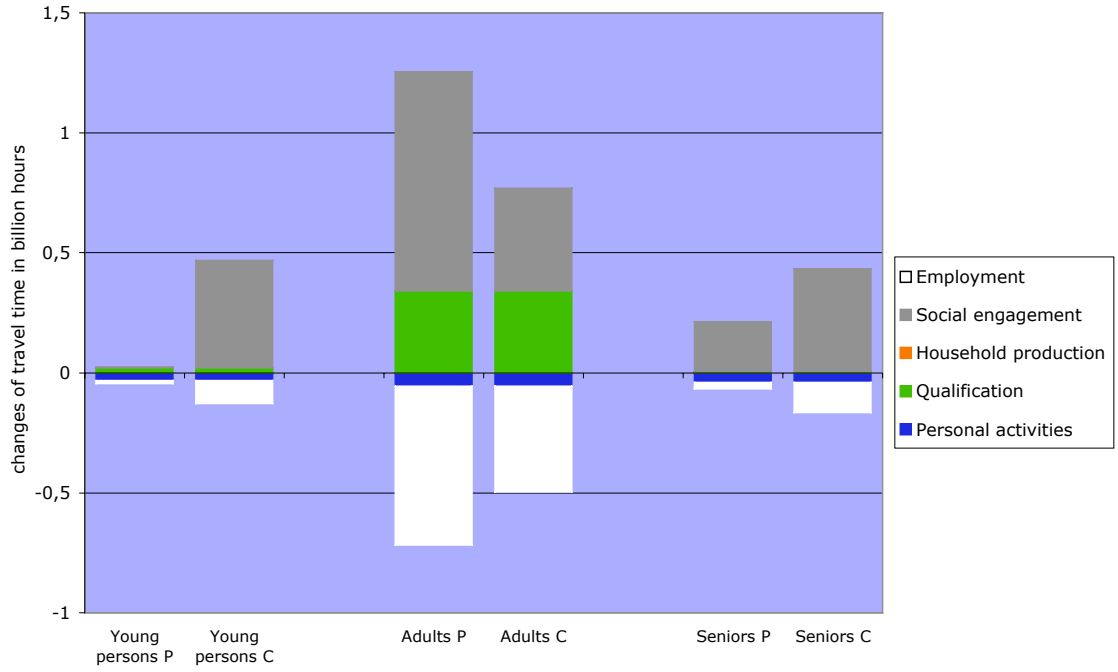
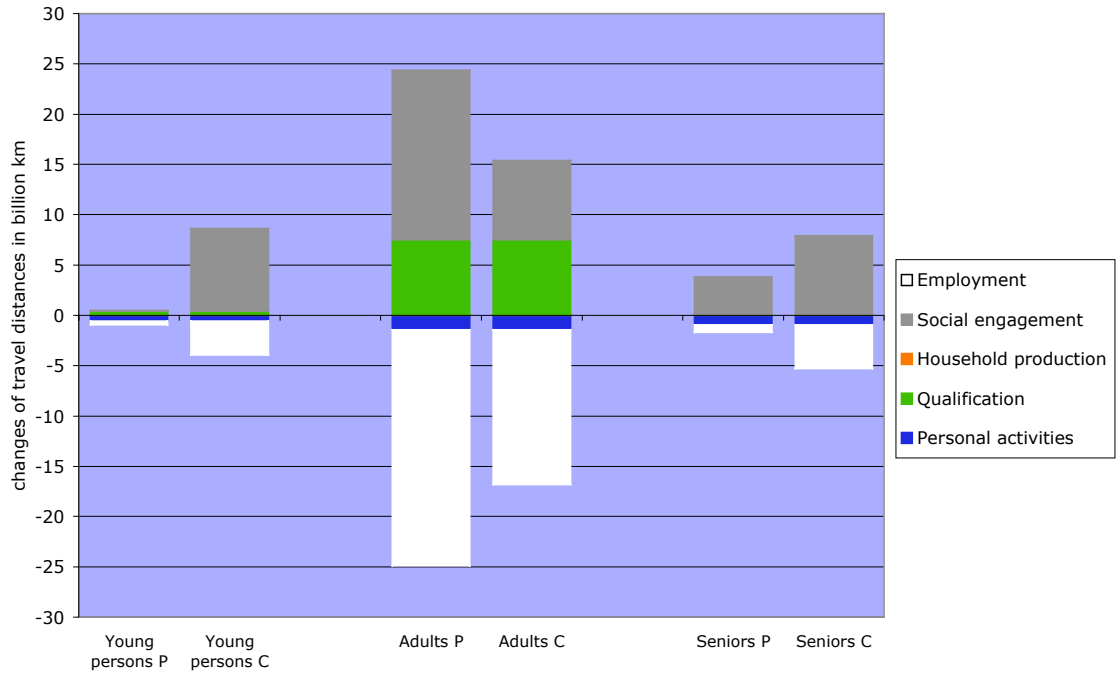


Figure 9: Changes of travel distances and age group



8 Conclusions

Using SIOT methodology we were able to show that considerable time flows can be observed between members of society belonging to various age groups. Not surprisingly we found out that the young and old are as a rule the "recipients" and the working age people the "providers" of time in the activity pattern of Germany, and most probably in other post-industrial economies. The negative and positive time-balances for various activities and age cohorts should be included in the reflection on the future societal arrangements in the aging Europe. Further research will address more detailed age cohorts and activity patterns, including the gender perspective.

The idea to decrease working time in such a significant manner contradicts, at first glance, the momentary political discussion of increasing working time. However, going into further detail, some parallels arise. The concept at hand indeed suggests a reduction of the average yearly working time, but it clearly favors a high flexibility of work schedules. A 42-hour-week, as now postulated by political decision-makers in Germany, is consistent with the concept at hand – with the exception of longer breaks in the same or the following year (including income cuts) for the employees. Furthermore, the reduction of annual work time could very well come along with the postponement of the retirement age, all the more since professional stresses and strains will not have been as intensive over working life in a *part-time-society*.

Coming from the production side, the constantly growing labor productivity will not lead to reducing pressure on the labor market. In fact industries of modern societies (often with shrinking populations) will hardly require more labor inputs in quantitative terms. However, higher qualitative inputs can surely be expected. If the *part-time-society* will come along with increasing human capital, the concept might be interesting for the entrepreneurs as well.

Since the time budget remains constant, people will use their time for other activities. Since all activities are embedded in time and space, changes of activity patterns will automatically result in changing mobility patterns. The study at hand gives a first idea of possible mobility patterns, if the reduction of working time is accompanied by a strengthening of social engagement. Due to the lower distances, related to the relevant activities, total time use for mobility and transport performances would decline according to the model. The arising contradiction with the hypothesis of constant travel time, could only be explained by a change to other less rapid modes or in other words by the discovery of the slowness.

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