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The dynamics of commuting over the life course: Swiss experiences

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ABSTRACT

Daily travel behavior, and especially commuting behavior, is strongly determined by the location of the places of residence, education and employment. After changes in these spatial choices, people inevitably show a travel behavior that is different from the travel behavior before these relocations occurred. Therefore, spatial alterations provide interesting starting points for policies and other interventions aiming at travel behavior change, as habits and routines are broken or at least weakened, and individuals reconsider their behavior and consciously reflect their decisions.

The life-oriented approach is utilized in order to examine the interrelationships of various life choices with respect to the development of the commuting behavior over time and over people's life courses. These analyses require corresponding longitudinal data, which was collected in the Zurich region, Switzerland, in a retrospective survey covering the 20 year period from 1985 to 2004.

The results show that the different dimensions of the life course are highly interdependent. The changes in residence, education and employment are to a great extent related to one another, occurring simultaneously rather than successively. A strong connection is also observed between the ownership of mobility tools and their usage for commuting. This applies likewise to changes in occupation and the most frequently used mode of transport for the commuting trips. Following a residential relocation, the mean distances to the places of occupation decline, indicating that moving is used as a mean to reduce commuting. In contrast, changes in education and employment lead to considerably longer commuting distances. Interestingly, persons altering their places of residence and occupation simultaneously have even lengthier commutes. The ownership of both cars and public transport tickets rises after all changes. Concurrent with this increase in mobility tool availability, the corresponding usage for commuting also expands overall. Private and public transport are in general more frequently used, while cycling and walking decline.

1. Introduction

Daily travel behavior, and especially commuting behavior, is strongly determined by the location of the places of residence, education and employment. After changes in these spatial choices, e.g., due to moves or changes in occupation, people inevitably show a travel behavior that is different from the travel behavior before these relocations occurred, as usually trip distances, routing, timing and frequency are altered (Chapin, 1965, 1974; Hägerstrand, 1970; Scheiner, 2006). At the same time, the availability as well as the quality and quantity of the available transport systems change. In turn, the decisions about the ownership and usage of the various mobility tools, such as cars and different public transport tickets, are influenced, as they provide access to the different transport systems and determine the marginal costs of use. In this context, the relationship between migration and mobility becomes much closer. The ability to commute over longer distances, without significantly increasing travel

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times, gives people the opportunity to substitute residential relocation by commuting. This leads to a reduction in residential mobility due to changes in occupation (Kalter, 1994; Pooley et al., 2005).

Residential and occupational decisions have long-lasting effects, since corresponding changes involve substantial amounts of resources (costs, time, etc.). Therefore, it is necessary to analyze their dynamics over longer periods of time. A longitudinal perspective is available from people's life courses, which link different dimensions of life together. Besides personal and familial history, locations of residence, education and employment as well as the ownership of various mobility tools and their usage can be taken into account. These life course dimensions are usually not independent from one another. Events in one area are frequently connected to changes in other areas. Decisions are rarely made in isolation and choice behavior is often context dependent (for example, Beige and Axhausen, 2012; Verhoeven et al., 2005; Zhang et al., 2014).

This interdependence of people's choices in various life domains is likewise explicitly assumed in the life-oriented approach, which emphasizes a two-way relationship between these decisions and travel behavior (Zhang, 2015). By incorporating various life choices, the life-oriented approach aims to improve the estimation of travel behavior models and to avoid biased forecasts. This is especially important in the context of policy decision-making, since behavioral responses of people towards different policy measures are thus better predicted (Zhang, 2015). The life-oriented approach, as already put forward in life course and biographical approaches, also has the advantage of adopting a longitudinal perspective instead of studying life decisions only at a single point in time, as the relationship between life choices and travel behavior is not necessarily invariant over time, and especially over the life course (Zhang, 2014).

In the next section, the concept of the life course approach is illustrated, followed by a review on the dynamics of commuting. The main part of the paper then concentrates on empirical analyses of the observable dynamics in residence, education and employment and the related commuting over time and over the life course. Section 4 describes the data used, while Section 5 presents various results with respect to the development of the residential, occupational and commuting behavior. The commuting behavior is investigated in detail with respect to the corresponding distances and the most frequently used mode of transport. Furthermore, the changes in residence, occupation and commuting are analyzed in relation to other life choices. Finally, the results are summarized and conclusions with respect to transport policy making are drawn.

2. Life course

The life course itself can be regarded as a contextual system (Mayer, 1990). A person's past affects his or her present, and his or her present affects his or her future, as individuals seek coherence and continuity (Ryder, 1965). Blossfeld and Huinink (2001) also describe the life course as a self-referential process. Each domain of life forms a part of this process. They are linked together by time and age. During the life course, the various dimensions have different priorities (Blossfeld and Huinink, 2001). Furthermore, the life course is embedded in the external conditions, i.e., the structuring influence of other people's life courses and society.

The structure of the life course is captured with its trajectories and transitions (Elder, 2000). The trajectories describe different domains of life, such as the social background, family life, education and employment, spatial mobility as well as health issues, etc. The transitions represent changes in a state that are more or less abrupt, for example, marrying, divorcing, the birth of children, entering and leaving school, acquiring and changing a job, retiring. Each transition is embedded in a trajectory that gives it specific form and meaning (Elder, 2000). Alternatively, the life course is seen as a sequence of events (Sackmann and Wingens, 2001). In this context, it is worthwhile to understand an event as well as the history leading up to its occurrence, since past behavior is strongly correlated to present behavior (Box-Steffensmeier and Jones, 2004). At the same time, expectations about the future play an important role (Oakil, 2013; Tran, 2015; Zhang et al., 2014).

Based on the life course approach, Lanzendorf (2003) develops the framework of mobility biographies for the analyses of travel behavior. It distinguishes between three life domains covering the relevant trajectories for travel behavior: first, the life style domain; second, the accessibility domain encompassing the relevant locations of residence, occupation and others activities; and third, the mobility domain referring to the availability of various mobility resources and the actual activity and travel patterns, including commuting (Lanzendorf, 2003).

3. Dynamics of commuting

Commuting is the consequence of a spatial discrepancy between the residential and occupational locations (Rouwendal and van der Vlist, 2005). Commuting distance and time are mainly changed either by residential or occupational mobility. These two types of mobility are closely connected, especially in the sense that observing one type of mobility makes it more likely to observe the other one as well (Rouwendal and van der Vlist, 2005). Kalter (1994) as well as Rouwendal and van der Vlist (2005) study the interaction and the timing between residential and occupational mobility, specifying duration models that focus on the time during which housing-labor-arrangements, and hence commutes, remain unchanged. Their results strongly suggest that a residential or occupational relocation causes a considerable increase in the propensity to move both on the housing and on the labor market, as observed change rates decrease substantially over time. Rouwendal and Rietveld (1994) study the impact of spatial mobility on the commuting distances, also applying a longitudinal perspective. They observe that changes in the employment situation lead to an increase in commuting distances. People who change job often commute over a longer distance

after the change occurs. Changes in the housing situation are more or less neutral in their effect on the average commuting distances.

Besides residential and occupational relocations, the following events form important occurrences in the occupational domain of the life course and with respect to commuting: starting and ending school, an apprenticeship or university, acquiring and changing a job as well as retiring (Müggenburg et al., 2015). In addition, further life course events, such as marriage, divorce, the death of a partner or spouse and the birth of children, play an important role. Various studies investigate interdependencies between these events and changes in commuting, identifying the events with a significant impact on travel behavior changes. For Germany, Prillwitz et al. (2007) show the importance of spatial relocations and professional changes for the commuting distances, besides socio-demographic and socio-economic factors. In addition, the spatial structure and accessibility have significant impacts on the distances traveled. For Switzerland, Schoenduwe et al. (2015) examine the influence of life course events with respect to changes in commuting mode choice, finding that, again, changes in the residential and occupational locations are the most important occurrences. Furthermore, mobility resources, like car ownership, have a substantial effect. The same interrelationships regarding the dynamics in commuting mode choice are confirmed by Oakil et al. (2011) for the Netherlands, though, in this context, residential mobility is less crucial. Based on panel data of the British population, results by Clark et al. (2016) as well as by Dargay and Hanly (2007) support these findings. Clark et al. (2016) show that commute mode changes are primarily driven by alterations in the commuting distance which occur in association with moving home and/or changing occupation. And again, the spatial context influences changes in the commuting behavior. Dargay and Hanly (2007) also find strong interdependencies between spatial relocations and alterations in commuting.

The purpose of this paper is to examine the interrelationships between residential and occupational mobility on the one hand and the corresponding commuting behavior on the other hand in a dynamic context. The stability and instability of the ownership of mobility tools and their usage for commuting is analyzed over time and over people's life courses. Additionally, the development of the commuting distances is investigated. In order to increase the understanding of the dynamics in commuting, the corresponding changes are studied in relation to other life choices, as questions about how, when and why such changes happen are of large interest for the formulation of transport policies.

The analyses of the dynamics of commuting decisions require corresponding longitudinal data that describe people's life courses in various domains. Solely this kind of data enables the investigation of continuity and change over time (Ryder, 1965).

4. Data

Essentially, there are two ways of collecting such longitudinal data. The most obvious and best-regarded method is to conduct a panel survey. Data collected this way is very reliable since events are observed as they happen and, hence, inaccuracies due to memory loss are reduced (Lanzendorf, 2003). However, panel surveys are difficult and expensive to carry out as well as effort and time consuming. The second method approximating a panel survey is to use a retrospective approach that relies on individual's recall capacity and, hence, is subject to the limitations of human memory. With increasing time elapsed since an event, the amount of information retained decreases in a logarithmic relationship (Brückner, 1994; Hollingworth and Miller, 1996; Lanzendorf, 2004). However, people tend to remember major events, such as personal and familial events or residential moves, better. Therefore, those can be used as support for the memory by further linking different dimensions of life together and in doing so placing single events into a larger context (Brückner, 1990). Experiences from Hollingworth and Miller (1996) show that a retrospective survey proves to be a favorable alternative to a panel survey. Brückner (1994) and Lanzendorf (2004) also argue that a retrospective approach is feasible and suitable for important events of the life course that respondents are able to remember well. However, Verhoeven (2010) notes that people have substantial difficulties to recall aspects of their daily travel behavior, such as mode choice, timing, etc., in retrospect. These short-term mobility decisions tend to vary more frequently, and are therefore harder to collect. This applies even more so to softer factors, such as attitudes, preferences, motives as well as satisfaction, which are prone to changes in retrospect, rather becoming an individual's own reflective evaluation of an experience (Zhang and Xiong, 2015).

In order to collect longitudinal data on people's life courses, a retrospective survey covering the 20 year period from 1985 to 2004 was carried out at the beginning of the year 2005 in a stratified sample of municipalities in the Zurich region, Switzerland, taking different spatial and transport related municipality types into account (Beige and Axhausen, 2005). The observed time period was based on the following considerations: on the one side, also rarer events, such as changes in car availability, were to be observed; on the other side, the accuracy of the recollection of events was to be sufficient. The chosen 20 year period represented an appropriate compromise.

Core element of the questionnaire was a multidimensional life course calendar for the period from 1985 to 2004, providing a visual reconstruction of the past (for a detailed discussion on the usage of the life course calendar see Schoenduwe et al., 2015). Besides information about the personal and familial history, data on places of residence, education and employment, the personal income as well as data on the ownership of various mobility tools and their usage for commuting was collected. Linking these various aspects together supported the recollection for the respondents, as associations were formed (Brückner, 1990). At the same time, the graphic representation of the life course increased the quality and accuracy of the data, since inconsistencies in the timing of events between different dimensions became easier to detect.

The survey was conducted using a written self-completion questionnaire which was sent out by mail to 3600 households. Each household received one household form and two person forms, containing the life course calendar, that were to be filled in by persons aged 18 years and older. Overall, 1166 persons in 780 households participated in the retrospective survey, and 1140 completed life course calendars were available for further statistical analyses. Table 1 describes these households and persons and shows a comparison with the entire population of Switzerland, when corresponding data is available. The mean household size in the retrospective survey amounts to 2.2 persons, with 1.8 adults and 0.4 children living on average in the households. About 30% of the households are one-person households, about 64% family households and about 6% non-family households. In comparison to the whole population of Switzerland, the deviations are relatively small. In the retrospective survey, the households are on average slightly smaller, whereas the share of one-person households is lower with some more family and non-family households participating in the survey. The shares of male and female persons in the survey sample are very similar to the census data of Switzerland. Concerning age, the persons living in the households are on average over three years younger in the retrospective survey than in the entire population, with a considerably higher share of persons aged from 20 to 64 years. Regarding the person level, only respondents aged 18 years and older are taken into account. The shares of males and females are relatively balanced. The deviations to the entire population amount to under 2%. On average, the respondents are about 44 years old, with 1% being younger than 20 years and 20% being older than 64 years. Overall, the persons participating in the retrospective survey are slightly older than the Swiss average. Noticeably, the persons aged from 20 to 64 years are overrepresented in the sample. With respect to nationality, there are 84% Swiss and 15% foreign nationals participating in the retrospective survey. In order to inquire the occupation of respondents, the questionnaire allowed for choosing multiple answers, so the shares sum up to over 100%. About 11% of the persons are in education, 51% full-time employed, 24% part-time employed and 3% seek a job. 13% are engaged in home duties and 17% are retirees.

Table 1
Description of the households and persons participating in the retrospective survey and a comparison with the entire population of Switzerland.

	Retrospective survey (2005)	Entire population of Switzerland (2000)
	Mean value (Standard deviation)	
Household-related variables		
Household size:		
Number of all persons	2.2 (1.2)	2.3
Number of adults	1.8 (0.7)	1.8
Number of children	0.4 (0.8)	0.5
Household type:		
One-person households	30.4%	35.2%
Family households	63.6%	60.7%
Non-family households	6.0%	4.1%
Gender of all household persons:		
Male	48.5%	49.0%
Female	49.9%	51.0%
Age of all household persons:		
Average age	35.9 years (19.9 years)	39.2 years
Aged below 20	20.1%	22.9%
Aged above 64	9.9%	15.4%
Household income per month	8227 CHF (4104 CHF)	
Accommodation size:		
Number of rooms	4.0 (1.4)	
Person-related variables (Only persons aged 18 years and older are considered.)		
Gender of all persons:		
Male	49.9%	48.4%
Female	50.1%	51.6%
Age of all persons:		
Average age	43.6 years (15.8 years)	41.7
Aged below 20	0.7%	2.9%
Aged above 64	13.6%	19.3%
Nationality:		
Swiss national	80.8%	
Foreign national	18.9%	
Occupation:		
In education	10.5%	
Full-time employed	50.6%	
Part-time employed	23.8%	
Job-seeking	2.9%	
Home duties	13.1%	
Retired	16.7%	
Person income per month	5534 CHF (3547 CHF)	

So far, this data was used to examine people's long-term mobility choices over the life course, including on the one side decisions on residential locations and the places of education and employment as well as on the other side the ownership of mobility tools, such as cars and public transport tickets. It was shown that there existed a strong interrelation between these aspects of long-term mobility behavior. Spatial mobility was influenced by the ownership of the different mobility tools, and vice versa. Thereby the mobility tool ownership, especially car availability, remained relatively stable over longer periods of time in comparison to the spatial mobility (Beige and Axhausen, 2008a). Furthermore, the dynamics of mobility tool ownership during the life course were analyzed in more detail, indicating that cars and public transport tickets were used as substitutes for one another (Beige and Axhausen, 2008b). In a next step, the interdependencies between turning points in life, also called life course events, and long-term mobility decisions were studied. The turning points considered included important personal and familial events, such as forming a partnership, marriage, break-up, divorce, and the birth of children as well as changes in residence, education and employment. In this context, strong interdependencies between the various turning points and long-term mobility decisions during the life course were observed, as events occurred to a great extent simultaneously. Persons tended to aim for compensation between the different dimensions of life (Beige and Axhausen, 2012).

Now, the data is utilized to investigate changes in residence and occupation as well as the corresponding commuting behavior over time and over the life course. The commuting behavior is investigated in detail with respect to the corresponding distances and the mode of transport most frequently used.

5. Results

This contribution focuses on the dynamics in the mandatory activities of individuals, such as education and employment, since these activities are linked to daily commuting trips which form an essential part of travel.

In this section, the following research questions are addressed:

1. How does the residential, occupational and commuting behavior develop over time and over people's life courses?
2. To what extent are changes in residence, occupation and the corresponding commuting behavior connected to one another as well as to other life choices? And what happens when these changes occur?
3. How are socio-demographic and socio-economic characteristics associated with changes in residence, occupation and commuting as well as with the durations between these changes?

5.1. Dynamics with respect to residence, education and employment

In a first step, the retrospective data for the period of the 20 years from 1985 to 2004 is explored in regard to the occupational choices occurring over time and over the life course. Fig. 1 shows the share of respondents that are engaged in education and employment as well as the personal monthly income. Furthermore, changes in the places of residence, education and employment as well as the corresponding linear distances between these places are analyzed by time and by age of the respondents, using five year intervals due to the size of the sample.

Over time (depiction on the left side of Fig. 1), the percentage of persons in education diminishes as they age during the observed period, whereas the share of employed persons increases. Accordingly, the income per month, without considering inflation, rises as well. The share of moves continuously increases over time, reaching a maximum in the year 2000. This also applies at a somewhat lower level to the changes in employment, whereas the share of changes in education slightly decreases between 1985 and 2004. The median linear distances between the place of residence and the corresponding places of occupation increase over time, to a greater extent for education than for employment. Frost et al. (1998), Kalter (1994), Prillwitz et al. (2007), Rouwendal and Rietveld (1994) as well as Van Acker and Witlox (2011) also observe a rise in commuting distance in various other European countries.

With regard to the life course of the respondents (depiction on the right side of Fig. 1), the share of persons in education is highest amongst the adolescents, consistent with expectations. Afterwards, it strongly decreases until the age of about 30 years. Employment shows a clear increase between the ages of 15 and 30 years, followed by a relative stable period with a share of about 80% until persons start retiring, when they reach the age of circa 60 years. The monthly income continuously increases over the life course, especially for persons aged from 15 to 30 years. Only after the age of 65 years, a small reduction is observable. Most moves occur between the ages of 20 and 35 years, with a maximum of about 15%. Afterwards, the share of residential relocations gradually decreases. This supports findings of Birg and Flöthmann (1992), Wagner (1990), and others. For the changes in the place of employment, the curve is again very similar, only at a lower level. Between the ages of 60 and 65 years, the influence of retirement becomes visible. Variations in education occur, concurrent with expectations, earlier during the life course. This share reaches a maximum for persons aged from 15 to 20 years. The median linear distance to the place of education shows a strong rise between the ages of 10 and 18 years. With increasing age the distance to education fluctuates, which is connected to more specialized educations and a rather low number of observed cases for the older age groups. For the distance to the place of employment, there is a likewise strong increase noticeable until the age of 18 years. Then, a slow decrease until the retirement age and an afterwards stable section with a median distance of about one kilometer follow. This in-

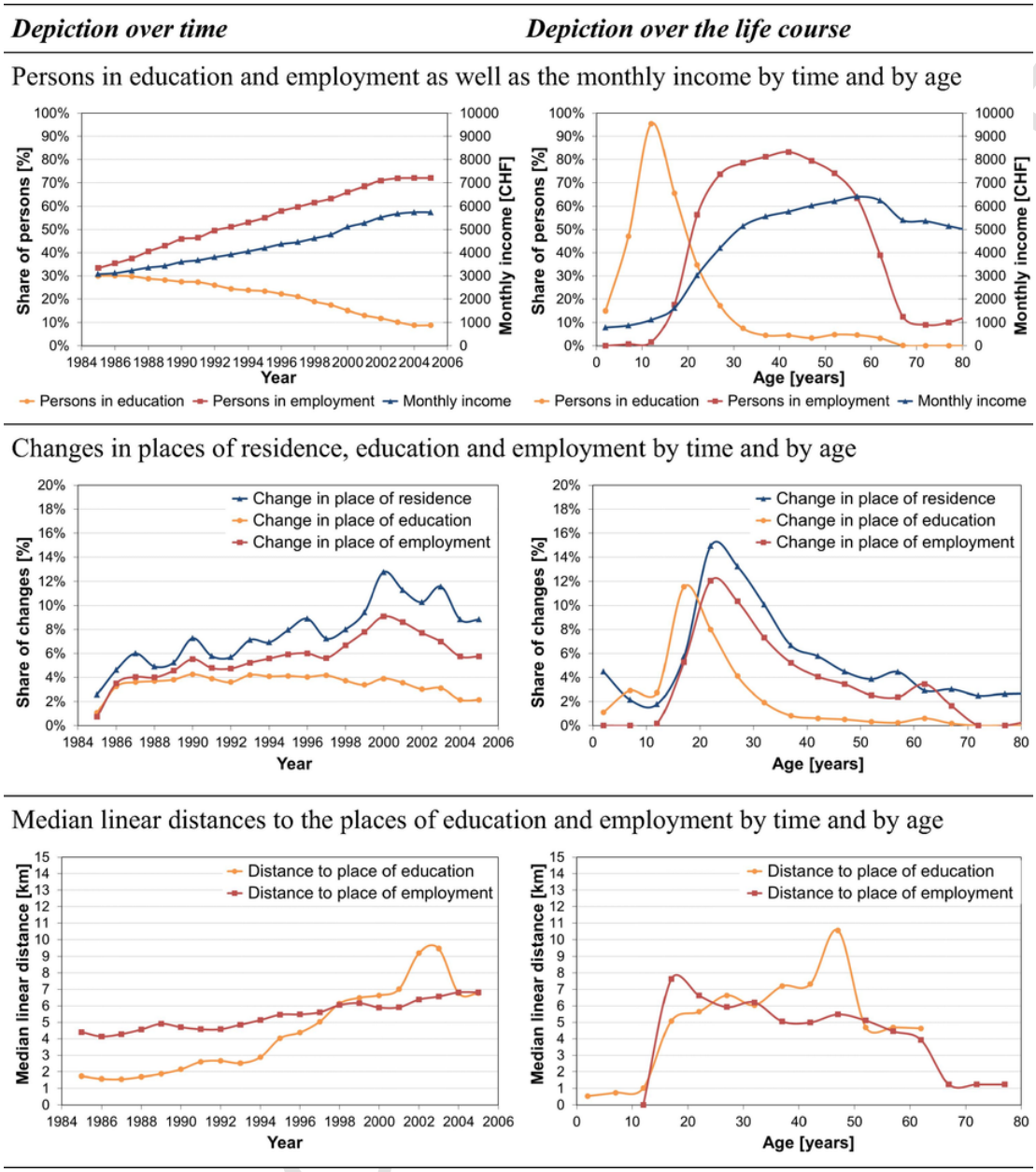

Fig. 1. Dynamics with respect to residence, education and employment over time and over the life course.

dicates that adjustments take place over the life course in order to reduce the commuting distance to the place of work, and thereby also decreasing the commuting burden (Stutzer and Frey, 2008).

5.2. Dynamics with respect to the ownership of mobility tools and their usage for commuting

In a second step, the ownership of mobility tools and their usage for commuting is examined. The mobility tools considered in the retrospective survey are on the one hand cars and on the other hand different public transport season tickets with a higher commitment, including national annual tickets as well as regional annual and monthly tickets. Regarding the analyses of the commuting trips and the mode of transport most frequently used for these trips, only respondents in education and employment are considered. Fig. 2 illustrates the corresponding dynamics over time as well as over the life course.

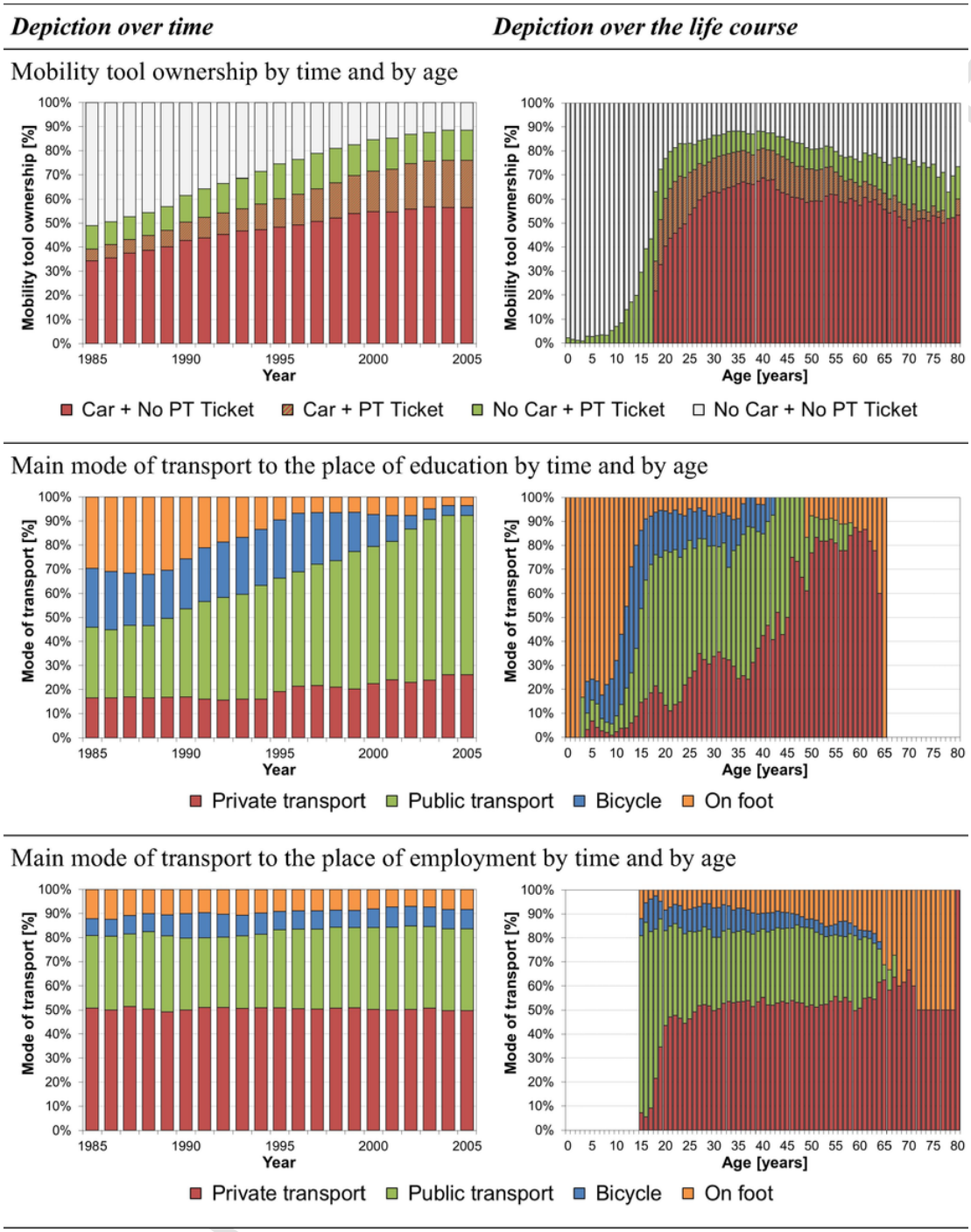

Fig. 2. Dynamics with respect to the ownership of mobility tools and their usage for commuting over time and over the life course.

During the 20 year period from 1985 to 2004 (depiction on the left side of Fig. 2), the ownership of all mobility tools increases, for cars from 40% to 75% and for public transport tickets from 15% to 30%. The share of simultaneous car and public transport ticket owners rises from 5% to 20%. At the same time, respondents without any mobility tools diminish. With respect to the commuting mode choice during the observed 20 year period, major changes concerning the main mean of transport to the place of education occur. There is a small increase in the share of private transport by about 10% and a much bigger increase in the share of public transport by over 30% discerned, whereas cycling and walking strongly decline. By contrast, the main mode

for the trip to the place of employment remains relatively stable over time. Approximately 50% of the respondents use private transport, 30% public transport and nearly 10% each cycle and walk.

Regarding the age of the respondents (depiction on the right side of Fig. 2), the ownership of mobility tools rises strongly at the beginning and then remains relatively stable over the life course with only approximately 10–20% of persons not having any mobility tool at their disposal. As expected, a strong increase in car ownership occurs after reaching the driving age of 18 years. Persons aged from 25 to 50 years show the highest share with about 75%. Then, a slow decrease is visible. The ownership of public transport tickets shows opposing dynamics over the life course. It considerably increases until the age of 18 years, followed by a decline until the age of 25 years and a relative stable period with shares of around 20–25%. About one sixth of the respondents own a car and public transport tickets at the same time. Concerning the use of the mobility tools for commuting over the life course, the usage of private and public transport strongly increases for persons in education, whereas walking is only for the younger age groups of some importance. Employed persons, especially those aged from 25 to 65 years, show a relative stable modal split during their life.

These developments are closely related to the development of the median distance from home to the places of education and employment over time and over the life course, as shown in Fig. 1. Increases in distance are accompanied by a higher usage of private and public transport for commuting.

5.3. Changes in residence, education, employment, the ownership of mobility tools and their usage for commuting

In a third step, the changes in the places of residence, education and employment as well as changes in mobility tool ownership and their usage for the commuting trips are investigated. In Table 2 the shares of these changes taking place within the same year are shown with respect to the non-occurrence and occurrence of all alterations. The table is read column by column. Considering mobility tool ownership as an example, a move within the same year takes place in about 38% of the years with a change in the availability of mobility tools, while this share amounts to only 14% of the years with no alteration in mobility tool ownership. Variations in the spatial context are more frequently observed, while the choices regarding mobility tools are more stable in comparison, an observation also made by Dargay and Hanly (2007) in Great Britain, by Oakil (2013) in the Netherlands as well as by Zhang et al. (2014) in Japan. Alterations are strongly interconnected across domains. In the case of one change taking place, the share of another change is significantly higher, as corresponding statistical analyses indicate. This especially applies to the main mode of transport used for the commuting trips. Furthermore, the spatial alterations are considerably interrelated with one another. So, about one sixth of all moves are accompanied by a change in education and about one third by a change in employment. For the variations in occupation, the shares of simultaneous changes in residence occurring within the same year are even higher.

Table 3 reports the corresponding correlations between the changes in the various domains. All shown correlation coefficients are significant at a 0.01 level. The different dimensions of the life course are highly interdependent. The strongest connections are observed for changes in occupation and the most frequently used mode of transport for the commuting trips as well as for the ownership of mobility tools and their usage for commuting, as is also observed by Clark et al. (2016), Oakil et al. (2011) and Schoenduwe et al. (2015). The changes in residence, education and employment are also to a great extent related to one another, occurring simultaneously rather than successively, confirming findings of Rouwendal and van der Vlist (2005), as well as others. Furthermore, education and mobility tool ownership show a relatively high association concerning the variations occurring within the same year.

Table 4 presents a comparison between the situations before and after all changes with respect to education, employment, the ownership of mobility tools and their usage for commuting. After an alteration occurs, fewer persons are in education, while the share of persons in employment increases. At the same time, the personal monthly income is considerably higher after all changes in comparison to the before situation. Following a residential relocation, the mean distances to the places of occupation decline, indicating that moving is used as a mean to reduce commuting, supporting results of Clark et al. (2003) as well as of Rouwendal and Rietveld (1994). In contrast, changes in education and employment lead to significantly longer commuting distances. Interestingly, persons altering their places of residence and occupation simultaneously have even lengthier commutes, as is also shown by Prillwitz et al. (2007) as well as by Rouwendal and Rietveld (1994). The ownership of both cars and public transport tickets rises after all changes, especially after variations in the ownership of mobility tools. This means that cars and public transport tickets are acquired rather than abandoned, confirming findings by Dargay (2001). Concurrent with this increase in mobility tool availability, the corresponding usage for commuting also expands overall. Private and public transport are in general more frequently used, while cycling and walking decline. Only after spatial changes, the share of private transport for the trips to work decreases.

The variations shown in Table 4 are mostly corroborated by the results of corresponding discrete choice models in form of binomial logit models for the occurrence or non-occurrence of all changes. In the context of the model estimation, it is necessary to take into account that each respondent appears several times in the data and, therefore, to control for unobserved characteristics of the individuals. Thus, an error term is added, which allows individuals who are homogeneous in their observed characteristics to be heterogeneous in their response probabilities (Hsiao, 2003, p. 193). Within the model specification a random parameter is introduced, which is normally distributed across the entire sample, but invariant for each individual. For this parameter, the standard deviation is estimated, while the mean value is set to zero (Bierlaire, 2005). Table 5 shows the results of dif-

Table 2
Changes in residence, education, employment, the ownership of mobility tools and their usage for commuting within the same year.

	Change in residence		Change in education		Change in employment		Change in mobility tool ownership		Change in main mode of transport	
	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Place of residence	0.0%	100.0%	13.2%	35.7%	11.5%	40.7%	14.1%	38.2%	12.4%	38.6%
Place of education	5.6%	17.8%	0.0%	100.0%	4.4%	27.4%	5.2%	31.3%	3.5%	40.0%
Place of employment	8.1%	31.7%	8.5%	43.2%	0.0%	100.0%	10.3%	35.5%	6.3%	56.0%
Mobility tool ownership	5.2%	17.2%	5.0%	30.6%	5.0%	20.1%	0.0%	100.0%	4.1%	33.2%
Main mode of transport	7.2%	25.79%	6.0%	53.8%	4.6%	47.8%	6.8%	46.3%	0.0%	100.0%
Number of observations	17,610	3080	21,231	1569	20,322	2478	18,581	1351	20,012	2050

Table 3
Correlations between changes in residence, education, employment, the ownership of mobility tools and their usage for commuting within the same year.

	Change in residence	Change in education	Change in employment	Change in mobility tool ownership	Change in main mode of transport
Place of residence	1.000	0.165	0.263	0.170	0.220
Place of education		1.000	0.283	0.258	0.417
Place of employment			1.000	0.195	0.463
Mobility tool ownership				1.000	0.339
Main mode of transport					1.000
Number of observations	20,690	22,800	22,800	19,932	22,062

ferent binomial logit models for the occurrence or non-occurrence of variations in residence, education, employment, the ownership of mobility tools and their usage for commuting. Unfortunately, it is not possible to take into account the direction of these changes, e.g., starting or ending education and employment, since the proportion of changes in the data set is not sufficient to be further distinguished. For the explanatory variables used in the models, the difference between the situation after and before each point in time is calculated on a semi-annual basis. All relevant variables are incorporated into the models and a corresponding indication of their significance is presented.

Concerning the changes in residence (referring to the first column of Table 5), the propensity to move rises with increasing age until reaching a maximum for persons aged between 20 and 30 years, and afterwards the probability declines. This also applies to the alterations in employment. Changes in education tend to happen earlier in life, peaking for persons aged between 10 and 20 years. Overall, men show a slightly more constant behavior than women. A higher number of household members reduces the probability of the occurrence of all spatial changes. At the same time, moves are connected to an increase in accommodation size. Regarding variations in occupation (encompassing both education and employment), these are more frequently related to ending education and starting employment as well as to longer distances to the corresponding places of occupation, supporting findings by Prillwitz et al. (2007) and Rouwendal and Rietveld (1994). All spatial changes are accompanied by a significant rise in income and an overall increase in mobility tool ownership. Solely, variations in occupation are linked, though not significantly, to the disposal of cars, confirming findings by Oakil (2013). Changes in education are associated with a considerable increase in the usage of all transport modes for commuting, while the opposite tendency is observed for the changes in employment.

Regarding the ownership of mobility tools and their usage for commuting (referring to the last two columns of Table 5), most changes occur for individuals aged from 15 to 30 years. And again, women behave more variable than men, most notably in the older age groups. Persons holding a college or university degree exhibit a less stable behavior. A rising index of purchasing power in the residential region, an index measuring the changes in consumer prices (Ascoli, 2000; Olsson, 2005), has a significant positive influence for the variations in mobility tool ownership. A simultaneous spatial change considerably increases the likelihood of an alteration in the ownership of mobility tools and their usage for commuting. The monthly income shows again a positive interrelationship with the propensity to alter mobility tool ownership and usage for commuting. Concurrent with expectations, there exists also a strong positive link to the acquisition of cars and public transport tickets, pointing to an overall increase in mobility tool ownership, and corresponding changes in their usage for commuting. Both variations in the availability of mobility tools and in the main mode of transport for commuting are associated with an increase in the usage of private transport, while cycling and walking decline.

The panel effect, represented by the shown standard deviation of the individual-specific random parameter, is only relevant for variations in occupation (education and employment) as well as in the main mode of transport used for commuting. In these cases, the high values for the standard deviation σ of the individual-specific error term indicate a substantial heterogeneity in the sample (Hsiao, 2003, p. 224). The sign of the random parameter is in this context not relevant, as the square of the random parameter represents the variance (Bierlaire, 2005).

5.4. Durations between changes in residence, education, employment, the ownership of mobility tools and their usage for commuting

In the following, the intervals between the events in the various life domains are analyzed in detail, on the one hand for the spatial relocations as well as on the other hand for the ownership of mobility tools and their usage for commuting. Fig. 3 illustrates the distribution of the corresponding durations during the surveyed 20 year period from 1985 to 2004. Overall, 4155 residential, 1290 education and 2589 employment durations are observed, which are on average 5.0, 3.9 and 4.8 years long, respectively. Approximately 70% of all the spatial durations are up to five years long. Regarding the mobility tool availability and the main mode of transport used for commuting, a slightly different picture arises. The distributions of these durations are to a lesser

Table 4
Comparison before and after all changes with respect to education, employment, the ownership of mobility tools and their usage for commuting.

	Change in residence		Change in education		Change in employment		Change in mobility tool ownership		Change in main mode of transport	
	Before	After	Before	After	Before	After	Before	After	Before	After
Persons in education	25.0%	21.8%	73.6%	58.7%	25.0%	11.9%	40.8%	36.8%	34.3%	33.4%
Persons in employment	63.6%	67.7%	22.3%	44.8%	68.2%	85.5%	48.7%	55.3%	47.2%	55.2%
Monthly income [CHF]	4211	4427	2279	2884	4026	4566	3301	3640	3293	3576
Linear distance [km] to place of education	15.9	15.4	13.9	16.5	15.6	19.9	13.2	15.0	10.9	13.7
Linear distance [km] to place of employment	15.8	14.9	16.1	17.3	16.4	16.9	16.5	17.3	15.9	15.5
Mobility tool ownership:										
Car	71.4%	72.7%	54.8%	55.5%	74.1%	75.9%	45.5%	63.8%	63.1%	64.4%
Public transport ticket	28.2%	29.9%	35.4%	41.9%	31.9%	33.4%	43.4%	58.0%	29.2%	34.2%
Main mode of transport to place of education:										
Private transport	18.5%	18.8%	13.9%	18.8%	22.8%	24.4%	10.6%	11.3%	11.7%	20.0%
Public transport	54.0%	54.3%	40.6%	55.9%	53.8%	60.0%	51.9%	67.9%	22.6%	47.4%
Bicycle	16.7%	15.3%	23.9%	14.8%	14.6%	9.5%	25.4%	14.5%	30.8%	19.4%
On foot	10.8%	11.6%	21.6%	10.5%	8.8%	6.1%	12.1%	6.3%	34.9%	13.2%
Main mode of transport to place of employment:										
Private transport	50.1%	48.6%	38.2%	36.9%	49.3%	44.9%	26.5%	27.9%	28.9%	38.8%
Public transport	34.3%	34.6%	45.8%	45.3%	34.7%	39.0%	53.5%	54.6%	40.2%	35.7%
Bicycle	8.4%	9.1%	9.7%	12.0%	8.0%	8.9%	12.6%	11.0%	15.7%	13.1%
On foot	7.2%	7.7%	6.3%	5.8%	8.0%	7.2%	7.4%	6.5%	15.2%	12.4%
Number of observations	3145	3163	1608	1608	2569	2571	1387	1387	2121	2121

Table 5
Binomial logit models for the changes in residence, education, employment, the ownership of mobility tools and their usage for commuting.

Explanatory variable *(Difference between the after and before situation)*	Change in residence	Change in education	Change in employment	Change in mobility tool ownership	Change in main mode of transport
Age	−0.262*	−0.463*	−0.768*	−0.491*	−0.204*
Age squared	+0.001*	+0.003*	+0.004*	+0.003*	+0.001*
Age natural logarithm	+5.022*	+5.174*	+14.228*	+7.329*	+2.584*
Gender: Male	−0.269*	−0.172	−0.535*	−0.021	−0.117
Gender: Male ∗ Age	+0.006	+0.003	+0.013*	−0.010*	−0.000
Nationality: Swiss national	−0.015	+0.552*	+0.147*	+0.082	+0.056
College or university degree	+0.051	+0.482*	−0.013	+0.217*	+0.145*
Increase in number of persons in household	−1.263*	−0.106	−0.110*	−0.024	−0.042
Increase in number of rooms in accommodation	+0.574*	−0.068	+0.011	+0.001	+0.036
Increase in population in res. municipality [1,000,000 inhabitants]	+0.271	−0.103	−0.305	+0.205	−0.540*
Increase in population density in res. municipality [1000 inhabitants/ km^2]	+0.072	+0.152	+0.000	+0.089	+0.084*
Increase in purchasing power index in res. region	+0.001	−0.017	+0.030*	+0.046*	+0.017
Simultaneous change in residence and occupation				+1.766*	+3.059*
Increase in education	−0.266	−2.526*	−0.993*	−0.073	−0.044
Increase in linear distance [100 km] to place of education	−0.818*	+1.096*	+0.723*	−0.158	+0.721*
Increase in employment	−0.240	+1.183*	+1.981*	−0.013	+0.060
Increase in linear distance [100 km] to place of employment	−0.319	+0.097	+0.197	+0.040	+0.070
Increase in monthly income [1000 CHF]	+0.160*	+0.218*	+0.256*	+0.120*	+0.073
Increase in mobility tool ownership:					
Increase in car ownership	+0.136	−0.007	−0.038	+4.679*	+0.411*
Increase in public transport ticket ownership	+0.543*	+0.701*	+0.719*	+2.131*	+0.608*
Increase in usage of main mode of transport for commuting:					
Increase in usage of private transport	+0.260	+2.215*	−1.884*	+0.187	+1.317*
Increase in usage of public transport	+0.267	+2.512*	−1.953*	−0.095	+0.072
Increase in cycling	+0.128	+0.909*	−2.243*	−1.190*	−1.041*
Increase in walking	+0.296	+1.136*	−2.013*	−0.346	−0.637
Constant	+12.686*	+11.003*	+31.666*	+16.782*	+7.107*
Standard deviation of the individual-specific random parameter	+0.004	−0.497*	−0.449*	−0.005	−0.509*
Number of persons	1043	1043	1043	1043	1043
Number of observations	31,546	31,546	31,546	31,546	31,546
ρ^2 (adjusted)	0.673	0.850	0.714	0.851	0.775

*Level of significance ⩽ 0.10.

extent left-skewed than the distributions concerning the places of residence and occupation. At the same time, only about 50% of these durations are shorter than five years. A stable ownership of mobility tools and their constant usage for commuting during the entire 20 year interval, i.e., with no changes occurring in this period, are indicated for about 18% and 8% of the durations, respectively, while these shares amount to less than 3% for the spatial durations. Overall, this shows again that the residential and occupational behavior is in comparison more variable over longer periods of time.

By means of duration modeling, also called event history modeling, differences in timing, rates of change and probabilities for the occurrence of certain events within a period of time are determined. At the same time, it is possible to study the influence of independent variables on the duration between events, the dependent variable. An essential advantage of duration modeling over traditional linear regressions is its ability to account for the problem of right and left censoring. Censoring occurs, when information about durations is incomplete. This is the case, when preceding and subsequent events are unobserved, which means that the transition from one state to another is not made within the surveyed period. Problems arise, when uncensored and censored cases are treated equally, since the parameters in the duration model may be biased, and under- or overestimated. Fur-

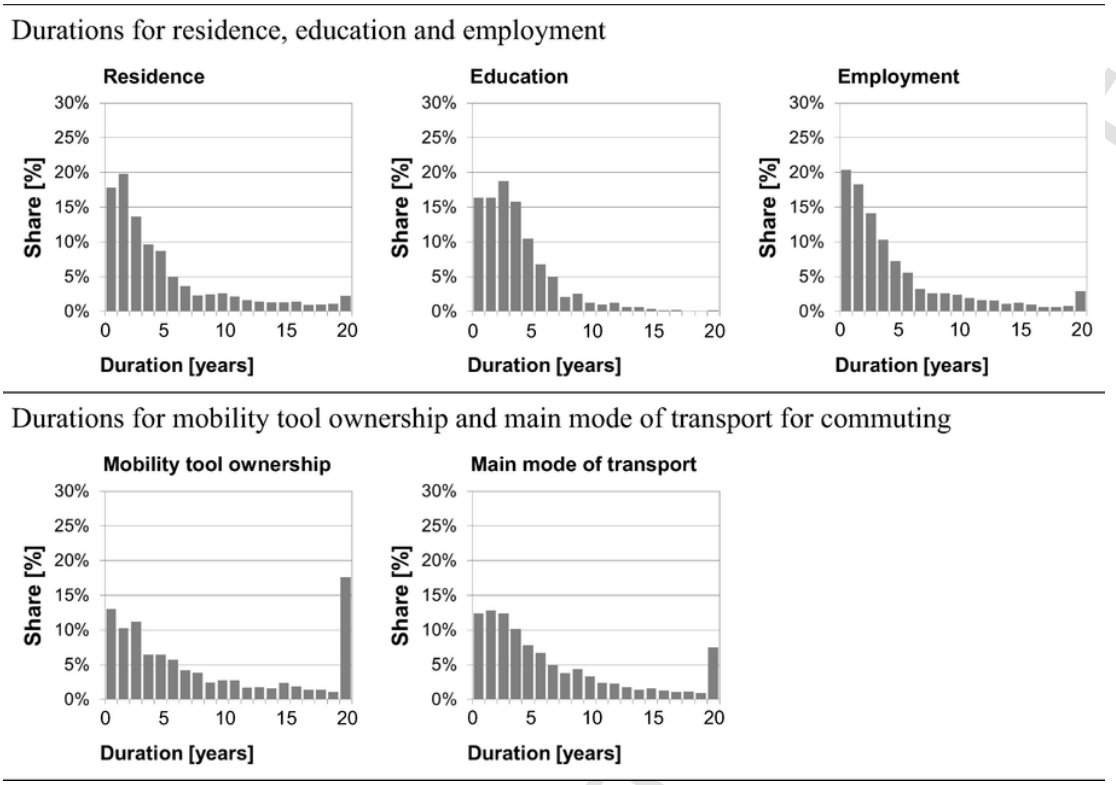

Fig. 3. Distribution of the durations between changes in residence, education, employment, the ownership of mobility tools and their usage for commuting.

thermore, time-varying covariates, i.e., explanatory variables with values changing over time, are easily included in event history analysis (Box-Steffensmeier and Jones, 2004; Yamaguchi, 1991).

In order to compare the different types of durations shown in Fig. 3, competing risks models are estimated. A competing risks situation is assumed when various kinds of events occur. Here, the latent duration time approach is applied, which means that for each specific type of duration a model is estimated, treating the others in this context as censored (Allison, 1995; Box-Steffensmeier and Jones, 2004). Table 6 presents the results of the different competing risks models for the residential, education and employment durations as well as for the intervals between changes in the ownership of mobility tools and their usage for commuting. In the table, the corresponding hazard ratios for the various explanatory variables are shown, which are equivalent to the exponential hazard parameters. For continuous variables they indicate the percentage change of the hazard rate, whereas for dichotomous variables they equal the proportion of the two corresponding hazard rates. The hazard rates, or transition rates, represent the probability or intensity of events occurring per time unit (Allison, 1995). Taking the competing risks model for the durations between changes in residence as an example, Fig. 4 shows on the one hand the influence of age and gender and on the other hand of the monthly income, since several corresponding explanatory variables are included in the model estimation.

With respect to the spatial durations (referring to the first three columns of Table 6), age has a positive effect on the risks of events occurring until the age of 20 years. Afterwards the hazard declines. Men are less likely to move than women, while the durations in occupation (again, encompassing both education and employment) are not significantly influenced by gender. Respondents holding a college or university degree tend to move and change employment more frequently. The number of births during an interval as well as the size of the household reduces the various risks. A higher number of rooms in the accommodation also leads to a decrease of the hazard rate for moving, namely by 16% with each additional room, while durations in education and employment tend to become shorter. An increasing index of purchasing power in the residential region is associated with less spatial alterations. Simultaneous changes of the places of residence and occupation strongly increase the probability of spatial variations taking place, whereas the number of residential relocations has a negative influence on the hazards. Persons in occupation are at a lower risk of changing the place of residence. At the same time, education leads to a considerably lower probability to alter employment, and vice versa. Changes in occupation during the observed period have a negative influence on the propensity to move. Concerning the education and employment durations, the number of variations shows opposing effects. Respondents with many changes in education are less likely to alter education, but more likely to vary employment. For the changes in employment, it is the other way around. With respect to moving, the commuting distances do not

Table 6
Hazard ratios of the competing risks models for the durations between changes in residence, education, employment, the ownership of mobility tools and their usage for commuting.

Explanatory variable *(Average values for the observed durations)*	Durations for residence	Durations for education	Durations for employment	Durations for mobility tool ownership	Durations for main mode of transport
Age	0.928*	0.590*	0.446*	0.435*	0.551*
Age squared	1.000	1.003*	1.005*	1.005*	1.004*
Age natural logarithm	4.767*	2971*	293,574*	530,107*	8536*
Gender: Male	0.709*	0.947	0.853	0.800	0.854
Gender: Male ∗ Age	1.007*	1.001	1.005	1.005	1.006
Nationality: Swiss national	1.043	1.554*	1.090	0.971	1.169
College or university degree	1.281*	0.999	1.186*	1.058	1.092
Number of births in the household	0.842*	0.374*	0.506*	0.555*	0.538*
Number of persons in household	0.895*	0.988	0.928*	0.943	0.980
Number of rooms in accommodation	0.839*	1.039*	1.061*	0.958	0.927*
Population in residential municipality [1,000,000 inhabitants]	0.998	0.725	0.918	0.952	1.002
Population density in residential municipality [1000 inhabitants/ km^2]	0.986	1.039	1.037	0.978	0.979
Purchasing power index in residential region	0.991*	0.996	0.983*	0.989*	0.975*
Simultaneous change in residence and occupation	3.161*	2.565*	2.658*	0.767*	1.212*
Number of changes in residence during the period	0.001*	0.806*	0.741*	0.923*	0.968
Share in education	0.718*		0.065*	0.566*	1.143
Number of changes in education during the period	0.865*	0.007*	1.215*	0.923*	0.922*
Linear distance [100 km] to the place of education	1.007	1.021*	0.953	1.025	1.025
Share in employment	0.707*	0.099*		0.658*	2.087*
Number of changes in employment during the period	0.813*	1.031	0.018*	0.971	0.925*
Linear distance [100 km] to the place of employment	0.999	1.007	1.025*	0.991	0.995
Monthly income [1000 CHF]	0.949	0.778*	0.848	0.929	1.097
Monthly income [1000 CHF] squared	1.003	1.017*	1.007	1.006	0.998
Monthly income [1000 CHF] natural logarithm	1.300*	1.107	1.313	0.729	0.577*
Mobility tool ownership:					
Car ownership	1.074	0.807*	1.174*	1.639*	1.022
Public transport ticket ownership	0.921	0.977	1.069	4.645*	1.013
Main mode of transport for commuting:					
Private transport	0.687*	3.037*	2.393*	1.275	
Public transport	0.788*	3.312*	2.871*	1.597*	1.937*
Bicycle	0.545*	1.933*	1.932*	1.747*	2.699*
On foot	0.599*	2.370*	2.144*	1.439	2.696*
Number of observations	9918	9918	9918	9918	9918
Number of observed events (uncensored cases)	2357	856	1489	677	1027
R^2 (generalized)	0.401	0.083	0.299	0.083	0.080

*Level of significance ⩽ 0.10.

play an important significant role. With increasing distance to the places of education and employment, the probability of changes in education and employment, respectively, rises considerably. This indicates a sooner occupational change in cases where the corresponding place is farther away from home, confirming findings by Kalter (1994) as well as by Van Ommeren et al. (1999). Overall, the residential durations are negatively affected by the monthly income, while the opposite applies to the durations in education and employment, again supporting results of Kalter (1994). For education, the different mobility tools have a negative influence, while it is positive for employment, though not statistically significant for the ownership of public transport tickets. This means that changes of the work place become by 18% more likely with the availability of a car and by 7% more probable for public transport ticket ownership. The usage of the mobility tools for commuting has a positive effect on the resi-

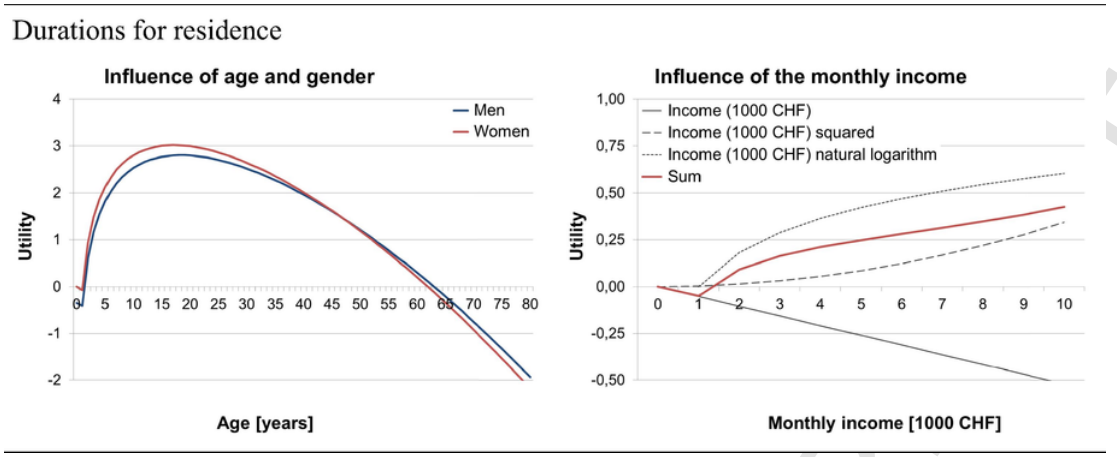

Fig. 4. Influence of age and gender as well as of the monthly income in the competing risks model for the durations between changes in residence.

dential durations, indicating a substitution of relocating by commuting to a certain extent. In contrast, the most frequently used modes of transport considerably increase the likelihood of changes in occupation.

Concerning the ownership of mobility tools and their usage for commuting (referring to the last two columns of Table 6), the influence of age and gender is very similar to the effects observed for the occupational durations. More births as well as bigger households and accommodations stabilize both mobility tool availability and the main mode of transport used for commuting. With an increasing purchasing power index of the residential region, the hazard of changes occurring again declines. Alterations in residence, education and employment also decrease the probability of variations in the ownership of mobility tools, especially when these spatial changes occur simultaneously. This likewise applies to the shares spent in occupation during the observed period. Regarding the main mode of transport used for commuting, simultaneous spatial changes shorten the corresponding durations, while the number of moves and variations in occupation prolong them. Pursuing an occupation considerably raises the probability of a change in mode choice. The linear distances to the places of education and employment have a positive and a negative effect, respectively, on the likelihood that both the availability of mobility tools and the most frequently used mode of transport for the commuting trips are altered. However, these effects are not significant. With increasing income, respondents tend to own mobility tools for considerably longer periods of time as well as to use them more constantly for commuting. The availability of cars and public transport tickets as well as their usage for commuting affect the ownership durations negatively. Regarding the model for the main mode of transport, the use of private transport for the commuting trips, as reference mode, is significantly more stable in comparison to the other modes.

6. Summary of the results and conclusions

The purpose of this paper was to examine the interrelationships between residential and occupational mobility on the one hand and the corresponding commuting behavior on the other hand in a dynamic context. The stability and instability of the ownership of mobility tools and their usage for commuting was analyzed over time and over people's life courses. Additionally, the development of the commuting distances was investigated. In order to increase the understanding of the dynamics in commuting, the corresponding changes were studied in relation to other life choices, as questions about how, when and why such changes happen are of large interest for the formulation of transport policies.

Returning to the research questions set out at the beginning of the previous section, the findings regarding the dynamics of commuting over the life course are summarized as follows:

1. How does the residential, occupational and commuting behavior develop over time and over people's life courses?

Over time, the median linear distances between the place of residence and the corresponding places of occupation increase. This also applies to the ownership of the mobility tools. Regarding the commuting to education, a small increase in the use of private transport and a much bigger increase in the use of public transport are observed, whereas cycling and walking strongly decline. For employment, the commuting mode choice remains relatively stable.

Over the life course, the distances to the places of occupation strongly increase until the age of 18 years. Then, an overall decrease follows. This indicates that adjustments take place over the life course in order to reduce the commuting distance to the place of work, and thereby also decreasing the commuting burden (Stutzer and Frey, 2008). Similarly, the ownership of mobility tools rises strongly at the beginning and then remains comparatively constant. The usage of private and public transport strongly increases for persons in education, whereas walking is only for the younger age groups of some importance. Employed persons, show a relative stable modal split during their life.

2. To what extent are changes in residence, occupation and the corresponding commuting behavior connected to one another as well as to other life choices? And what happens when these changes occur?

The different dimensions of the life course are highly interdependent. The changes in residence, education and employment are to a great extent related to one another, occurring simultaneously rather than successively, confirming findings by Rouwendal and van der Vlist (2005). At the same time, the various discrete choice and duration models show the importance of the simultaneous changes in residence and occupation, when people alter their spatial context to a great extent. Concurrent with expectations, a strong connection is also observed between the ownership of mobility tools and their usage for commuting, confirming findings by Oakil et al. (2011) and Schoenduwe et al. (2015). This applies likewise to changes in occupation and the most frequently used mode of transport for the commuting trips.

Following a residential relocation, the mean distances to the places of occupation decline, indicating that moving is used as a mean to reduce commuting, supporting results of Clark et al. (2003) as well as of Rouwendal and Rietveld (1994). In contrast, changes in education and employment lead to considerably longer commuting distances. Interestingly, persons altering their places of residence and occupation simultaneously have even lengthier commutes, as is also shown by Prillwitz et al. (2007) as well as by Rouwendal and Rietveld (1994). At the same time, longer distances to the places of education and employment considerably raise the probability of changes in education and employment, respectively. This indicates a sooner occupational change in cases where the corresponding place is farther away from home, confirming finding by Kalter (1994) as well as by Van Ommeren et al. (1999). The ownership of both cars and public transport tickets rises after all changes, especially after variations in the ownership of mobility tools. This means that cars and public transport tickets are acquired rather than abandoned, supporting findings by Dargay (2001). Concurrent with this increase in mobility tool availability, the corresponding usage for commuting also expands overall. Private and public transport are in general more frequently used, while cycling and walking decline. Only after spatial changes, the share of private transport for the trips to work decreases. The usage of the mobility tools for commuting has a positive effect on the residential durations, indicating a substitution of relocating by commuting to a certain extent.

3. How are socio-demographic and socio-economic characteristics associated with changes in residence, occupation and commuting as well as with the durations between these changes?

Most changes take place for individuals aged from 15 to 30 years. And men show a slightly more stable behavior than women. Respondents holding a college or university degree tend to relocate, both the places of residence and occupation, as well as to alter their mobility tool ownership and usage for commuting more frequently. This positive relationship is also valid for the personal monthly income and moving, while the opposite applies to the changes in education and employment, supporting results of Kalter (1994). Furthermore, the number of births as well as the size of the household has overall stabilizing effects on the probability of the occurrence of variations in all considered life domains.

With respect to the implementation of policy instruments, the life course events provide good opportunities to significantly influence and alter travel behavior, as habits and routines are broken or at least weakened, and individuals reconsider their behavior and consciously reflect their decisions (Müggenburg et al., 2015; Scheiner, 2006). The analyses of the life courses show that these events play a substantial role with respect to the ownership of the various mobility tools and their usage for commuting. In this context, residential relocations as well as changes in occupation seem to be the most important ones. Therefore, these spatial alterations provide interesting starting points for policies and other interventions aiming at travel behavior change, due to accessibility and transport systems changes (Bamberg, 2006). Corresponding policy instruments, especially aiming at new residents or people entering education or employment as well as at persons changing both residence and occupation, could include the provision of information about alternative ways to travel from and to a new place of residence or occupation (e.g. by issuing tailored travel packs) as well as free personal travel planning advice (e.g. per telephone hotline) (Chatterjee and Scheiner, 2015; Clark et al., 2016; Rolfsmeier, 2015). In order to encourage a shift from cars towards more sustainable means of transport, like public transport, cycling and walking, public transport promotion strategies, for instance, the supply of temporary free or discounted public transport tickets, could be implemented (Bamberg, 2006; Thøgersen, 2012). Thøgersen (2012) also emphasizes the importance of timing for the effectiveness of such interventions, as significant behavioral effects of a free travel card were only observed among car drivers who had recently relocated their residence or workplace, prior to the intervention. Furthermore, free bicycles or subsidies for purchasing bicycles could be given to new residents or new trainees and employees. At the same time, younger people should be targeted, as they change their travel behavior more often and their habits and routines are not fully established yet, and, therefore, easier to influence. In this context, it might be possible to avoid or at least postpone the acquisition of cars, since a reversion is much more difficult to achieve, due to the stable and asymmetrical nature of car ownership and its usage (Dargay, 2001). Besides mobility management measures, it is important to make the alternative modes of transport more attractive as well as to provide a more public transport friendly, cyclable and walkable environment. In this context, spatial and transport planning play a crucial role, by creating dense and mixed land-use surroundings and by providing better public transport services (for instance see Clark et al., 2016; Keller and Vance, 2013).

These findings confirm the advantages of the life-oriented approach with its consideration of people's life decisions in various domains in the context of policy decision-making, as a better assessment of the impacts of policies and other interventions on travel behavior is expected (Lanzendorf, 2006; Müggenburg et al., 2015; Zhang et al., 2014). For successful transport poli-

cies, an improved understanding and incorporation of the whole context of individual life choices with respect to travel behavior is crucial (Zhang, 2015).

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