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LONG-TERM AND MID-TERM MOBILITY DECISIONS DURING THE LIFE COURSE

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ABSTRACT

Long-term and mid-term mobility of people involves on the one hand decisions about their residential locations and the corresponding moves. At the same time, the places of education and employment play an important role. On the other hand the ownership of mobility tools, such as cars and different public transport season tickets, are complementary elements in this process, which also bind substantial resources. These two aspects of mobility behavior are closely connected to one another. A longitudinal perspective on these relationships is available from people's life courses, which link different dimensions of life together.

In order to study the dynamics of long-term and mid-term mobility decisions, a longitudinal survey covering the 20 year period from 1985 to 2004 was carried out at the beginning of 2005 in a stratified sample of municipalities in the Zurich region, Switzerland.

The paper shows that there exists a strong interrelation between the two aspects of long-term and mid-term mobility. The residential mobility is influenced by the ownership of the different mobility tools and vice versa. Thereby the mobility tool ownership remains comparably stable over longer periods of time.

INTRODUCTION

Long-term and mid-term mobility of people involves on the one hand decisions about their residential locations and the corresponding moves. In this context distance and direction, frequency of moves and durations of stays as well as reasons for moving are of central interest (*1*). At the same time, the places of education and employment play an important role. On the other hand the ownership of mobility tools, such as cars and different public transport season tickets, are complementary elements in this process, which also bind substantial resources. These two aspects of mobility behavior are closely connected to one another. A longitudinal perspective on these relationships is available from people's life courses, which link different dimensions of life together. Besides the personal and familial history locations of residence, education and employment as well as the ownership of mobility tools 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. At the same time, this longitudinal approach provides the possibility to observe developments over time (*1*; *2*; *3*; *4*). Concerning the analysis of residential mobility there is the further advantage of taking into account resident and mobile people at the same time since the respondents both stay and move during the observed period of time (*1*).

In order to study the dynamics of long-term and mid-term mobility decisions, a longitudinal survey covering the 20 year period from 1985 to 2004 was carried out at the beginning of 2005 in a stratified sample of municipalities in the Zurich region, Switzerland.

The paper describes residential mobility and mobility tool ownership as well as the possibilities given by the life course approach to long-term and mid-term mobility followed by a discussion of the methodologies for analyzing life course dynamics. Subsequently the longitudinal data collected in the retrospective survey is described. The paper then concentrates on the analysis of the long-term and mid-term mobility decisions during the life course. The main focus lies on the residential, education and employment durations on the one hand as well as on the mobility tool ownership durations on the other hand. Furthermore, the occurring changes are examined. Finally the results are summarized in the conclusions.

LONG-TERM AND MID-TERM MOBILITY

Residential mobility

Various variables significantly affect residential mobility. In the literature age is most consistently reported showing an inverse relationship to the number of moves (*3*). A higher education and employment status is associated with more changes in residence (*5*). Changes in occupation also lead to a higher number of moves (*3*). At the same time, residential mobility is less dependent on the absolute income and more dependent on variations in income. The influence of the household structure is rather ambiguous (*6*). Housing characteristics also play an important role, such as type, size, space adequacy and the tenure status. Renters are about twice as likely to move as owners because the transaction costs of owning are substantially higher than those of renting (*3*). Accessibility to the places of occupation influences the residential mobility such that with increasing travel distance the probability for moving also rises (*7*). In this context residential mobility is closely related to the situation on the housing market and its conditions (*8*; *9*). Furthermore, the residential history and the different durations a person stayed in former places of residence are of some importance since prior mobility is strongly correlated to current mobility.

Mobility tool ownership

Mobility tools include driving licenses and available cars as well as different public transport season tickets, such as such as national and regional tickets for different time periods and half-fare discount tickets. Through the ownership of those mobility tools people commit themselves to particular travel behaviors as they trade large one-time costs for a low marginal cost at the time of usage. Simma and Axhausen found that the ownership of the different mobility tools influences the usage of the same mode positively and the usage of the other mode negatively (*10*). This means that the relationship between the private and the public transport mode is a substitutive one (*10*). In general the commitment to car availability is higher than that to season ticket ownership. In this context the ownership of cars and the related commitment are widely covered in the literature (*3*; *11*; *12*; *13*), whereas the commitment to public transport is seldom considered in studies as they mostly only emphasize its supply. Models taking into account both the ownership of cars and the ownership of different public transport season tickets are rarer (*10*; *14*; *15*; *16*).

Different variables influence the ownership of the various mobility tools (*10*; *15*). The relationship between age and ownership is nonlinear. Men are more likely to own driving licenses and cars, whereas women show a higher public transport season ticket ownership. Education and employment status as well as income have positive effects on the driving license and car ownership. A higher income also promotes the ownership of public transport season tickets. The location of the place of residence influences the ownership in such a way that people living in more urban areas tend to have less cars and more public transport season tickets at their disposal as they have better access to public transport in comparison to rural areas.

Long-term and mid-term mobility during the life course

The life course perspective allows the inclusion of the temporal dimension into the analysis of long-term and mid-term mobility. Decisions concerning residential mobility as well as mobility tool ownership have long-term and mid-term effects since corresponding changes involve substantial amounts of resources (costs, time, etc.). Furthermore, it is possible with this approach to link different dimensions of life together as they are usually not independent from one another. Events in one area are frequently connected to changes in other areas. Analyzing people's life course can contribute to the understanding of their reactions to changes occurring in their personal and familial life, within their household as well as in the spatial structures (*10*). For instance, one can analyze how a move affects mobility tool ownership and, therefore, travel behavior. At the same time, developments over time can be observed, including time dependent aspects of decisions concerning long-term and mid-term mobility (*2*; *3*).

METHODS FOR THE ANALYSIS OF LIFE COURSE DYNAMICS

Life course dynamics can be described with the concepts of trajectory and transition. In this context the life course is seen as a sequence of events. It is therefore worthwhile to understand an event and the history leading up to its occurrence (*17*). By means of event history modeling differences in timing, duration, rates of change and probabilities for the occurrence of certain events within a period of time as well as explanatory variables can be determined. In this context the dependent variable is the duration until an event occurs.

An essential advantage of the duration modeling approach over traditional linear regression models is its ability to account for the problem of censoring. Censoring occurs when information about durations is incomplete. This is the case when subsequent events are unobserved, which means that no transition from one state to another is made within the surveyed time. Problems arise when uncensored and censored cases are treated equally since the parameters in the duration model are maybe under- or overestimated. Furthermore, time-varying covariates, i.e., explanatory variables with values changing over time, can easily be included in event history modeling (*17*; *18*).

In the context of duration modeling there exist different approaches. In parametric models the underlying hazard rate or transition rate, i.e., the rate at which events occur, is parameterized in terms of its probability distribution, e.g., Weibull, Gompertz, exponential, gamma, log-logistic and log-normal distributions (*19*). A semi-parametric alternative is represented by the Cox proportional hazard model (*20*; *21*). Thereby it is not necessary to make assumptions about the particular distributional form of the duration times. This makes it preferable over its parametric alternatives (*17*). In the Cox model the hazard rate for the *i*th individual is defined as follows

$$h_i(t) = h_0(t)\exp\left(\beta' x_i\right),$$

where $h_0(t)$ denotes the baseline hazard function and $\beta' x_i$ are the parameters and covariates. The hazard rate for the Cox model is proportional as the hazard ratio for the two individuals *i* and *j* is written as

$$\frac{h_i(t)}{h_j(t)} = \exp\left(\beta'\left(x_i - x_j\right)\right),$$

which demonstrates that this ratio is constant over time (*17*). The estimation method in the Cox model is the maximum partial likelihood method and allows to estimate the parameters *β'* without specifying the baseline hazard function $h_0(t)$. This method is based on the assumption that the intervals between successive duration times contribute no information regarding the relationship between the hazard rate and the covariates, but rather the ordered duration times (*17*).

Event histories can consist of single events. On the other side they can include multiple events of the same type or multiple events of different types. Cases where different kinds of events occur are often referred to as competing risks situations. There are many variants of competing risks models proposed in the literature (*17*; *19*; *22*; *23*). A commonly applied approach is the latent duration time approach. It assumes that there are *K* ($k=1,2,3,\ldots,r$) specific events and that there exists a potential or a latent duration time associated with each event. The implementation of this model simply requires that *K* models with type specific hazards are estimated where all events other than *k* are treated as randomly censored (*17*). Thereby the assumption is made that the *K* risks are conditionally independent. The latent variables approach has been extended to both parametric and semi-parametric settings.

DATA

For the estimation of dynamic models on long-term and mid-term mobility longitudinal data is required. Essentially, there are two ways of collecting such data. The most obvious and well-recognized method is to conduct a panel survey. Data collected this way is very reliable since events are observed as they happen. However, panel surveys are difficult and expensive to carry out as well as rather 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 the human memory. With increasing time elapsed since an event the amount of information retained decreases in a logarithmic relationship (*3*; *24*). People tend to remember major events, such as residential moves or personal and familial events, 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 (*24*). Experiences from Hollingworth and Miller showed that a retrospective survey proved to be a favorable alternative to a panel survey (*3*).

In order to collect longitudinal data concerning long-term and mid-term mobility, 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 (*25*). The survey was conducted as a written self-completion questionnaire consisting of two parts, a household form and a person form. The household form asked for the current address, a short description of all persons living in the household and the household income. In the person form socio-demographic and socio-economic characteristics of the respondents were collected. The essential part of this form was a multidimensional life course calendar for the years from 1985 to 2004. For this 20 year period retrospective information about the personal and familial history, the household size as well as data on moves and corresponding places of

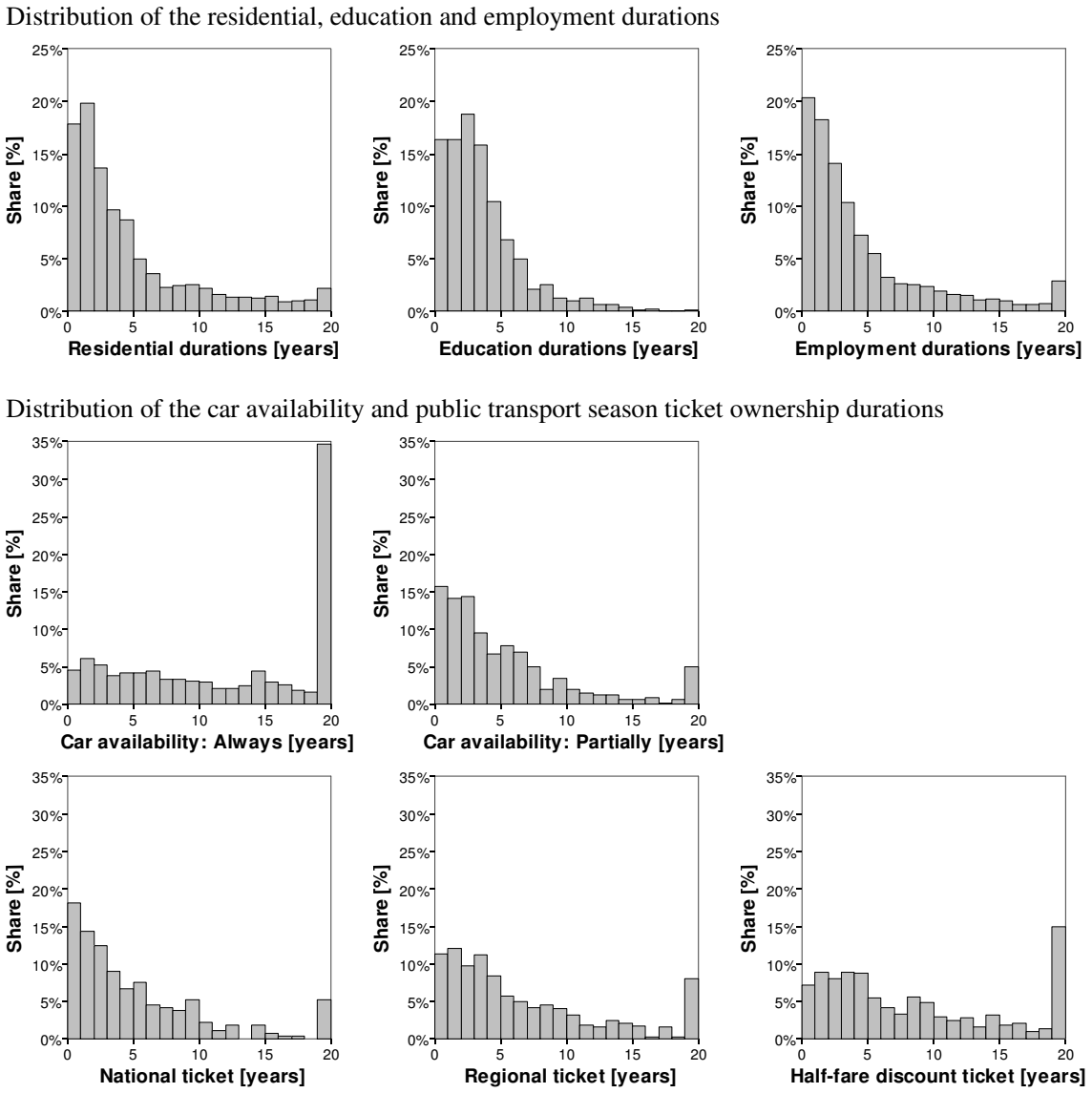
residence we collected. Furthermore, the respondents were asked to indicate their changing ownership of cars and different public transport season tickets, such as national and regional tickets as well as half-fare discount tickets. Data on the places of education and employment, on the main mode of transport for the commuting trip as well as on the personal income was collected for the period from 1985 to 2004. Each household received two person forms that were to be filled in by persons aged 18 years and older. The questionnaire was sent out by mail to 3600 households. The response rate amounts to only 23.1%, which is primarily due to the relative length and complexity of the questionnaire (*26*). Overall 780 household forms and 1166 person forms are available for further statistical analyses.

RESULTS

Duration analyses for long-term and mid-term mobility

In the following, the method of event history modeling is applied to the retrospective data on the one hand for the residential mobility and the changing locations of education and employment as well as on the other hand for the ownership of the different mobility tools. In FIGURE 1 the distribution of the corresponding durations during the last 20 years is shown. Overall 4155 residential, 1290 education and 2589 employment durations are observed between 1985 and 2004. On average these durations are 5.0, 3.9 and 4.8 years long with a standard deviation of 4.8, 3.0 and 4.8 years, respectively. Approximately 70% of all the durations are up to five years long. Concerning the ownership of the various mobility tools, for about one third of the durations cars are always available over the whole period from 1985 to 2004. In this context the other duration lengths are relatively evenly distributed. Partial car availability is more often indicated for shorter periods of time with over 50% being less than five years long and over 80% being less than ten years long. The ownership of national and regional tickets shows a left-skewed distribution, where the highest shares occur for durations shorter than five years. To a lesser extent this also applies to the half-fare discount ticket ownership. Overall the ownership of the different mobility tools is relatively stable over time, especially the availability of cars, whereas the slightly more variable ownership of season tickets during the period from 1985 to 2004 points to a weaker commitment to public transport. This stability in mobility tool ownership over longer periods of time is also found in other studies (*10*; *27*). The distribution of mobility tool ownership durations is to a lesser extent left-skewed compared to the durations concerning the places of residence, education and employment. The various groups of observed durations are significantly different from one another. The shortest periods are observed between moves as well as between changes in education and employment, whereas always available cars and half-fare discount tickets stand at the other end of the spectrum.

FIGURE 1 Distribution of the durations



In order to compare the different types of durations, competing risks models for the residential, education and employment durations on the one hand as well as for the car availability and public transport season ticket ownership durations on the other hand are estimated. 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 right censored (*17*; *19*).

TABLE 1 Hazard ratios of the competing risks duration models for the residential, education and employment durations

Explanatory variable *(Average values for the observed durations)*	Residential durations	Education durations	Employment durations	Education and employment durations
Left censoring of the duration	0.598	0.428	0.316	0.320
Age in years	1.043	1.125		1.025
Age in years squared	0.999	0.997	0.999	0.999
Gender: Male	0.905			
Nationality: Swiss national		1.308		1.240
College or university degree	1.211			
Share in education during the period	0.605		0.087	
Duration in education at the beginning of the period in years	1.072	1.070	1.074	
Changes in education during the period	0.891	0.013	1.130	0.556
Distance between the place of residence and the place of education in 1000 kilometers		1.241		1.205
Share in employment during the period	0.660	0.116		
Duration in employment at the beginning of the period in years	1.025	1.055	0.974	0.977
Changes in employment during the period	0.832	1.196	0.032	0.340
Distance between the place of residence and the place of employment in 1000 kilometers			1.289	1.328
Monthly income natural logarithm	1.182	0.839		
Car availability: Always			1.526	1.241
Car availability: Partially			1.855	1.460
National ticket ownership	1.420	1.750	1.928	1.715
Regional ticket ownership		1.242	1.455	1.331
Half-fare discount ticket ownership		1.375	1.254	1.264
Simultaneous change of the place of residence and the places of education or employment	2.125	2.213	2.030	1.682
Moving out of parents' house		0.640	0.582	0.592
Duration in residence at the beginning of the period in years	0.943	1.046	1.032	1.036
Changes in residence during the period	0.001		0.832	
Number of births in the household	0.735	0.381	0.526	0.479
Number of persons in the household	0.952		0.865	0.928
Number of rooms in the accommodation	0.882			
Place of residence abroad	1.495		1.486	1.428
Purchasing power index in the residential region	0.975	0.975	0.966	0.968
Number of observations	6880	6880	6880	6880
Number of censored observations	4408	5894	5377	4391
R^2 (generalized)	0.402	0.346	0.313	0.325

TABLE 2 Hazard ratios of the competing risks duration models for the car availability and public transport season ticket ownership durations

Explanatory variable *(Average values for the observed durations)*	Car availability: Always	Car availability: Partially	National ticket ownership	Regional ticket ownership	Half-fare discount ticket ownership
Left censoring of the duration	0.388	0.250	0.114	0.309	0.233
Age in years	0.919	1.175	1.298	0.932	0.966
Age in years squared		0.996	0.995		
Nationality: Swiss national			2.598		
College or university degree			1.795		
Share in education during the period	0.332			1.775	
Duration in education at the beginning of the period in years	1.064	1.139			
Changes in education during the period		0.741	0.708	0.776	
Distance between the place of residence and the place of education in 1000 kilometers			1.614		
Share in employment during the period				1.985	
Duration in employment at the beginning of the period in years		1.086			
Changes in employment during the period		0.832	0.619	0.863	0.809
Distance between the place of residence and the place of employment in 1000 kilometers			5.600		
Monthly income natural logarithm		0.738			
Fuel price in 0.01 CHF per liter (lead free 95)	0.954	0.956		0.958	0.950
Car availability: Always			0.173	0.295	0.286
Car availability: Partially			0.328	0.296	0.261
National ticket ownership	0.283	0.546			
Regional ticket ownership	0.276	0.441			0.303
Half-fare discount ticket ownership	0.474	0.565		0.664	
Simultaneous change of the place of residence and the places of education or employment	2.284	2.677	1.929	1.918	1.857
Moving out of parents' house		0.564			
Duration in residence at the beginning of the period in years	0.964			0.978	
Changes in residence during the period	0.537	0.618	0.722	0.584	0.679
Number of births in the household	0.639	0.755	0.336	0.563	0.533
Number of persons in the household	0.802				
Number of rooms in the accommodation	0.844			0.913	
Degree of urbanization:					
Urban (referential category)					
Urban to rural			0.646		
Rural			0.538		
Number of observations	2685	2685	2685	2685	2685
Number of censored observations	2550	2440	2558	2387	2415
R^2 (generalized)	0.100	0.203	0.116	0.235	0.172

TABLE 1 presents the results of the different competing risks models for the residential, education and employment durations, grouping the observations for these three types together. All explanatory variables shown are significant at a level of at least 0.10. Their selection is based on a forward stepwise inclusion method using the significance of the change in the log-likelihood as entry or removal criteria. In the table the hazard ratios are given, which are equivalent to the exponential hazard parameters (*19*). 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. As a measure of how good the different models are and how well the corresponding durations can be predicted with the set of covariates, respectively, generalized R^2's are given at the bottom of the table (*19*). The generalized R^2 is calculated, as proposed by Cox and Snell, as follows

$$R^2 = 1 - \exp\left(-\frac{2\big(L(\max) - L(0)\big)}{N}\right),$$

where *L(0)* and *L(max)* represent the initial and the final log-likelihoods, respectively, and *N* is the sample size. In the estimated models shown in the table the durations are relatively well predictable by the given explanatory variables. The variable indicating that the duration is left censored has, concurrent with the expectations, a strong positive influence. With increasing age the hazard of changes occurring in residence, education and employment decreases. In this context men are by about 9.5% less likely to move than women. Respondents holding a college or university degree tend to move more frequently. Persons in education and employment are at a lower risk of changing the place of residence. At the same time, education leads to a considerably lower hazard in employment, and vice versa. A longer duration in education at the beginning of the period shortens the various durations, whereas a longer duration in employment prolongs the corresponding duration in employment. Changes in education and employment during the observed period have a negative influence on the propensity to move. The education and employment durations show opposite effects concerning the number of changes. Respondents with many changes in education are less likely to change education, but more likely to change employment. For the changes in employment it is the other way around. The distances between the places of residence, education and employment increase the probability of changes in education and employment, respectively. The residential durations are negatively affected by the monthly income. The ownership of the different mobility tools leads to higher hazards regarding spatial mobility. Simultaneous changes of the places of residence, education and employment strongly increase the probability of variations. The duration a person already lives in a place has a positive influence on the residential duration, which is primarily connected to the cases where left censoring occurs, and a negative influence on the durations in education and employment. The number of births as well as the size of the household and the accommodation reduces the various risks. Abroad the durations in residence, education and employment tend to be by over 40% shorter than in Switzerland. The index of purchasing power in the residential region measures the changes in consumer prices in a country in Euro, making an adjustment for changes in exchange rates (*28*). It has a hazard ratio that is smaller than one.

In TABLE 2 the hazard ratios of the different competing risks models for the mobility tool ownership durations are shown, when all mobility tools are grouped together. Again, left censoring has a strongly positive effect on the durations. With increasing age the respondents tend to own mobility tools longer. This is especially true for older persons. The share spend

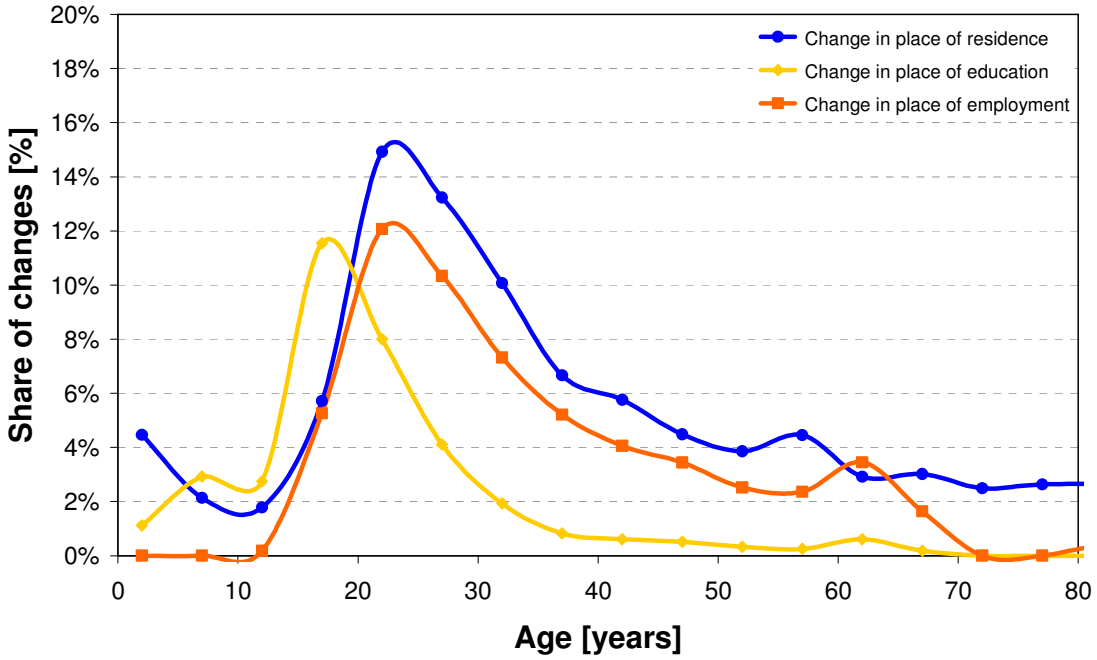
in education during the observed periods has a negative influence on the hazard for always available cars. Changes in residence, education and employment decrease the probability of variations in the ownership of mobility tools, whereas in the case that these changes occur simultaneously, the probability is considerably increased. Higher fuel prices lead to reduced hazards. Contrary to the expectations, this also applies to the ownership of the different mobility tools in the competing risks situation. This means that the longer respondents hold one mobility tool the less likely they are to change the ownership of any other mobility tool. The number of births in the household affects the various durations positively. National tickets are owned for shorter periods of time generally by Swiss nationals, persons with a college or university degree and persons living in non-urban areas.

Changes in long-term and mid-term mobility

Furthermore, the changes in the places of residence, education and employment as well as in car availability and public transport season ticket ownership are analyzed. FIGURE 2 shows the occurring alterations during the life course. Thereby five years are grouped together, respectively. Concerning the changes in the place of residence, most moves occur between the ages of 20 and 35 years, with a maximum of about 15%. Afterwards the share of moves gradually decreases. For the changes in the place of employment the curve is very similar at a lower level. Between the ages of 60 and 65 years the influence of retirement becomes visible. Variations in education occur, concurrent with the expectations, earlier during the life course. This share reaches a maximum for persons aged from 15 to 20 years. In comparison to the spatial changes, the shape of the curves regarding mobility tool ownership is overall very similar, but ranging only up to 5% instead of up to 20%. For the ownership of always and partially available cars the two maxima are slightly offset from one another, with always following partially car availability. After the age of 40 years both curves become flat. There are some persons who give up their car as they get older, but this happens only to a lesser extent. For the national tickets the share of variations is noticeably lower, with the highest values being surveyed between the ages of 15 and 30 years. Regional tickets behave very similar to the partially available cars with a maximum for persons aged around 18 years. The half-fare discount tickets show larger variations with increasing age compared to the other mobility tools.

FIGURE 2 Changes during the life course

Changes in residence, education and employment during the life course



Changes in car availability and public transport season ticket ownership during the life course

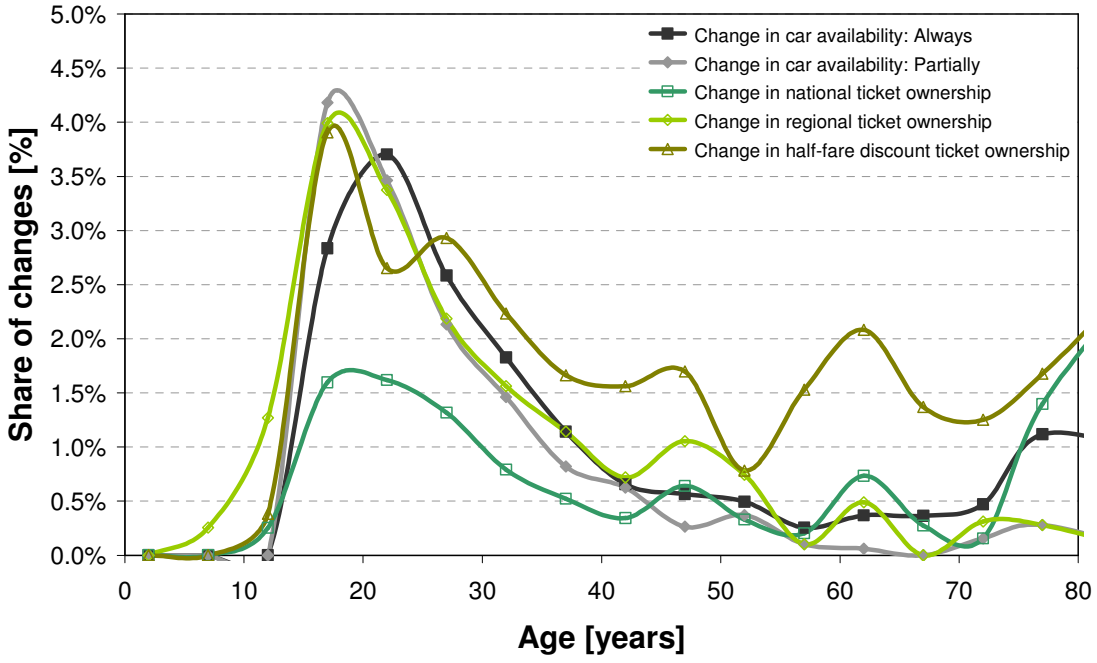


FIGURE 3 Distribution of the delays following a move until the next change

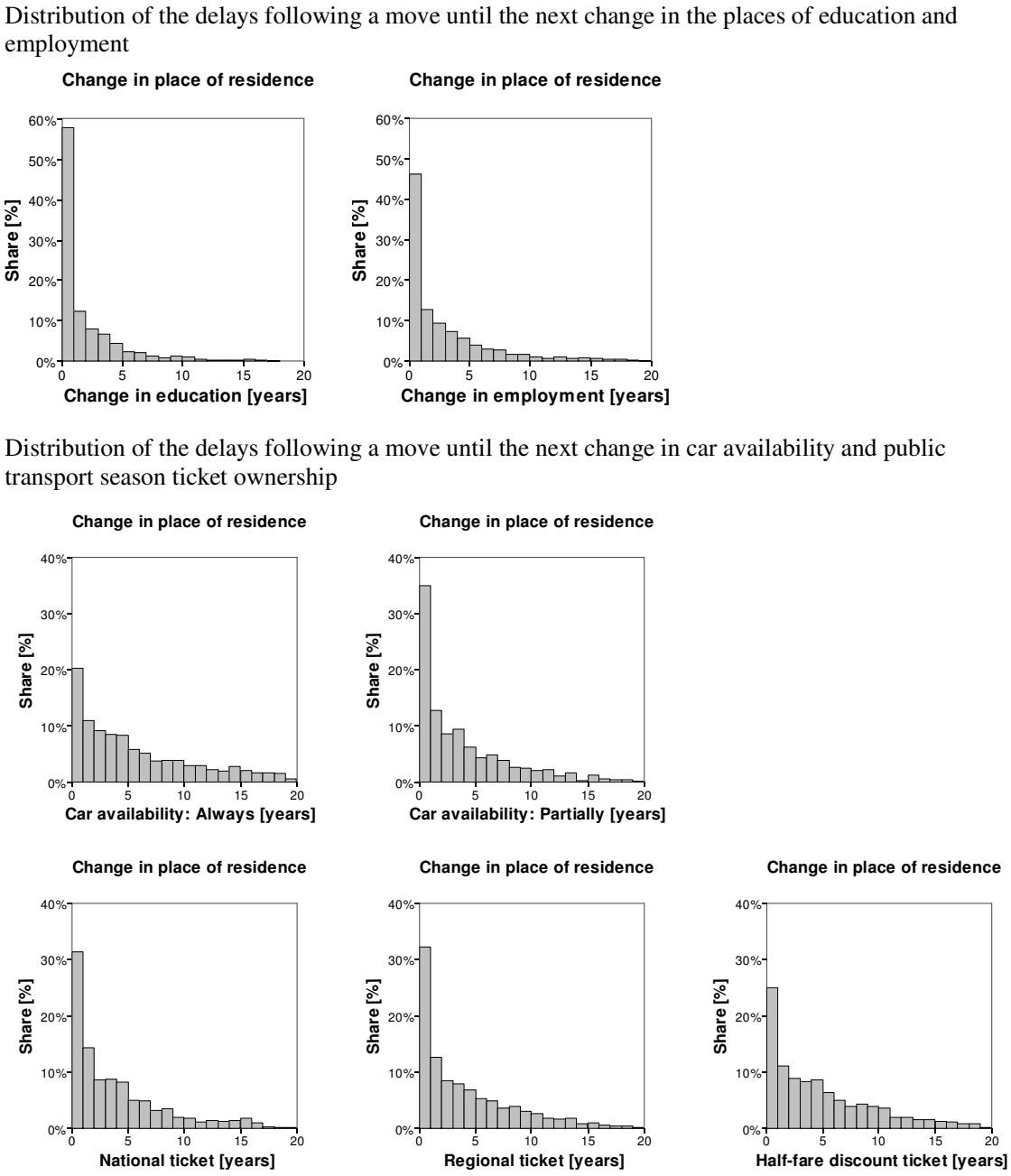


FIGURE 3 shows the distribution of the delays following a change in the place of residence until the next change in the places of education and employment on the one hand as well as in car availability and public transport season ticket ownership on the other hand. Around 50% of all moves are connected to a change in education and employment within the first year following a change in the place of residence. After that the shares of the longer delays observed strongly decrease. This also applies to the various mobility tools, but the

shares are lower overall. Respondents with always available cars show the most stable behavior. In this group changes after a change in residence occur for only about 20% of the persons within the first year, whereas this share amounts to about 30% to 35% for persons with partially available cars. For the national and regional tickets approximately one third of all the delays are shorter than one year. The changes in half-fare discount ticket ownership show trends comparable to the always available cars. And again, the shares of the longer durations until the next change in mobility tool ownership decrease strongly after the first year.

In the following, the delays occurring subsequent to a move until the next changes in the ownership of mobility tools are analyzed. In this context FIGURE 4 illustrates the corresponding hazard rates. The hazard rate represents the probability or intensity of events occurring per time unit. For the always available cars the curve is the flattest one, followed by the half-fare discount tickets. The partially available cars as well as national and regional tickets show a clear increase for the first year, after which the hazard rates decrease. Regarding the longer durations greater variations occur since these estimates are only based on a relatively small number of observations.

FIGURE 4 Hazard rates for the delays following a move until the next change in car availability and public transport season ticket ownership

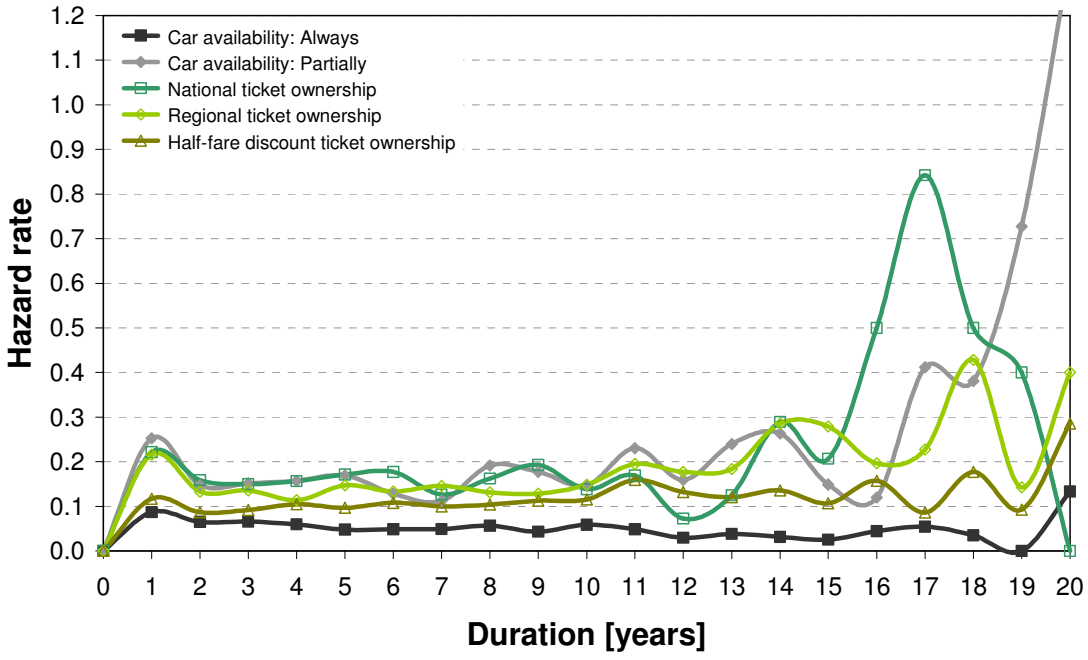


TABLE 3 Hazard ratios of the duration models for the delays following a move until the next change in car availability and public transport season ticket ownership

Explanatory variable *(Values at the time of moving)*	Change in car availability: Always	Change in car availability: Partially	Change in national ticket ownership	Change in regional ticket ownership	Change in half-fare discount ticket ownership
Age in years		1.111		0.946	
Age in years squared		0.998	1.000		1.000
Age in years natural logarithm				4.551	1.780
Gender: Male	1.526	0.746			
Age in years * Gender: Male	0.979				
Nationality: Swiss national					0.754
College or university degree	1.203	1.249			
Duration in education at the beginning of the period in years	1.049			0.965	1.066
Changes in education during the period		0.887			
Fuel price in 0.01 CHF per liter (lead free 95)	1.027				1.024
Car availability: Always	0.089	1.805			0.825
Car availability: Partially	1.269	0.415			
National ticket ownership					1.776
Regional ticket ownership	1.221		1.586	0.383	
Half-fare discount ticket ownership			1.696		0.240
Simultaneous change of the place of residence and the places of education or employment	1.290	1.303		1.251	1.198
Moving out of parents' house				1.195	
Number of rooms in the accommodation	0.911		0.946		
Place of residence abroad		0.724			
Purchasing power index in the residential region		1.025	1.042	1.025	
Number of observations	1967	846	524	1029	1621
Number of censored observations	1318	231	132	329	764
R^2 (generalized)	0.383	0.237	0.163	0.190	0.264

TABLE 3 lists the hazard ratios for the delays until the next change in car availability and public transport season ticket ownership after moving. With increasing age the hazard decreases, especially after reaching the age of 30 years. Men are in general at a lower risk than women, in the cases where gender has an effect. Swiss nationals tend to alter their ownership of half-fare discount tickets later after a change. For car availability the duration following a move is negatively influenced by a college or university degree. The variables describing education and employment only play a minor role for some of the mobility tools. Higher fuel prices lead to shorter durations concerning always available cars and half-fare discount tickets. Already having a car at disposal at the point of time when a change in residence occurs decreases the probability of changes in car availability of the equal level, whereas an always available car increases the hazard for partially available cars and vice versa. This means that cars are acquired rather than abandoned. That provides a further indication of the stability of car availability. Among the various public transport season tickets this relationship between the ownership of the same and another type exists as well. At

the same time, car availability has only an influence for the half-fare discount ticket ownership, which is positive. A simultaneous change of the place of residence and the places of education or employment leads to a shorter duration until the next alteration in mobility tool ownership. The number of rooms in the accommodation diminishes the probability of such changes occurring. With each additional room the hazard rate declines by 5% to 9%. The index of purchasing power in the residential region has a negative effect on the delays.

CONCLUSIONS

The analyses concerning long-term and mid-term mobility show that approximately 70% of all residential, education and employment durations observed during the period from 1985 to 2004 are only up to five years long. In contrast, the ownership of the different mobility tools is relatively stable over time, especially the availability of cars.

In the competing risks models for the residential, education and employment durations the hazard of changes occurring decreases with increasing age. In this context men are by about 9.5% less likely to move than women. Respondents holding a college or university degree tend to move more frequently. Persons in education and employment are at a lower risk of changing the place of residence. Changes in education and employment during the observed period have a negative influence on the propensity to move. The distances between the places of residence, education and employment increase the probability of changes in education and employment, respectively. The residential durations are negatively affected by the monthly income. The ownership of the different mobility tools leads to higher hazards regarding spatial mobility. The competing risks models for the car availability and public transport season ticket ownership durations show similar results. With increasing age the respondents tend to own mobility tools longer. Changes in residence, education and employment decrease the probability of variations in the ownership of mobility tools, whereas in the case that these changes occur simultaneously, the probability is considerably increased. Higher fuel prices lead to reduced hazards. Contrary to the expectations, this also applies to the ownership of the different mobility tools in the competing risks situation. This means that the longer respondents hold one mobility tool the less likely they are to change the ownership of any other mobility tool.

Around 50% of all moves are connected to a change in education and employment within the first year following a change in the place of residence. This also applies to the various mobility tools, but to a slightly lesser extent.

The analyses of the delays occurring subsequent to a move until the next changes in the ownership of mobility tools show that the hazard decreases with increasing age, especially after reaching the age of 30 years. Men are in general at a lower risk than women. Higher fuel prices lead to shorter durations concerning always available cars and half-fare discount tickets. Already having a car at disposal at the point of time when a change in residence occurs decreases the probability of changes in car availability of the equal level, whereas an always available car increases the hazard for partially available cars and vice versa. This means that cars are acquired rather than abandoned. That provides a further indication of the stability of car availability. Among the various public transport season tickets this relationship between the ownership of the same and another type exists as well. A simultaneous change of the place of residence and the places of education or employment leads to a shorter duration until the next alteration in mobility tool ownership.

In summary, one can say that there exists a strong interrelation between the two examined aspects of long-term and mid-term mobility. The residential mobility is influenced by the ownership of the different mobility tools and vice versa. Thereby the mobility tool ownership remains comparably stable over longer periods of time.

However, to deepen the understanding of long-term and mid-term mobility and the decision processes involved, further analyses are necessary. As example, developments in duration modeling include the estimation of more flexible hazard models with the form of discrete choice models that allow for inter-individual and intra-individual variability of people, which can be applied to the retrospective data (*29*; *30*).

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