

Ownership of Mobility Tools in Switzerland

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Abstract

Due to ongoing changes in the demography, the economy and the environment the Federal Office for Spatial Development (ARE) decided to revise and renew the 1994 long-term forecasts of Swiss passenger and goods traffic up to the year 2030.

In this context the Institute of Transport Planning and Systems (IVT) developed forecasts of the ownership of mobility tools, such as driving licence, car and different tickets for public transport.

In a first step the previous development in ownership was analysed using data from the Swiss national travel surveys of the years 1984, 1989, 1994 and 2000. The main focus of this analysis was the influence of age effects and membership in a certain birth cohort.

In a second step multinomial logit models for the ownership of the different mobility tools were estimated based on the year 2000 survey data. Thereby the significant variables were identified, which included variables describing on the one hand the person and on the other hand the corresponding residential municipality. In the first group were variables such as gender, age, employment status and income as well as the ownership of mobility tools. The second group included the size of the municipality, its type and location, as well as the average travel times from the municipality to the local and regional centre by public and private transport.

Based on the estimated models and the actual Swiss data for population, employment, income and travel times for the year 2000 the ownership of mobility tools in relative and absolute figures was calculated at municipal level, disaggregated for different age groups. The results were then compared and adjusted to the actual ownership data of Switzerland on district level.

For the ownership forecasts to the year 2030 the predicted developments of population by age and gender, employment and income, as well as calculations of travel times to the local and regional centre of the municipality by public and private transport were used.

Ownership forecasts for mobility tools from 2000 to 2030 however will not be published until the final analysis of different scenarios is completed by the ARE.

Keywords

Traffic Forecasts (2000 – 2030), Ownership of Mobility Tools, Multinomial Logit Models, 4th Swiss Transport Research Conference, STRC 2004, Monte Verità

1. Introduction

Due to ongoing changes in the demography, the economy and the environment the Federal Office for Spatial Development (ARE) decided to revise and renew the 1994 long-term forecasts of Swiss passenger and goods traffic up to the year 2030.

In this context the Institute of Transport Planning and Systems (IVT) developed forecasts of the ownership of mobility tools, such as driving licence, car and different tickets for public transport.

In a first step the previous development in ownership is analysed using data from the Swiss national travel surveys of the years 1984, 1989, 1994 and 2000. The main focus of this analysis is the influence of age effects and membership in a certain birth cohort.

In a second step multinomial logit models for the ownership of the different mobility tools are estimated based on the year 2000 survey data. Thereby the significant variables are identified, which include variables describing on the one hand the person and on the other hand the corresponding residential municipality.

The estimated models for the ownership of mobility tools are then used to estimate the ownership for entire Switzerland on the basis of the actual Swiss population, employment, income and travel times data at the municipal level for the year 2000.

The last chapter offers a comparison between the actual values of mobility tool ownership and the modelled results at the district level.

2. Previous development of mobility tool ownership

2.1 Approach

The previous development in mobility tool ownership is traced using data from the Swiss national travel surveys of the years 1984, 1989, 1994 and 2000. The analysis is carried out by age of the respondent and her or his membership in a certain birth cohort. Thereby it is possible to take into account changes during the life cycle of a person as well as cohort effects which specify intra- and intergenerational similarities and varieties in one generation or between different generations (Ryder, 1965; Armoogum, Madre and Bussière, 2002). In this context it is assumed that people born in the same time interval and ageing together therefore also share a common life experience due to the fact that general changes have differing impacts for persons of unlike age and that the consequences of these changes persist in the subsequent behaviour of these individuals and thus of their cohorts (Ryder, 1965). A third temporal dimension includes period effects indicating the impact of the global context (Armoogum, Madre and Bussière, 2002).

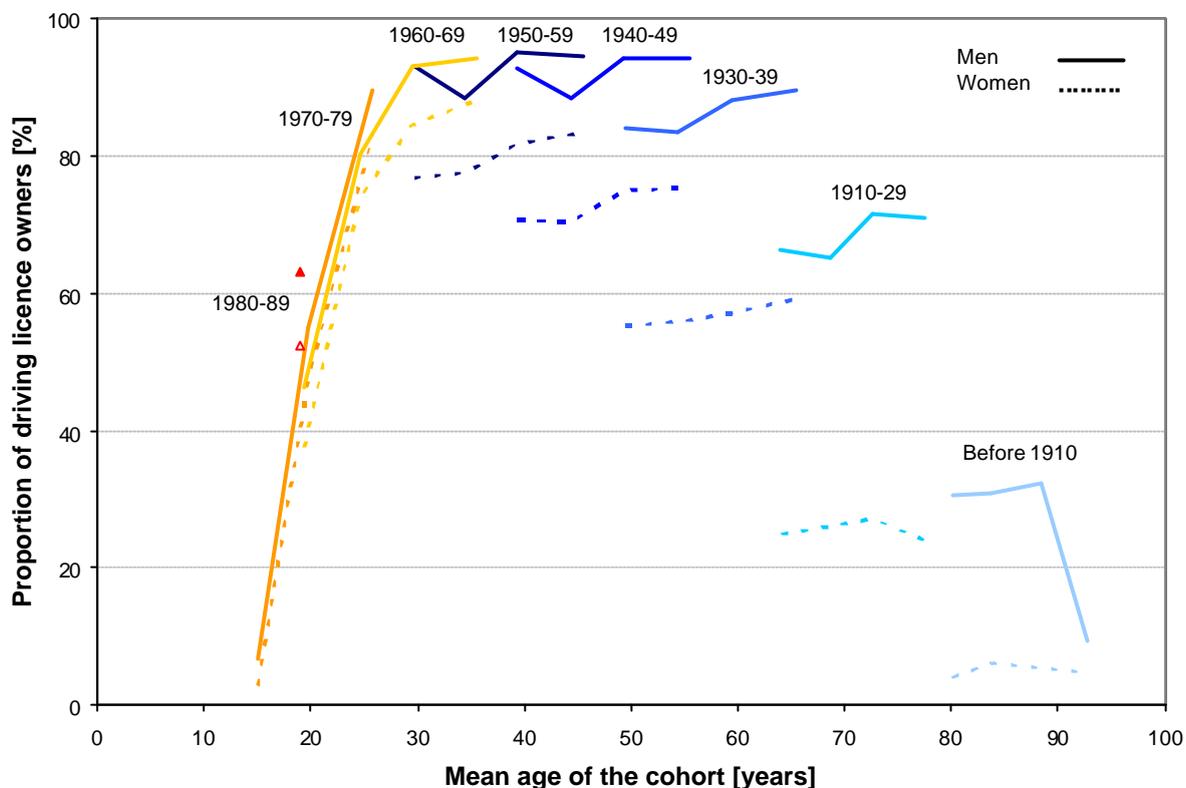
In this analysis the following cohort classification is used. The oldest cohort group comprises of people which were born before 1910. Then the cohort of people born between 1910 and 1929 follows. The next cohorts span a period of ten years in each case.

2.2 Driving licence and car ownership

In Figure 1 the proportion of people in each cohort group owning a driving licence for cars is shown for the years 1984, 1989, 1994 and 2000.

It is noticeable that for the older cohorts the share of driving licence owners is considerably lower than for the younger cohorts. Highest is the ownership among those who are 25 to 55 years old today. At the same time men acquire more licenses than women of the same age. For the younger generations saturation rates of about 90-95% for men and of about 80-85% for women can be observed.

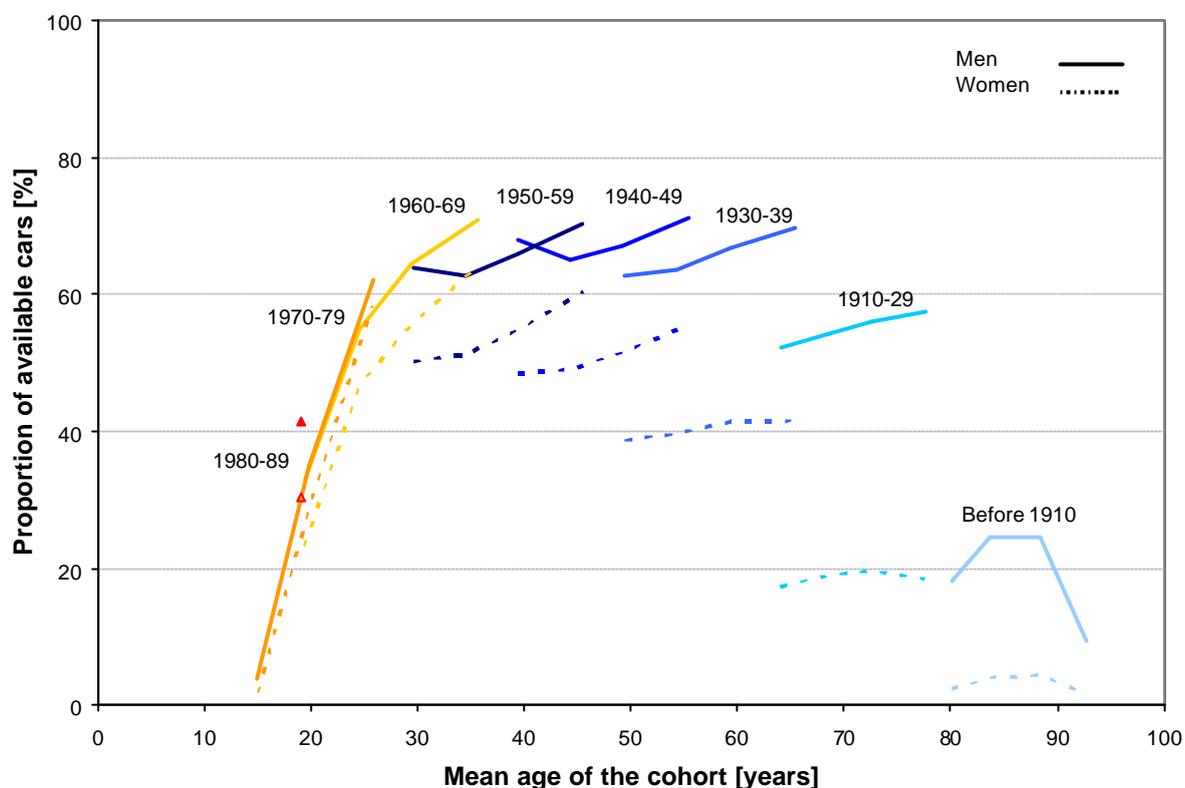
Figure 1 Driving licence ownership by age and birth cohort



In Figure 2 the extent of car availability is shown for the different cohorts. Car availability is determined on the basis of the ratio of the number of cars to the number of driving licences in a household, and if the particular person owns a driving licence. This definition enables the comparison of the different travel surveys.

The development of the availability of cars bears a strong resemblance to that of driving licence ownership, though the general curve is slightly flatter with a maximum of about 70% for men and of about 60% for women. Within each cohort an increase continues to occur. This means that the level of saturation is not reached yet.

Figure 2 Car availability by age and birth cohort

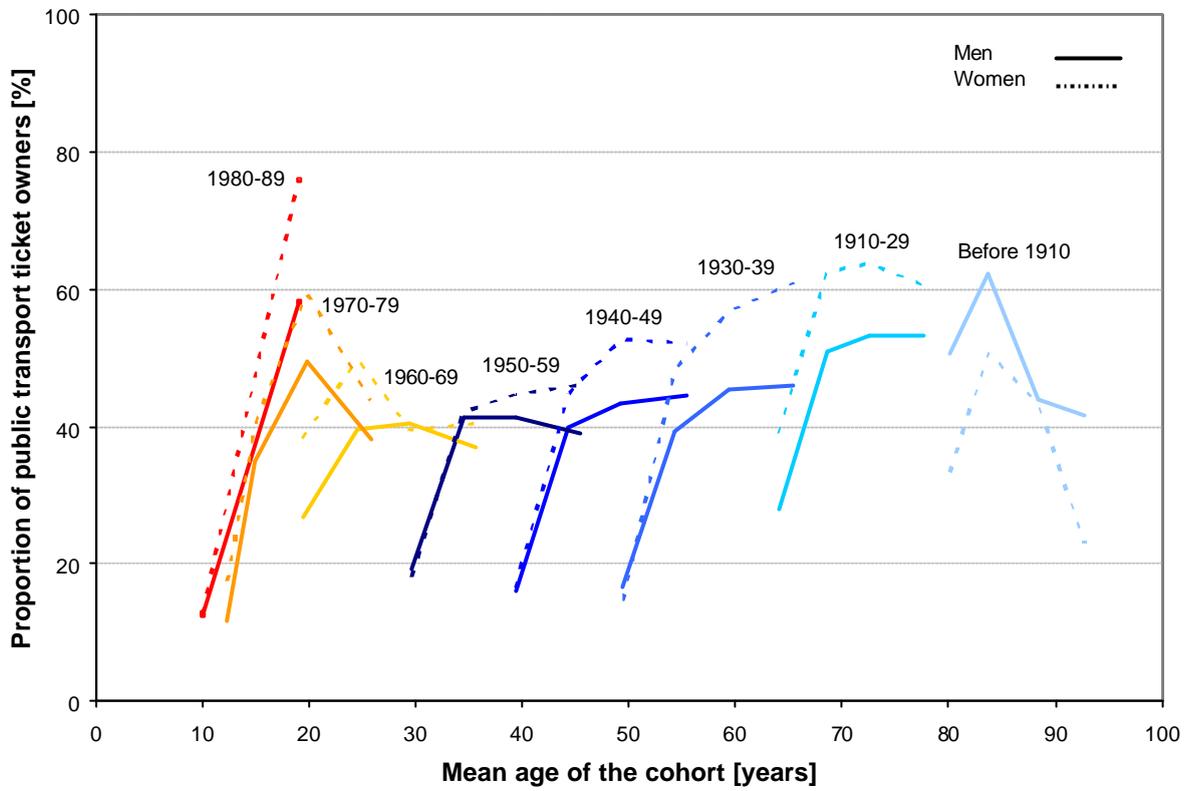


2.3 Public transport ticket ownership

Figure 3 illustrates the trend in the ownership of tickets for the public transport such as half-fare and general passes, as well as season tickets by age and cohort.

Compared to the analysis of the driving licence ownership and car availability the proportion of public transport ticket owners shows a different trend. On the one hand the cohorts with an age between 25 and 55 years now show a minimum ownership rate of approximately 40%. And on the other hand women show a higher share than men.

Figure 3 Public transport ticket ownership by age and birth cohort



3. Modelling of mobility tool ownership

3.1 Approach

To estimate the ownership of mobility tools discrete choice models in the form of multinomial logit models are used. These models are based upon the assumption of utility maximisation. This means that an individual chooses that one alternative from a finite set of mutually exclusive and collectively exhaustive alternatives with the highest utility (Maier and Weiss, 1990; Ben-Akiva and Lerman, 1985).

The models of the ownership structures are sequential. At first driving licence ownership is estimated followed by car ownership. The ownership of public transport tickets is then estimated taking the prior two mobility tools into account, which means that both of them are incorporated into the models for the ticket ownership.

The estimation of the models is carried out for persons aged 18 and older using the software BIOGEME which was developed by Michel Bierlaire (Bierlaire, 2003).

The data of the Swiss national travel survey from the year 2000 with 25318 observations is used. It comprises variables describing on the one hand the person and on the other hand the corresponding residential municipality. In the first group are variables such as gender, age, employment status and monthly household income as well as the ownership of mobility tools. The second group includes the size of the municipality as number of inhabitants. For the four biggest cities of Switzerland Zurich, Basle, Bern and Geneva a binary variable is introduced. The type of the residential municipality is defined with six different categories considering size, location and accessibility by the Federal Office for Spatial Development. The first one includes the nine main centres (V1). The second and third categories are the local and ancillary centres with access (V2) and without access (V3) to the national railway network. The municipalities of the inner and outer belts of the agglomerations form the fourth type (V4). The rural municipalities and the tourism destinations comprise the categories (V5) and (V6), respectively. The place of residence is also allocated to one of six greater regions of Switzerland (Schuler, 1997). Further variables are the average travel times from the residential municipality to the corresponding local centre by public and private transport which are calculated using existing network models.

3.2 Models

Table 1 shows the results of the models of mobility tool ownership in the form of the mean elasticities for the year 2000. These elasticities are relative terms which indicate how strongly the probability of choosing a particular alternative changes due to changes of one of the variables if all other explanatory variables remain constant.

Table 1 Mean elasticities for the ownership of mobility tools (2000)

Influencing variable	Driving licences	Cars	Half-fare passes	General passes	Season tickets
Age	- 0.013	+ 0.221	+ 0.566	- 0.494	- 0.614
Male	+ 0.077	+ 0.023	- 0.092	+ 0.185	- 0.107
Employment status	+ 0.055	+ 0.036	- 0.033	- 0.073	+ 0.157
Monthly household income / 1000	+ 0.108	+ 0.132	+ 0.269	+ 0.420	+ 0.079
Driving licence ownership		+ 2.036	+ 0.116	+ 0.320	- 0.131
Car ownership			- 0.255	- 1.009	- 0.662
Population of the residential municipality / 1000	- 0.109	- 0.274	+ 0.028	+ 0.009	+ 0.020
Main centre	- 0.022	- 0.026	- 0.010	- 0.001	+ 0.003
Transport classification of municipalities:					
V1 (main centres) as referential category					
V2 (local and ancillary centres with railway access)			- 0.010		- 0.005
V3 (local and ancillary centres without railway access)			- 0.007		- 0.001
V4 (agglomeration municipalities)			- 0.018		- 0.009
V5 (rural municipalities)			- 0.024		- 0.026
V6 (touristic municipalities)			+ 0.002		- 0.001
Classification of Switzerland into greater regions:					
G1 (East Switzerland)	+ 0.025	- 0.072	+ 0.060	+ 0.004	+ 0.003
G2 (North Switzerland)	+ 0.041	- 0.112	+ 0.165	+ 0.006	+ 0.028
G3 (Central Switzerland)	+ 0.010	- 0.037	+ 0.046	+ 0.001	+ 0.006
G4 (Central Midland)	+ 0.018	- 0.087	+ 0.100	+ 0.010	+ 0.016
G5 (Lake Geneva region)	+ 0.032	+ 0.002	+ 0.034	+ 0.004	+ 0.007
G6 (Tessin) as referential category					
Travel time to the local centre by public transport	+ 0.036	- 0.062	+ 0.017	- 0.002	+ 0.010
Travel time to the local centre by private transport	+ 0.025	+ 0.057	- 0.020	- 0.001	- 0.009

The influence of age and gender on the ownership of mobility tools is quite variable. As seen in the analysis of the Swiss national travel surveys the driving licence ownership decreases with increasing age, whereas the car ownership also increases which is probably due to higher incomes. Male persons are more likely to own those two mobility tools than female persons. Both employment status and household income have positive effects on the driving licence

and car ownership. Logically the proportion of driving licences influences the proportion of cars very strongly. The size of the residential municipality affects their ownership negatively. This means that persons directly living in main centres and larger towns own less driving licences and cars. Concerning the greater regions of Switzerland the reference category Tessin shows a lower share of driving licences but a higher share of cars than the other five greater regions.

Regarding the different public transport tickets the influence of age and gender again varies. Employment leads for half-fare and general passes to a decrease in ownership in contrast to season tickets. A higher income promotes ownership of public transport tickets. The availability of cars in a household however shows a detrimental impact. Municipalities with a larger population have higher proportion of ticket ownership due to a better public transport provision. The Tessin possesses the lowest ownership rates within Switzerland.

The average travel times to the local centre by public and private transport have little impact on the ownership of mobility tools.

4. Predicted development of mobility tool ownership

The estimated model parameters for the ownership of mobility tools are used to estimate the ownership for each municipality on the basis of the current Swiss data concerning population, employment, income and travel times for the year 2000. In Table 2 a comparison between these modelling results and the corresponding data for Switzerland is shown.

Table 2 Comparison of the actual Swiss data and the modelling results (2000)

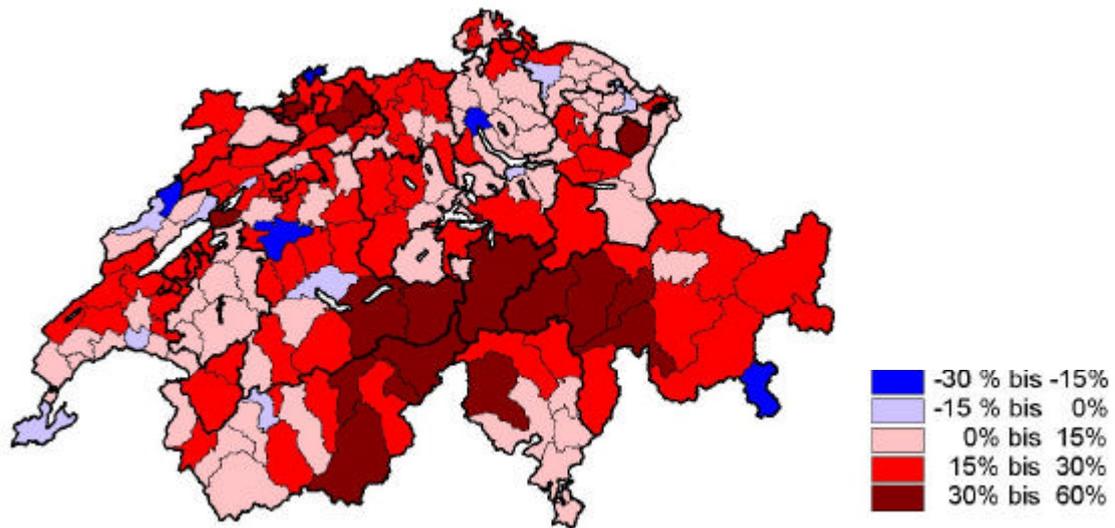
Mobility tool	Switzerland	Model	Deviation
Driving licences	4508855 *	4666481	+ 3.5%
Cars	3543396	3823778	+ 7.9%
Half-fare passes	1924222	2051929	+ 6.6%
General passes	358140	352971	- 1.4%
Season tickets	719134 *	746075	+ 3.7%

* Assumption for the ownership of driving licences and season tickets:
number of persons aged 18 and older in Switzerland (5707411 persons) multiplied with the proportion of driving licence and season ticket owners calculated from the Swiss national travel survey from the year 2000 (79.0% and 12.6%, respectively)

The ownership of driving licences and cars is slightly overestimated by the models. The same is also true for the ownership of public transport tickets, except for the general passes which are a little underestimated. Altogether the relative deviations are marginal with an 8% maximum.

Concerning the ownership of cars, half-fare and general passes these differences are adjusted at the district level (184 districts). Figure 4, Figure 5 and Figure 6 show the corresponding relative deviations of the modelling results from the actual Swiss data for the year 2000.

Figure 4 Relative deviation between the results of the car ownership model and the observed ownership (2000)



The spatial distribution of the relative deviations indicates that for the main centres such as Zurich, Basle and Bern the car ownership is underestimated, whereas in the alpine regions it is strongly overestimated.

Figure 5 Relative deviation between the results of the half-fare pass ownership model and the observed ownership (2000)

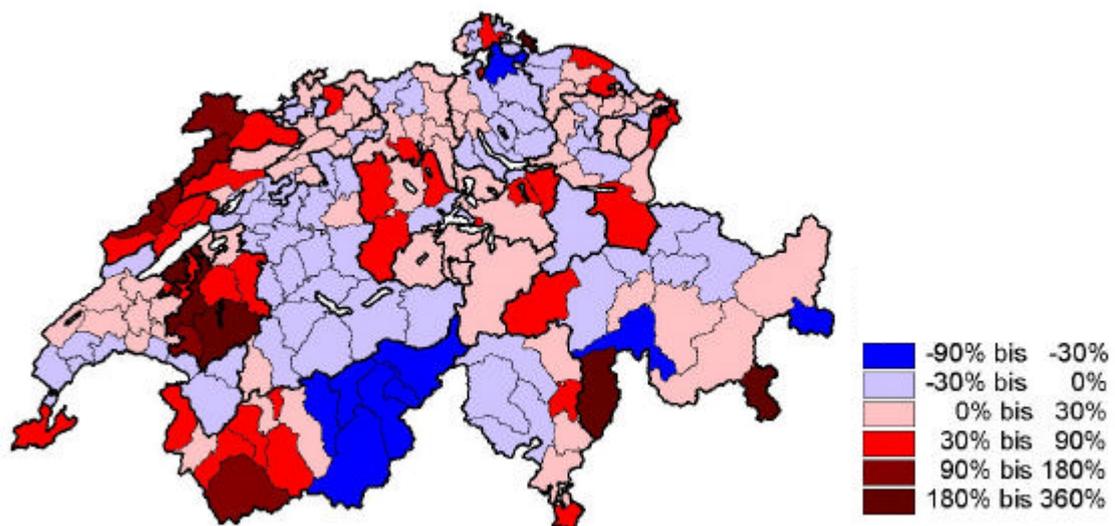
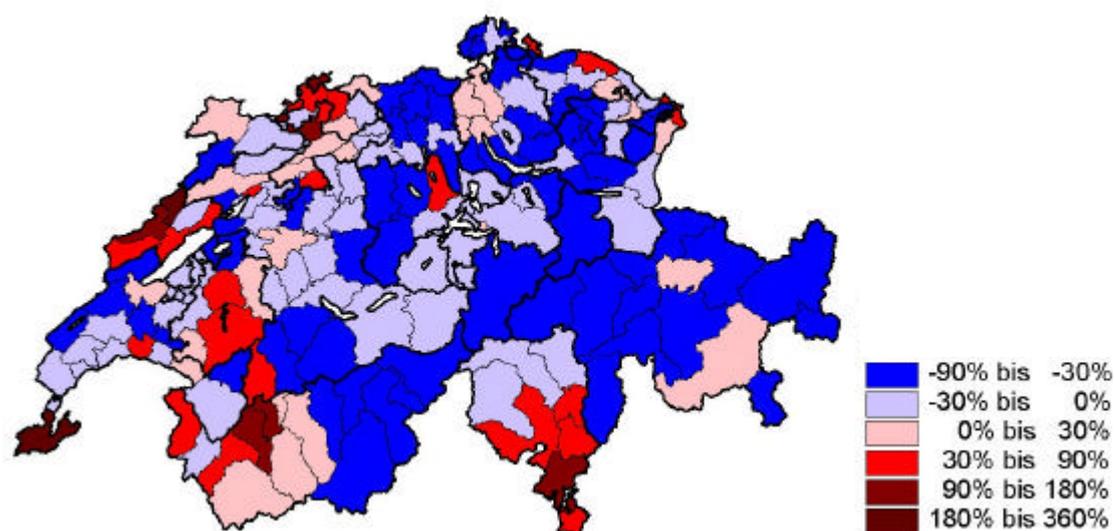


Figure 6 Relative deviation between the results of the general pass ownership model and the observed ownership (2000)



The analysis of the ownership of half-fare and general passes does not show a clear spatial pattern. Regarding the half-fare passes the German-speaking part and the Tessin are quite well modelled. In contrast to this the results in the French-speaking part of Switzerland are too high. The statement concerning the French-speaking part also applies for the ownership of general passes which is however strongly underestimated in the German-speaking part.

For the ownership forecasts until the year 2030 data of the predicted development of population by age and gender estimates, employment and income, as well as travel times to the local and regional centre of the municipality by public and private transport is used.

The results concerning the development of the ownership of mobility tools from 2000 to 2030 however will not be published until the final analysis of different scenarios is completed by the ARE.

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