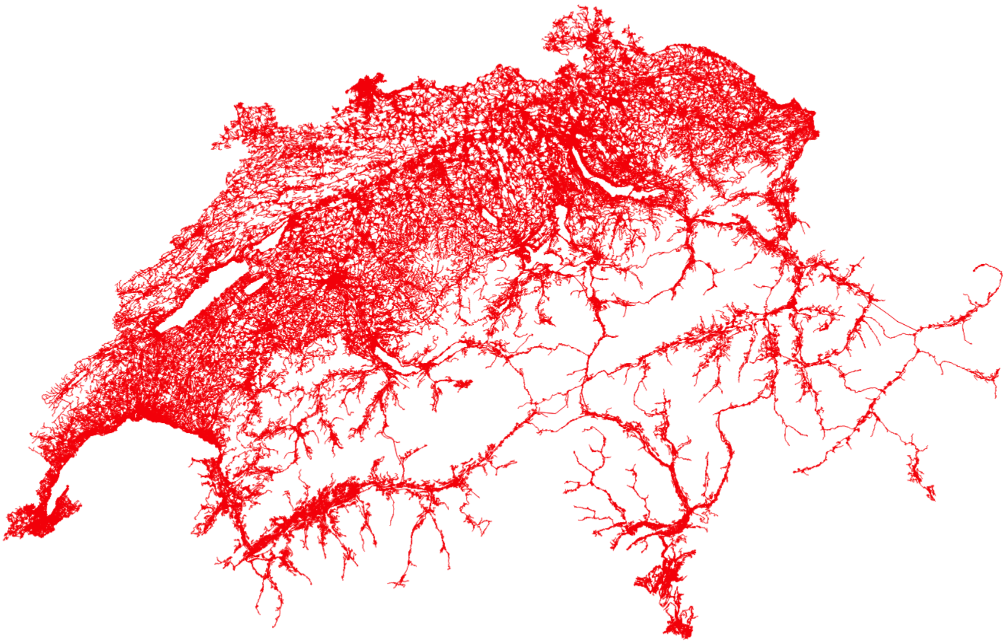

Trip generation in Switzerland, 2015-2030

Antonin Danalet

Andreas Justen

Nicole A. Mathys

Federal Office for Spatial Development ARE

September 2021

STRC | **21th Swiss Transport Research Conference**
Monte Verità / Ascona, September 12 – 14, 2021

Federal Office for Spatial Development ARE

Trip generation in Switzerland, 2015-2030

Antonin Danalet, Andreas Justen, Nicole A.
Mathys
Fundamental Policy Questions Section
Federal Office for Spatial Development ARE
3003 Bern
phone: +41-58-467 44 92
{antonin.danalet,andreas.justen,nicole.mathys}@are.admin.ch

September 2021

Abstract

In this paper, we present an ordered logit model. The choice variable (dependent variable) is the number of trips done by an individual in a day. We estimate the model using the data of the Swiss national travel survey, the Mobility and Transport Microcensus, collected in 2015. We internally validate the model. We also externally validate the model using a synthetic population of the Swiss resident population of 2017. Finally, we apply the model to a synthetic population for 2030, forecasting the number of trips that will be done in the future. This is a work in progress, describing an approach and not final results. In particular, no calibration of the cuts of the ordered logit model was done.

Keywords
trip generation; ordered logit; Switzerland; forecasting; discrete choice model

Introduction

Our goal is to forecast the number of trips per day that will be done in 2050 for different pairs of trip purposes (e.g. home-work). This is useful in developing transport outlooks. Currently, the state of the practice is to define these inputs for the traditional four-step transport models based on literature review or expert opinions. We propose a data-driven methodology to quantitatively define these values using a transport survey. We estimate an ordered logit model based on the data of the Swiss Mobility and Transport Microcensus collected in 2015 and apply it to a synthetic population representing the forecasting years 2030.

In this paper, the model has been applied to home-based work trips. It includes the impact of home-based telecommuting. The methodology could also be applied to other pairs of trip purposes as home-work, such as home-leisure.

The approach in this paper is disaggregate and models individual behaviour. One person per household has been randomly selected and interviewed on the phone in the Mobility and Transport Microcensus 2015. Similarly, the synthetic populations for 2017 and 2030 represent separate individuals, hence our unit of observation is an individual person. The households are also represented but the level of detail allows to apply the model to each single person in the households in the Swiss population.

We use a ordered logit model in this paper. Such an approach, also called "cumulative logistic regression", for trip generation has already been used by Huntsinger *et al.* (2013) for the number of home-based work trips and the number of home-based trips for other purposes (other meaning not shopping and not school, i.e. most probably mostly leisure trips). Among the attributes (independent variables) they used, they particularly focus on life cycle, area type, and accessibility. They found that accessibility was significant only for home-other trips, area type was never significant for both pairs of trip purposes and life cycle was significant for both pairs of trip purposes. They also studied the temporal stability of such models, i.e. the capacity of a model to forecast the number of trips in the future, and concluded that "the models are temporally stable and acceptable for forecasting trip generation". In comparison, we focus in this paper on home-based telecommuting as an attribute of the choice model, on the calibration of the model and on forecasting the number of trips in the future using a synthetic population, less to validate the temporal stability of the model than to really produce forecasts for a distant future.

Sheffi (1979) applied a similar model to represent a household's trip generation. Daly and

Van Zwam (1981) applied it to tours (and not pairs of trip purposes). Agyemang-Duah and Hall (1997) studied the spatial transferability of ordered logit models of trip generation.

This is a work in progress, describing an approach and not final results. In particular, no calibration of the cuts of the ordered logit model was done.

1 Data

In this section, we present the three main data sources used in this paper: the Mobility and Transport Microcensus 2015 (chapter 1.1) and synthetic populations of Switzerland for 2017 and 2030 (chapter 1.2 & 1.3).

Descriptive statistics of some attributes and a comparison between the data of the Mobility and Transport Microcensus (MTMC) 2015 and the synthetic population (SynPop) 2017 and 2030 is available in the Appendix.

1.1 Mobility and Transport Microcensus 2015

For the estimation of the model, we use the data of the Mobility and Transport Microcensus (MTMC) 2015 (Federal Statistical Office / Federal Office for Spatial Development, 2017). The MTMC (`https://www.are.admin.ch/mtmc`) is the Swiss national travel survey. It is conducted every five years. Data were collected in 2015 and are currently being collected again in 2021 (originally planned in 2020, but postponed due to the coronavirus pandemic). However, data of 2021 are not yet available. The Mobility and Transport Microcensus contains information about the socioeconomic characteristics of households and individuals, mobility resources (vehicles and public transport season tickets), daily mobility (trips on a given reference day), occasional journeys (day trips and trips with overnight stays) and attitudes towards transport policy in Switzerland. 57'090 persons, all from different households, were interviewed by telephone (CATI) about their travel behaviour.

Only trips between Monday and Friday are considered in this paper. The number of trips (e.g., to work) per person are identical to the ones used in the national transport model 2017 (Justen *et al.,* 2020). Weights have been computed [1]. The weighted results are representative of the

[1] Weights have been computed both for households and for persons. They are first computed using the probability of being drawn. Then, the non-response is corrected according to the NUTS-2 region where the person live, the

mobility behaviour of the Swiss resident population aged 6 or older.

People with a job do 0.658 home-based trips to work on average per weekday (weighted average). They represent 62.7% of all people 15 years old or older in the MTMC 2015.

1.2 Synthetic Population 2017

A synthetic population calibrated to retrospective data for the reference year 2017 was developed as an input into the transport models of the Swiss government and the Swiss Federal Railways (Bodenmann *et al.,* 2019). It contains a georeferenced dataset of the full Swiss resident population grouped in households. The demographic and socio-economic attributes include among other age, sex, education level, nationality, income, mobility tools - such as car availability and possession of public transport season tickets, work location and business sector.

The synthetic population is primarily based on the Population and Households Statistics (STATPOP) and the Structural Business Statistics (STATENT) of the Swiss Federal Statistical Office (FSO, `https://www.bfs.admin.ch/`). These register data contain the geocoordinates of households and businesses, the age and sex of individuals, the size of the household and the number of employees of businesses. Then, additional attributes are added by simulating and calibrating an agent-based land use model, "Facility Location Choice Simulation" (FaLC), on aggregate values: language, education level, work percentage, business category, position in the company, assignment of employed individuals to businesses, training status (pupils or students), income of individuals and households, mobility resources (car and public transport season tickets), and owning or renting the place of living. For more details, see Bodenmann *et al.* (2019).

1.3 Synthetic Population 2030

Using the population scenarios for Switzerland and Swiss cantons up to 2050 by the Swiss Federal Statistical Office, the land use model FaLC was applied to forecast synthetic populations. It generates a synthetic population for 2030 with the same data structure as in the synthetic population 2017. These forecasts are used for the Swiss transport outlook 2050, including

age, the gender, the size of the household, the day of the week, the structure of the household, etc. Finally, a calibration process takes place. For more details, see Federal Statistical Office (2018).

forecasts for the year 2030. For this paper, preliminary versions of the forecasted synthetic population were used.

2 Model

An ordered logit applies to ordered discrete alternatives, in our case the number of trips made by a person per day for a given pair of trip purposes. Let's define U as the propensity to do trips, e.g. from home to work. This unobserved utility U is continuous and represents the tendency to do more trips. A higher level of utility U means that the person tends to do more trips and a lower level means that the person tends to do less trips. Formally, in an ordered logit representation, the person chooses to do one more trip when the utility exceeds a threshold. If the utility is below a first cutoff k_1, the person decides not to start any trip; If the utility is above k_1 but below a second cutoff, k_2, the person decides to do exactly one trip; etc.; finally, when the utility is above the last cutoff, k_n, the person chooses to do the maximum number of trips considered in the model. The observations are discrete.

Similarly as in a traditional logit for unordered discrete alternatives, the utility U is written as a function of observed factors X, the choice attributes (see Section 2.2 below), and random unobserved factors ε, distributed logistic: $U = \beta X + \varepsilon$. Both the parameters β of the utility U and the cutoffs $k_1, k_2, ...k_n$ are estimated by maximising the likelihood function based on the logit probabilities of a person choosing the number of trips that was actually observed in the data. For more details on ordered logit, see e.g. Ben-Akiva and Lerman (1985, pp.125-126) or Train (2003, ch. 7.4, p. 182).

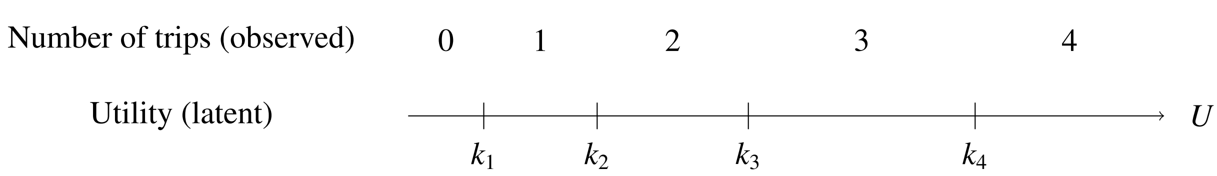

Figure 1: Ordered logit for number of trips: Representation of the number of trips and the utility

Sample of choice makers For the estimation of the model for the number of home-based trips to work, only people 15 years old or older and people with a job (including apprentices) are kept. People 14 years old or younger or unemployed do not do home-based trips to work in the MTMC sample.

2.1 Choice variable

For home-work trips, the maximum number of trips is 10 int the Mobility and Transport Microcensus 2015. Because only 8 persons do more than 4 trips per day among 21829 persons, we group them in a category "4+". This has a low impact on the average number of trips: 0.659 with the complete dataset and 0.658 when considering all people doing more than 4 trips as doing exactly 4 trips. We consider this impact to be acceptable in order to have a simpler model.

2.2 Choice attribute

We have used the attributes listed in Table 1 in the model. We have kept only the significant ones, with reasonable signs.

2.3 Estimation results

The model has been estimated using PandasBiogeme (Bierlaire, 2020). In the specification of the model, we don't estimate k_1, k_2, k_3 and k_4. Instead, we estimate k_1 and the distance δ_2 between k_1 and k_2, δ_3 between k_2 and k_3 and δ_4 between k_3 and k_4.

2.3.1 Work related: Business sector, function in the company, telecommuting and work percentage

The parameters for people working in retail, finance, services and in the "other" category are fixed to 0 and used as reference values.

The results of the estimation of the model show that people working in agriculture tend to do less trips to work. It is coherent with the fact that they work more from home (Moeckel, 2017, Danalet *et al.,* 2021). People working in accommodation and food services ("gastronomy") are less likely to do many trips to work in comparison to other sectors. On the contrary, people working in public administration, defence and education ("non movers"), in production and in wholesale do more trips from home to work in comparison with other sectors.

Table 1: Choice attributes used in the model

Attributes	**# of levels (if relevant)**
Car availability	2
Public transport travelcards (GA travelcard[2], regional travelcards[3])	2
Urban-rural typology of the place of living (urban, intermediate, rural)	3
Household structure	6
Studying	2
Public transport connection quality of the place of living	4
Income of the household	10
Level of education	4
Region of the place of living	7
Sex	2
Doing some home office	2
Function in the company	3
Work percentage	
Language of the interview	3
Business sector	10
Home-work crow-fly distance	
Number of cars in the household	
Nationality	8
Age	
Number of children 15 years old or younger in the household	
Number of children 6 years old or younger	
Number of childrenbetween 6 and 15 years old	
Couples without children with age below 30	
Couples without children with age between 30 and 49	

Independent workers, owners of their own company, people working in their own family business, and employees with management position (managing a team) or members of the direction of the company (all grouped in attribute "executives") tend to do less home-based trips to work than workers without management position in the company (fixed to 0, reference value).

Starting from 10%, the higher percentage people work, the more they do home-based trips to work.

Table 2: General statistics about the estimation

Number of estimated parameters	26
Sample size	21829
Init log likelihood	-23601.13
Final log likelihood	-19444.41
Likelihood ratio test for the init. model	8313.432
Rho-square-bar for the init. model	0.175
Final gradient norm	7.1939E-02
Relative projected gradient	2.486696e-06

People having the possibility to telecommute do, as expected, less home-work trips.

2.3.2 Socio-economic factors: Language, education, age and household structure

Couple with children tend to do more home-based trips to work compared to other household structures. However, the presence of children younger than 6 years old has the opposite effect.

(1) People who did the interview on the phone in French, (2) who are currently studying or (3) with a tertiary education and without management position are travelling less from home to work.

The number of home-work trips tend to slightly increase together with age between 20 and 65 years old and then decreases starting at about the retirement age (65).

2.3.3 Spatial factors: Home-work distance, public transport quality and region

People with a larger crow-fly distance between home and work or with the worst quality of public transport on a 5 level-scale (as defined by the Federal Office for Spatial Development) at their home location tend to do less home-work trips. On the contrary and against expectations, people living in Eastern Switzerland are doing more home-based trips to work compared to inhabitants of the 6 other NUTS-2 regions of Switzerland.

Table 3: Parameter estimates

	Value	Rob. Std err	Rob. t-test	Rob. p-value
b_business_sector_agriculture	-0.484	0.0476	-10.2	0.0
b_business_sector_gastronomy	-0.277	0.089	-3.12	0.00183
b_business_sector_non_movers	0.158	0.0417	3.8	0.000146
b_business_sector_production	0.212	0.0468	4.53	5.93e-06
b_business_sector_wholesale	0.284	0.0927	3.06	0.00218
b_couple_with_children	0.109	0.0299	3.65	0.000257
b_executives	-0.173	0.031	-5.56	2.64e-08
b_french	-0.0872	0.0313	-2.79	0.00533
b_home_work_distance	-0.159	0.0459	-3.46	0.00054
b_nb_less_than_6_in_hh	-0.287	0.0273	-10.5	0.0
b_public_transport_connection_quality_are_na	-0.0959	0.0377	-2.54	0.0111
b_region_eastern_switzerland	0.144	0.0401	3.6	0.000321
b_studying	-0.463	0.0814	-5.69	1.29e-08
b_tertiary_education_employees	-0.171	0.0546	-3.14	0.00167
b_working_from_home	-0.369	0.0504	-7.33	2.32e-13
beta_age_0_20	0.0465	0.0322	1.44	0.149
beta_age_20_65	0.00251	0.00126	1.99	0.0466
beta_age_65_75	-0.0687	0.0201	-3.41	0.000639
beta_age_75_200	-0.0157	0.0565	-0.277	0.782
beta_work_percentage_0_10	-0.0343	0.0159	-2.15	0.0313
beta_work_percentage_10_50	0.0329	0.00236	14.0	0.0
beta_work_percentage_50_101	0.0151	0.000887	17.1	0.0
delta2	2.75	0.0253	109.0	0.0
delta3	3.38	0.115	29.5	0.0
delta4	0.809	0.13	6.24	4.45e-10
k1	2.01	0.653	3.08	0.0021

3 Internal validation of the model

We estimated the model on 80% of the data (only employees) and applied it to the 20% of the remaining data. Among the 20% of randomly selected employees (n=2588), the observed average number of trips is 0.662 (+/- 0.023) and the predicted average number of trips is 0.682 (+/- 0.008). We can conclude that the model has a sufficient internal prediction power.

If we focus on subgroups, as it could be of interest in practice for the Transport Outlook 2050, we can see that the model performs well too. For employees that are younger than 24 years old, having a car available and without a public transport subscription (group PG1 in the Swiss national passenger transport model, n=135, see Justen *et al.* (2020) and `www.are.admin.ch/npvm` for more details), the observed average number of trips is 0.851 (+/- 0.104) and the predicted average number of trips is 0.751 (+/- 0.032). These values are not significantly different and the model is also internally valid for this level of analysis.

We conclude that the model is valid when used with the synthetic population and without "working from home" as an attribute and can be used for forecasting.

4 Application of the choice model to synthetic populations 2017 & 2030

In this section, we apply the model without using the attribute "working from home", since this attribute is not (yet) available in the synthetic population.

4.1 Application of the choice model to a synthetic population 2017 - internal validation

We first apply the ordered logit model to the synthetic population 2017 to validate our approach. 66.3% of people aged 15 years old or more in the synthetic population are employed (in comparison to 62.7% in the MTMC 2015).

The output of the model shows 0.632 home-based trips to work among the synthetic population (SynPop) 2017, similar to the ground truth of 0.658 (+/- 008) calculated using the Mobility and Transport Microcensus (MTMC) 2015.

Cadres do 0.655 (+/- 0.014) home-based trips to work in the MTMC 2015. The model applied on the SynPop 2017 predicts 0.645 such trips. For employees without management function, the MTMC shows 0.660 (+/- 0.010) home-work trips and the SynPop with the model predictions 0.625. Results for socio-economic groups used in the Swiss National passenger transport model 2017[4] are in Table 4. We see that for the majority of socio-economic groups (16 out of 20, group

[4] In German: Nationales Personenverkehrsmodell (NPVM), `www.are.admin.ch/npvm`, see also Justen *et al.*

codes in bold text) the predicted value for 2017 is in the 90% confidence interval of the MTMC 2015.

4.2 Application of the choice model to a synthetic population 2030

In the synthetic population 2030, 71.8% of the persons 15 years and older are employees. The average number of trips from home to work done by employees on weekdays (Monday to Friday) is 0.358 (2015: 0.658). If we focus on cadres, the average number of trips from home to work on weekdays is slightly higher, at 0.371 (2015: 0.655 +/- 0.014). Employees without management function do 0.354 trips from home to work on weekdays on average (2015: 0.660 +/- 0.010). The detailed results by group of persons can be seen in Table 4.

When looking at the descriptive statistics of the attributes, it seems that the decrease of the population of the Eastern Switzerland region and the increase of people with tertiary education in the synthetic population 2030 tend to decrease the number of trips on average.

(2020)

Table 4: Number of trips per group of persons, Mobility and Transport Microcensus (MTMC) 2015 and synthetic population (SynPop) 2017 and 2030, using a specification of the model without the attribute “working from home” and without calibration of the cuts based on SynPop 2017 for application to SynPop 2030.

Group codes	**Description of the groups of persons**	**MTMC** 2015	**SynPop** 2017	2030
PG1	⩽ 24, simple employee, with car, without PT subscription	0.739 (± 0.041)	0.642	0.340
PG4	⩽ 24, simple employee, with car, with PT subscription	0.561 (± 0.045)	0.610	0.330
PG7	⩽ 24, simple employee, without car, without PT subscription	0.748 (± 0.201)	0.612	0.588
PG10	⩽ 24, simple employee, without car, with PT subscription	0.703 (± 0.148)	0.604	0.422
PG2	25-44, simple employee, with car, without PT subscription	0.643 (± 0.019)	0.649	0.309
PG5	25-44, simple employee, with car, with PT subscription	0.648 (± 0.030)	0.636	0.295
PG8	25-44, simple employee, without car, without PT subscription	0.701 (± 0.091)	0.647	0.277
PG11	25-44, simple employee, without car, with PT subscription	0.675 (± 0.088)	0.611	0.223
PG3	45+, simple employee, with car, without PT subscription	0.683 (± 0.019)	0.682	0.430
PG6	45+, simple employee, with car, with PT subscription	0.676 (± 0.036)	0.690	0.420
PG9	45+, simple employee, without car, without PT subscription	0.678 (± 0.093)	0.654	0.347
PG12	45+, simple employee, without car, with PT subscription	0.603 (± 0.096)	0.634	0.333
PG13	44-, cadres, with car, without PT subscription	0.695 (± 0.026)	0.647	0.316
PG15	44-, cadres, with car, with PT subscription	0.630 (± 0.050)	0.641	0.311
PG17	44-, cadres, without car, without PT subscription	0.585 (± 0.179)	0.636	0.662
PG19	44-, cadres, without car, with PT subscription	0.547 (± 0.164)	0.607	0.249
PG14	45+, cadres, with car, without PT subscription	0.652 (± 0.021)	0.673	0.428
PG16	45+, cadres, with car, with PT subscription	0.617 (± 0.039)	0.681	0.425
PG18	45+, cadres, without car, without PT subscription	0.669 (± 0.123)	0.629	0.372
PG20	45+, cadres, without car, with PT subscription	0.711 (± 0.155)	0.620	0.327

5 Limitations and future work

The predicted number of trips for 2030 is clearly too low. We would expect a decrease of the number of trips to work by less than a fifth. This is a work in progress. The very first step to improve the forecasts would be to calibrate the cuts using the approach by Train (2003) to reproduce the market shares of each number of trips. This approach could be used for the whole population (employees), but also for each socioeconomic subgroup used in the Swiss National passenger transport model 2017[5].

We should also include the choice attribute "telecommuting" in the forecast. It is significant in the estimation of the model, but has not been used yet in the forecasting process using the synthetic population in this paper. The question on how exactly will we integrate the result of the home-based telecommuting model presented in Danalet *et al.* (2021) in this model is still open.

The current application of our approach is limited to home-based trips to work. To be complete, the model should be applied to all pairs of trip purposes used as inputs in the transport model, e.g. home-leisure. When doing so, we recommend to test if home-based telecommuting is a significant attribute of the choice for non-work trips. It might shed light on the debate on rebound effects on the total number of trips. The number of work-related trips decreases with telecommuting, but does the overall number of trips (including e.g. leisure trips) increases when telecommuting?

The specification of the model could also be improved. Early results, not presented in this paper, show that attributes such as home-work distance and public transport connection quality of the home location could be segmented between people having a car available or not. The differences are significant.

Acknowledgement

The authors would like to thank Matthieu de Lapparent from the School of Engineering and Management Vaud (HEIG-VD) for the interesting exchange on ordered logit models and calibration of constants.

[5] In German: Nationales Personenverkehrsmodell (NPVM), `www.are.admin.ch/npvm`, see also Justen *et al.* (2020)

6 References

Agyemang-Duah, K. and F. L. Hall (1997) Spatial transferability of an ordered response model of trip generation, *Transportation Research Part A: Policy and Practice*, **31** (5) 389–402, ISSN 09658564.

Ben-Akiva, M. and S. R. Lerman (1985) *Discrete Choice Analysis: Theory and Application to Travel Demand*, MIT Press, Cambridge, MA, ISBN 978-0-262-02217-0.

Bierlaire, M. (2020) A short introduction to PandasBiogeme, *Technical Report TRANSP-OR*, **200605**, Transport and Mobility Laboratory, ENAC, EPFL, Lausanne, Switzerland.

Bodenmann, B., P. Bürki, C. Philipp, N. Bernhard and K. Müller (2019) Synthetische Population 2017 - Modellierung mit dem Flächennutzungsmodell FaLC, *Technical Report*, Federal Office for Spatial Development ARE and Swiss Federal Railways SBB, Bern.

Daly, A. J. and H. H. P. Van Zwam (1981) Travel Demand Models for The Zuidvleugel Study, paper presented at the *Proceedings of Seminar N*, 65–84, University of Warwick, England, July 13-16.

Danalet, A., A. Justen and N. A. Mathys (2021) Working from home in Switzerland, 2015-2050, paper presented at the *21th Swiss Transport Research Conference*, Monte Verità, Ascona, Switzerland.

Federal Statistical Office (2018) Microrecensement mobilité et transports 2015, Rapport méthodologique: plan d'échantillonage, taux de réponse et pondération, *Technical Report*, **do-f-11.04-MZ-15-meth**, Federal Statistical Office, Neuchâtel, Suisse.

Federal Statistical Office / Federal Office for Spatial Development (2017) Comportement de la population en matière de transports. Résultats du microrecensement mobilité et transports 2015, *Technical Report*, Neuchâtel et Berne.

Huntsinger, L. F., N. M. Rouphail and P. Bloomfield (2013) Trip Generation Models Using Cumulative Logistic Regression, *Journal of Urban Planning and Development*, **139** (3) 176–184, ISSN 0733-9488, 1943-5444.

Justen, A., A. Danalet and N. A. Mathys (2020) Das neue Schweizer Personenverkehrsmodell, in C. Laesser, T. Bieger and K. W. Axhausen (eds.) *Schweizer Jahrbuch Für Verkehr 2020*, SVWG Schweizerische Verkehrs-wissenschaftliche Gesellschaft, IMP-HSG Institut für Systemisches Management und Public Governance der Universität St.Gallen, St.Gallen, Schweiz, ISBN 3-906532-32-1.

Moeckel, R. (2017) Working from Home: Modeling the Impact of Telework on Transportation and Land Use, *Transportation Research Procedia*, **26**, 207–214, ISSN 23521465.

Sheffi, Y. (1979) Estimating choice probabilities among nested alternatives, *Transportation Research Part B: Methodological*, **13** (3) 189–205, ISSN 01912615.

Train, K. (2003) *Discrete Choice Methods with Simulation*, Cambridge University Press, University of California, Berkeley.

A Appendix

A.1 Distribution of explanatory variables

In this section, we show the distribution of a selection of explanatory variables in three datasets (2015, 2017 & 2030), how similar they are and how they differ.

A.1.1 Living in Eastern Switzerland

In the MTMC data, 14.0% of the sample lives in Eastern Switzerland (weighted average, 6 years old and older). They are 13.8% in the synthetic population 2017 and 8.3% in the synthetic population 2030 (6 years old and older).

A.1.2 Level of education

In the MTMC data, 3.8% of the sample is an employee (and no executive) with a tertiary education (not university). They are 4.4% in the synthetic population 2017 and 5.9% in the synthetic population 2030.

A.1.3 Business sector of employees

Business sector	MTMC 2015	SynPop 2017	SynPop 2030
Agriculture	1.4%	2.0%	0.9%
Gastronomy	2.1%	3.0%	1.4%
Production	10.9%	12.0%	6.1%
Wholesale	5.6%	6.8%	3.5%
“non-movers” category	6.8%	6.7%	27.9%

A.1.4 Position in the company

Business sector	MTMC 2015	SynPop 2017	SynPop 2030
Qualified employees	21.5%	20.9%	15.4%
Simple employees	35.0%	36.9%	47.3%
Apprentices	2.6%	2.3%	2.1%

A.1.5 Family structure

Business sector	MTMC 2015	SynPop 2017	SynPop 2030
Single persons with or without children	25.8%	28.4%	9.0%
Pairs with children	40.8%	43.9%	33.7%
Pairs without children	28.5%	27.6%	17.0%

4% are considered as “not family household” in the MTMC.