Regional Trips

Content

Introduction

The task for the regional models is to produce estimates of trips for the following modes: car as driver, car passenger, bus, commuter train, bicycle and walk. The models work on a tour basis. In some cases, more than one mode was used for a tour. In the case, the following mode hierarchy was used: train, bus, car as driver, car as passenger, bicycle and walk. The mode highest up in the hierarchy was considered to be the main mode for the tour. In the Sampers 2.1 revision, bus and train were however not separated in the mode choice model.

Work tours are defined as home based tours. There are 5 other trip purposes defined, for which home based tour models have been defined. These trip purposes are:

- Business
- School
- Social
- Recreation
- Other

The aim of the model structure is to also capture trip chaining when fulfilling this task. This has been done by conditioning secondary destinations and work based tours on the work tour. Thus, if a person has made a work tour, he/she can choose to make for example a shopping trip not only as an ordinary home based trip, but also as a work based tour or as an intermediate stop on the way from work to home. This does of course not capture all types of trip chaining, but a fair share of them.

Models including secondary destination choices are much more burdensome to compute, and therefore simplifications are necessary. One simplification of that kind is to work with home and work based tours only, and the SAMPERS system therefore contains a full set of home based models. Secondary destinations are more or less significant for different travel purposes and modelling of secondary destination (as well as work place based tours) are restricted to the most important ones.

Some trips are generated in summer houses. These trips are not being modelled, as there is no information on the trip generating population in summerhouses. However, the system includes the possibility of user generated calibration factors that influence trip

frequency. These can be used to increase trip generation in areas containing a significant amount of summer houses.

Access and egress trips for long distance travel are modelled at the regional level, and are contained in separate models.

This Chapter describes the regional model system in three major Sections:

- Regional home based models
- Regional models with secondary destinations and work based tours
- Access/egress tours

Data

For regional trips, the source for behavioural data in Sampers versions up to and including 2.0 was the Riks-RVU for the period 1994-04-01 - 1997-12-31. For Sampers 2.1, data for the period 1998 – 2000 were added. The data preparation involved the following steps (the numbers are related to version 2.0) :

1. Exporting trips and individuals from the Riks-RVU SAS system database. This operation resulted in 90939 trips ("delresor").

2. Checking data for partial non-response and consistency. In this operation, the Riks-RVU definition of main trips (“huvudresor”) was used. The following checks were performed:
   - Valid start and destination zone
   - Valid start and arrival time
   - Valid order of start and arrival times
   - Valid trip purpose
   - Start zone equal to preceding destination zone

   Out of 53373 identified main trips, 21264 passed the checks with no errors. Additional 28355 main trips contained partial or total non response for zone numbers. A non response zone number means that the destination is not known, which consists a major problem. Consequently, the very large zone number with no responses reduces the usefulness of the data. In total 49619 main trips were used in the subsequent process.

3. Constructing trip chains according to the modelling approach. This involved the identification of home based tours, work place based tours and secondary destinations between home and work (or reverse). The operations in constructing the trip chains were the following:
   - Adding missing outbound or homebound trip legs to get complete tours.
   - Simplifying more complex trip chains with respect to origins and destination. The criteria for choosing one of several destinations was a combination of a hierarchical trip purpose criterion (work, business and other) and a duration

time criterion (if more than one destination with the same level of trip purpose).

- Selecting a main mode. This was done by using a mode hierarchy, defined as train, bus, car as driver, car as passenger, bicycle and walk.

A total of 83287 trips ("delresor") were converted into

32 560	home based tours
1 210	work place based tours
2 040	secondary destinations

The validity of this operation was checked by manually comparing a random sample of individuals and their trips, and the conversion to the tour concepts used for modelling.

4. Matching the obtained trip chains with socio-economic data for each individual, the supply data and the zonal data. The client supplied the data sources (supply matrices and the SAMS database) for the matching. The resulting files also contain individuals not having made any trip. The matching was done separately for work trips and for other trips.

   The validity of this operation was checked by manually comparing individual observations with the information in the EMME/2 databases used.

5. In a special operation, data on destination zones separately collected and supplied by the client were matched to the data processed as described above.

   In context with the description of each model, further statistics on the data is supplied. It should be noted that the description above includes trip making on all days of the week.

During the course of work, it was found that the destination codes were defined differently for different years in the survey. Transek received a conversion key and converted all codes to the definition of the year 1998.

Sampers version 2.1 data extension

For the Sampers 2.1 revision, data for three additional years were used. The dta processing was redone for the whole period from 1994-2000, because some quality improvements had been made over the years. In the table below, the new data set is divided into two parts, one corresponding to the old data set (1994-97) and the other one to the added years (1998-2000). The first part is also compared to the old data. As can be seen form the table, only small changes between the old data set and the corresponding part of the new data set can be seen. The overall difference of 6 percent is partly due to the fact that the old data also included one quarter of 1998.

Regional trips, old and new data for different modes

	Car as driver	Car as passenger	Bus	Train	Walk	Bicycle	Other	Total
94-00	16949	5963	4422	683	5461	5558	563	39599
94-97	10897	3821	2817	400	3433	3869	359	25596
Old data set	11452	3962	2921	415	3588	4049	811	27198
9497/Old	0,95	0,96	0,96	0,96	0,96	0,96	0,44	0,94

The picture is the same for the distribution on travel purposes, as can be seen from the table below:

Regional trips, old and new data for different travel purposes

Travel purpose	94-00	94-97	Old data set	94-97/Old
Work	12988	8346	9559	0,87
School	4738	2996	3167	0,95
Business	764	505	506	1,00
Service	923	663	671	0,99
Health	726	482	487	0,99
Child care	703	483	490	0,99
Social	3723	2414	2454	0,98
Recreation	7030	4735	4807	0,99
Giva a ride	1370	784	789	0,99
Daily shopping	3704	2509	2532	0,99
Other shopping	1922	1174	1198	0,98
Other	1001	505	527	0,96
Total	39592	25596	27187	0,94

Party size treatment

First, some general considerations may be mentioned. Party size may be assumed to be exogenous, or to be endogenous. In the first case, it should be kept in mind that a party size distribution is needed for the forecasting situation. The simplest assumption is of course that the party size is the same as in the base year. If the party size is endogenously determined, then an explicit party size model is needed. According to the contract, the party size shall be taken as fixed.

In model estimations, we need to consider the fact that the car cost does not increase by the number of individuals using it, whereas the public transport cost in most cases is related to the number of people using it. Therefore, and since the model is a model for individual trips, it is appropriate to divide the car cost by the number of persons in the travelling party to reflect the cost per person. This concerns the car as driver alternative as well as the car as passenger alternative. However, the car as passenger alternative should only be available for party sizes of at least two persons.

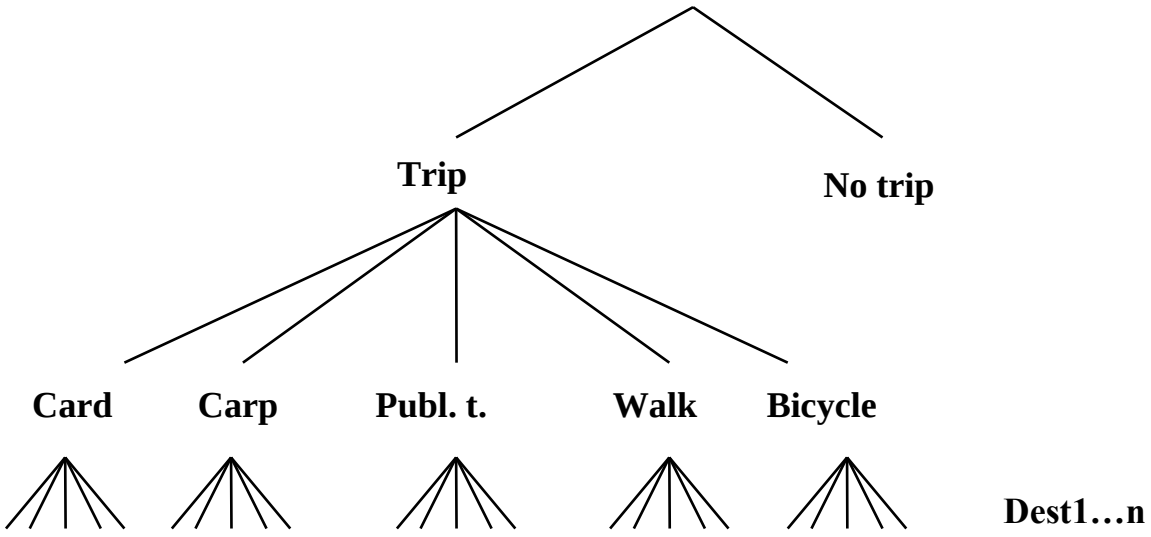
In the tour frequency model, an assumption on party size has to be made - here we have chosen to set it equal to the mean party size for work tours, 1.1.

Model structure

Regional home based models

The work trip model for working tours and non-working tours respectively is structured in a way which is best illustrated by the following graph:

Figure: Work trip model structure



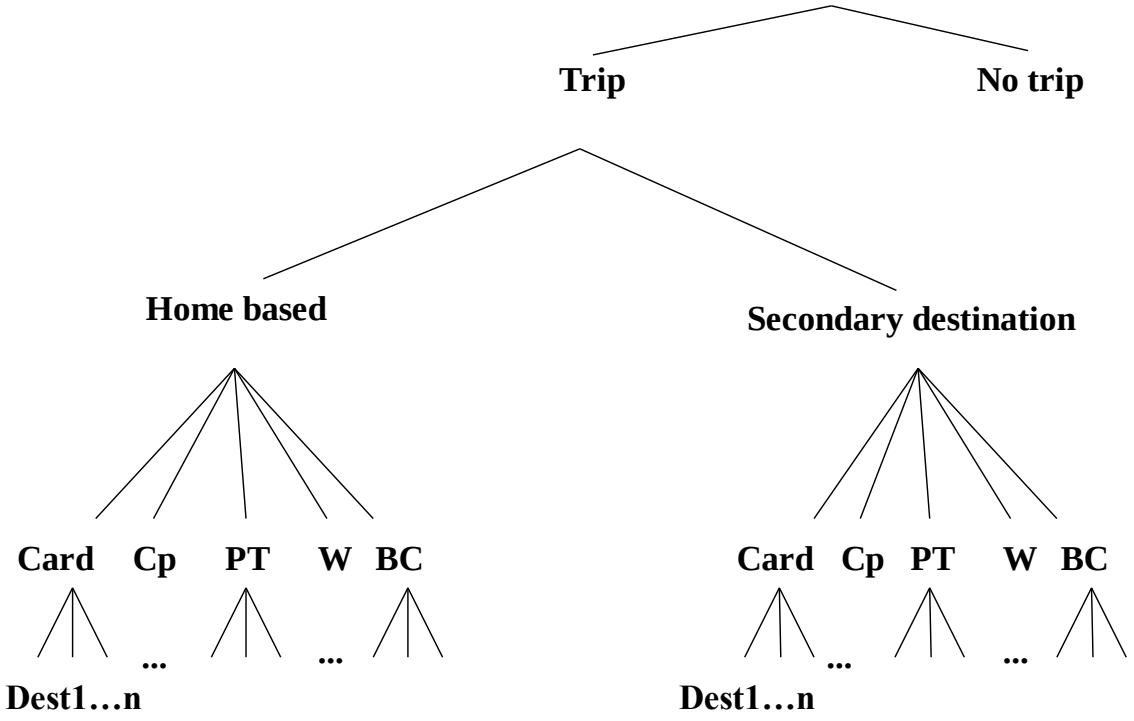
This model structure is also used for the other home based trip purposes

Regional models with secondary destinations and work based tours

In the case of secondary destinations and work based tours, the model structure becomes more complicated. Tests showed that the lions part of secondary destinations concerned the "Other" trip purpose (including shopping and service), and that business trips accounted for the majority of work based trips. As data on trips chains was rare for the other trip purposes, secondary destination was only modelled in context with "Other" trips, and work based trips were only modelled in context with business trips.

Modelling secondary destination also involves a choice of trip type – home based or as a secondary destination. In the figure below, the model structure for "Other" trips including secondary destination and trip type is shown:

Figure: Model structure for non-working tours



For business trips, work based tours are modelled without the trip type choice, which means that they are independent of each other – a work based business is not a substitute for a home based business trip.

Access and egress trips

For access and egress trips only mode choice is modelled. The structure is simultaneous, i.e. the modes are modelled without any nesting.

Variables

The models explain travel behaviour by three types of variables – transportation supply variables, destination zone variables and socio economic variables. In all estimation work, in principle all available information was used. In some cases, variables were explicitly tested, and in other cases variables were used to see how well the model performed for different segments. The models presented here reflect the final stage in this process, including the revisions that have been made in Sampers 2.1

Regional models – home based tours

Introduction

This document reports the final regional models from the 2.1 revision. The estimation work has been carried out with regard to the differences that may exist between regions. The Chapter is divided into two major parts, one for work tours and one for other tours.

Data - work tours

The supply data delivered data from the client has been supplemented with matrices relating to train only in-vehicle time.

Cost Assumptions

Tax deductions

Under some conditions, tax deductions for travelling costs relating to work tours are allowed. These tax deductions can be rather large and thus, have a large impact on the mode choice and destination choice. Also, investigations show that tax deductions often are permitted in practical life, although the formal requirements are not fulfilled.

Regarding the way of treating tax deductions within the model system, two demands can be expressed:

- the tax deductions must be treated in a realistic way
- it must be possible to analyse changes of tax deduction rules

When are tax deductions allowed?

The National Swedish Tax Board states that tax deductions for car trips only are allowed if:

- travelled distance is at least 5 km and if a gain in time is made that corresponds to at least two hours per day.
- lack of public transport and travelled distance is at least two kms.
- a company car has been used at least 60 days and if the distance travelled on official business is at least 3000 km per annum, for the days the car has been used for

business a company car has been used at least 160 days and if the travelled distance on official business is at least 3000 km, for the days the car has been used for work tours.

Tax deductions can not be made if the car is a company car.
Tax deductions for a public transport journey can only be made if the distance exceeds two kms.

The information regarding number of days that a car was used for business trip purposes, that can be obtained from the RVU, is limited. The range defined in the RVU (numbers from Sampers 2.0 data are used throughout this section) is:

RVU response	Corresponds to no. of days/year
every day	220
approx twice a week	80
approx. 2-3 times/week	22-33
occasionally	10
never	0

It is possible to reveal from the RVU data if a preferential car exist within the household, however not who is using it (if several adults with a driver licence exist within the household).

When can tax deductions be made?

The tax deduction distribution by mode for working trips is according to the following:

Tax deduction distribution by mode

Mode	Yes	No	E.U.	Total
Car	207.0	263.0	5.0	475.0
Passenger	3.0	21.0	2.0	26.0
Bus	4.0	34.0	.0	38.0
Train	4.0	8.0	1.0	13.0
Pedestrian	7.0	7.0	.0	14.0
Bicycle	3.0	136.0	.0	139.0
Total	228.0	469.0	8.0	705.0

From this, it may be concluded that merely half of the drivers count on making a tax deduction in this year's income tax return. Approx. 10 percent of the drivers who count on a tax deduction, have travelled by different modes. This points at two problems: 1) it cannot be proved that the stated trip is the normal working trip and 2) the driver may state a tax deduction but still use another mode of travelling.

How can tax deductions be calculated?

Naturally, it seems reasonable to try to calculate tax deductions according to various the National Swedish Tax Board criteria. The associated problems are 1) the figures correspond to average data which can deviate from the individual case (especially regarding waiting time for public transport) and 2) the National Swedish Tax Board can take a rather benevolent view of the interpretation of the criteria.

Thus, it would be very interesting to compare different ways of calculating tax deductions with real data. It is possible to make a model that calculates the probability that a driver will make a tax deduction in the income tax return. The following model can be estimated (the variables are associated with the tax deduction alternative):

"Rho-Squared" w.r.t. Zero = .1361
"Rho-Squared" w.r.t. Constants = .1265
ESTIMATES OBTAINED AT ITERATION 4
Likelihood = -282.6459

	Ded.const	Cwork160	Cwork60	Tgain>2h	CompCar	Dist>5km
Estimate	-1.895	-.1240	-.2488	.7698	-.8480E-01	1.635
"T" Ratio	-6.7	-.4	-.7	3.5	-.2	5.0

The different tax deduction rules are included as dummy variables. The variable Cwork160 takes the value one if the person has stated "every day" when asked about using the car for business trips. Cwork60 takes the value 1 if the person has stated "about two times a week". The variable Tgain<2h takes the value 1 if the time gain is larger than 2 hours. The time gain is calculated as the difference between connecting time + on board time + total wait time and car in-vehicle time. The variable CompCar takes the value 1 of the household has a company car. There is also an alternative specific constant for the alternative to make a tax deduction.

In an alternative model specification, dummy variables for driver categories, defined according to the categories which are tax deductible, have been introduced.

"Rho-Squared" w.r.t. Zero = .0770
”Rho-Squared" w.r.t. Constants = .0669
ESTIMATES OBTAINED AT ITERATION 3
Likelihood = -301.9589

	ded.const	Cat1	Cat2	Cat3	Cat4
Estimate	-.7599	1.244	.2753E-01	-.4175	.0000
"T" Ratio	-5.5	6.3	.1	-1.2	.0

Cat4, i.e. those persons that do not have public transport options, are not represented in the sample (normally, in these cases only access/egress times exist).

As can be seen, only Cat1 (i.e. those persons that can make a tax deduction for time gain) is a significant variable. Cat2 (having more than 160 days of car in work but no company car), and Cat3 (having more than 60 days of car in work but no company car) are not significant. A model variant, including a lowering of category demands (time gain was set to 1.5 hours), has also been tested. This variant resulted in a better model fit:

"Rho-Squared" w.r.t. Zero = .1056
"Rho-Squared" w.r.t. Constants = .0957
ESTIMATES OBTAINED AT ITERATION 4
Likelihood = -292.6114

	ded.const	Cat1	Cat2	Cat3	Cat4
Estimate	-1.087	1.524	.7664E-01	-.5160	.0000
"T" Ratio	-6.7	7.5	.2	-1.4	.0

A lowering of the distance demand to 3 km resulted in a poorer model fit:

"Rho-Squared" w.r.t. Zero = .1022
"Rho-Squared" w.r.t. Constants = .0922
ESTIMATES OBTAINED AT ITERATION 4
Likelihood = -293.7435

	ded.const	Cat1
Estimate	-1.111	1.504
"T" Ratio	-7.0	7.4

A further gain was obtained if the access to a company car was excluded from the model:

Mod Avdm16

"Rho-Squared" w.r.t. Zero = .1274
"Rho-Squared" w.r.t. Constants = .1178
ESTIMATES OBTAINED AT ITERATION 4
Likelihood = -285.4879

	ded.const	Cat1
Estimate	-1.414	1.793
"T" Ratio	-7.6	8.1

Taking the monetary deduction limit of 6,000 SEK is taken into account, yields the same result as sharpening the demand on the minimum trip distance to obtain the tax deduction up to 10 km (10km*1,30SEK*2*220 days/year = 5,720 SEK)

Mod Avdm17

"Rho-Squared" w.r.t. Zero = .1684
"Rho-Squared" w.r.t. Constants = .1592
ESTIMATES OBTAINED AT ITERATION 4
Likelihood = -272.0825

	ded.const	Cat1
Estimate	-1.398	2.025
"T" Ratio	-8.3	9.4

If the time gain criteria is set to one hour, a further model fit is obtained:

Mod Avdm18

"Rho-Squared" w.r.t. Zero = .1976
"Rho-Squared" w.r.t. Constants = .1887
ESTIMATES OBTAINED AT ITERATION 4
Likelihood = -262.5229

	ded.const	Cat1
Estimate	-1.676	2.297
"T" Ratio	-8.7	9.9

The Rho-Square of .19 indicates a poor explanatory power of the model. However, 63 % were correctly classified.

Thus, it is concluded that the tax deductions ought to be calculated according to the required distance gain and time gain solely, however reduced to 1 hour time gain, calculated as the difference between connecting time + on board time + total wait time and car in-vehicle time, and also by neglecting the household's access to company cars.

When this criteria is not fulfilled, the person is supposed to make a public transport tax deduction. This was calculated by using the monthly pass cost matrix.

Income-dependent marginal tax effects were used when the travel costs were calculated.

Running costs

Running costs were estimated to 13 SEK per 10 km, due to the taxation authority. This cost estimate has been used for all years of the survey.

Company cars

During the survey period, people having a company car (a car leased or owned by the employer, and disposed by the employee) paid a fix cost for the benefits, and in the normal case the marginal cost to use the car was zero. In this project, car costs for work trips were assumed to be zero if the household had only a company car, and if there were other cars, an average was calculated.

Public transport costs

For work trips, it was assumed that monthly passes would be used, and consequently the corresponding monthly pass matrix was used.

Estimation data – work trips

An important problem was how to handle the coding problem for the destination zones. Estimation runs based on full response data showed that the model structure should contain destination choice at the lowest level. This allowed the use of data containing choice information at the mode choice level, and thus the destination non-response data could be used in the estimation process, but of course less efficiently. In the 2.1 revision, the treatment of destination zone non- response was further developed by assigning destinations with very short travel distance reported in the survey (less than 1 km tour length) to the home zone.

In order to make it possible to estimate model with a large number of alternatives, such as the number of destination zones, sampling of alternatives has to be undertaken. The following sampling scheme was adopted for work trips:

Stratum	Number of zones
0-5 km single trip (excluding home zone)	6
5-15 km single trip	6
15-35 km single trip	4
35-60 km single trip	3
60- km single trip	1
Home zone	1

In order to obtain correct parameter values, the utility functions of the destination alternatives were corrected with respect to the sampling fraction within each stratum.

Variable definitions - work tours

Variables attached to a specific mode ends with letters referring to that mode. C refers to car, CPass to car passenger, Ko to public transport, W to walk and Cy to bicycle. Tr denotes the alternative to travel. Regions are numbered. The following numbering is used: 1. Palt 2. Samm 3. Skåne 4. Sydost 5. Väst

Variable definitions – work tours

Name	Definition
Auxtime*n*_Ko	Auxiliary time, piecewise, piece *n*, *n*=1, 2, 3, for public transport mode 30 minutes intervals
Ccompetition_C	Car competition (licenses / cars)
Cent_m*n*	Dummy for central district and mode *m* in region *n*
Cent*n*	Dummy for central district in county *n*
Const_Tr*n*	Constant for making a trip in region *n*
Const*n*_Ko	Constant public transport in region *n*
Const*n*_CPass	Constant car passenger in region *n*
Const*n*_Cy	Constant cycling in region *n*
Const*n*_T	Const commuter train in region *n*
Const*n*_W	Constant walking in region *n*
Cost_allmodes	Cost all modes, SEK
Dailycarwork_C	Using car often in work (daily use)
Distance_CPass	Distance for the car passenger mode, km
Distance_woman	Distance for woman, km
Distance-5_woman_Cy	Distance between 0-5 km for cycling if female
Distance6-_woman_Cy	Distance 6- km for cycling if female
Distance-20_man_Cy	Distance between 0-20 km for cycling if male
Distance21-_man_Cy	Distance 20- km for cycling if male

Name	Definition
Distance-5km_W	Distance for walking shorter than 5 km
Distance5km-_W	Distance for walking longer than 5 km
Drivinglicence_C	Driving licence (1 = yes, 0= no)
First Waittime_BT	First waiting time, for mode B and T
GÄ-cut	Göta Älv cut
In-veh.time_C	In-vehicle time, car
In-veh.-transfer time_BT	In-vehicle time, transfer time for bus and commuter train
LSM_BT	Logsum from the bus/train choice level
LSM_Dest	Logsum from the destination choice level
LSM_Mode	Logsum from the mode choice level
Part time employed_Tr	Part time employed person travelling
Self employed_Tr	Self-employed person travelling
Size – N:oemployed	Number of employed persons in the destination
SM-cut	Saltsjö-Mälar cut
Sthlm municip_Tr	Dummy for Stockholm municipality, travel alternative
Sthlmcounty_T	Dummy for Stockholm county, train
Summer_Cy*n*	Dummy for the summer period (may-sept), bicycle region n
Withinarea_Cy	Origin and destination in same area for the cycle mode
Withinarea_W	Origin and destination in same area when walking
Woman_C	Dummy if the person is a female for the car driver mode

Model results – work tours

Frequency, mode, destination and public transport models

The work trip model is estimated with all choice levels simultaneously included. In the table below, the model parameters are reported.

In the last column, there is an indicator of the choice level at which the variable is located. The frequency level is marked by an F, the general mode level by an M, and the destination level by a D.

Name	2.0	t-value	2.1	t-value	Choice level
Final log(L)	-22926		-33790		
Observations	11619		17012		
Rho²(0)	0,5344		0,5039		
Auxtime1_Ko	-0,006	(-0,8)	-0,0134	(-2,3)	D
Auxtime2_Ko	-0,0222	(-3,5)	-0,0216	(-4,3)	D
Auxtime3_Ko	-0,0039	(-1,7)	-0,0036	(-1,7)	D
CCompetition_C	-1,0425	(-20,7)	-0,974	(-23,8)	M
Cent_C1	-0,2101	(-1,6)	-0,2926	(-2,7)	D

Name	2.0	t-value	2.1	t-value	Choice level
Cent_C2	-0,4043	(-7,7)	-0,3687	(-7,8)	D
Cent_C3	-0,0848	(-0,6)	-0,0863	(-0,7)	D
Cent_C4	-0,3761	(-2,2)	-0,6085	(-5,0)	D
Cent_C5	-0,4094	(-3,2)	-0,5488	(-5,6)	D
Cent_Cy1	-0,2723	(-1,1)	-0,0297	(-0,1)	D
Cent_Cy2	-0,4293	(-2,8)	-0,5859	(-4,5)	D
Cent_Cy3	-0,6696	(-3,0)	-0,4018	(-1,9)	D
Cent_Cy4	-0,7923	(-3,0)	-0,9729	(-4,4)	D
Cent_Cy5	-0,8359	(-4,0)	-0,9114	(-5,1)	D
Const_Tr1	-1,0284	(-5,9)	-1,4851	(-9,6)	F
Const_Tr2	-1,1348	(-6,0)	-1,6294	(-9,8)	F
Const_Tr3	-1,0935	(-5,5)	-1,6632	(-9,5)	F
Const_Tr4	-1,0065	(-5,5)	-1,4445	(-9,0)	F
Const_Tr5	-1,137	(-6,1)	-1,6262	(-10,0)	F
Const1_CPass	1,36947	-6,3	1,48934	-8,3	M
Const1_Cy	-0,2792	(-1,3)	-0,2272	(-1,3)	M
Const1_Ko	0,09652	-0,6	0,03935	-0,3	M
Const1_T	-1,3015	(-1,5)			D
Const1_W	0,03278	-0,1	-0,5102	(-2,2)	M
Const2_CPass	1,00698	-4,7	1,16383	-6,8	M
Const2_Cy	0,37422	-1,9	0,44716	-3	M
Const2_Ko	0,19544	-1,5	0,46803	-4,8	M
Const2_T	-1,4968	(-4,7)			D
Const2_W	0,06549	-0,2	-0,3137	(-1,4)	M
Const3_CPass	0,7689	-2,9	1,06827	-5	M
Const3_Cy	1,19993	-5,9	1,11743	-7	M
Const3_Ko	0,31756	-1,9	0,50907	-4,1	M
Const3_T	-0,4019	(-1,3)			D
Const3_W	-0,1733	(-0,5)	-0,4718	(-1,9)	M
Const4_CPass	1,07294	-4	1,15322	-5,5	M
Const4_Cy	0,95275	-4,5	0,99839	-6,2	M
Const4_Ko	-0,3777	(-1,9)	0,08456	-0,6	M
Const4_W	0,09179	-0,3	-0,4645	(-2,0)	M
Const5_CPass	1,16213	-5,4	1,09454	-6,3	M
Const5_Cy	0,35295	-1,8	0,3061	-2	M
Const5_T	-1,044	(-2,7)			D
Const5_W	0,03599	-0,1	-0,6528	(-2,9)	M
Cost_allmodes	-0,028	(-13,8)	-0,0218	(-13,8)	D
Dailycarwork_C	1,79798	-12,9	1,60335	-14,4	M
Distance_CPass	-0,0141	(-4,8)	-0,0147	(-5,4)	D
Distance_woman	-0,0079	(-6,0)	-0,0083	(-8,7)	D
Distance-20_man_Cy	-0,1336	(-18,9)	-0,134	(-21,6)	D

Name	2.0	t-value	2.1	t-value	Choice level
Distance21-_man_Cy	-0,0333	(-3,1)	-0,1514	(-1,2)	D
Distance-5_woman_Cy	-0,2183	(-13,2)	-0,2013	(-14,9)	D
Distance-5km_W	-0,3837	(-4,9)	-0,1951	(-3,1)	D
Distance5km-_W	-0,1381	(-7,9)	-0,2928	(-9,5)	D
Distance6-_woman_Cy	-0,1269	(-13,6)	-0,1404	(-14,2)	D
Drivinglicence_C	3,29697	-20,9	3,19655	-26,4	D
First Waittime_BT	-0,0221	(-4,8)	-0,0281	(-7,1)	D
GÄ-cut			-0,0228	(-0,2)	D
In-veh.time_C	-0,0313	(-14,5)	-0,0294	(-17,6)	D
In-veh.-transfer time_BT	-0,0206	(-19,5)	-0,0176	(-23,5)	D
LSM_BT	0,88105	-64,5			D
LSM_Dest	0,91863	-25,4	0,73273	-29,3	M
LSM_Mode	0,21691	-11,3	0,29049	-15,2	F
Part time employed_Tr	-0,4043	(-4,4)	-0,4288	(-6,1)	F
Self employed_Tr	-1,1096	(-17,4)	-1,0607	(-20,3)	F
Size - N:oemployed	1	(*)	1	(*)	D
SM-cut			-0,7942	(-4,5)	D
Sthlm municip_Tr	-0,4237	(-4,4)	-0,4356	(-5,7)	D
Sthlmcounty_T	1,2587	-3,6			D
Summer_Cy1	1,20852	-7	1,1101	-7,8	M
Summer_Cy2	0,60278	-5	0,41464	-4,1	M
Summer_Cy3	0,44655	-2,9	0,30277	-2,2	M
Summer_Cy4	0,40077	-2,3	0,32563	-2,4	M
Summer_Cy5	0,66837	-4,5	0,56604	-4,6	M
Withinarea_Cy	0,297	-2,2	0,27617	-2,7	D
Withinarea_W	0,94735	-2,7	1,79052	-6,7	D
Woman_C	-0,7987	(-12,9)	-0,726	(-14,8)	M

The transportation supply variables contain travel costs and travel time components. The model contains significant time and cost parameters. The wait time variable has been transformed according to findings in the Swedish National Study on values of time. These findings indicate that wait time (or rather headway) is valued lower as it increases. The wait time variable has therefore been transformed to reflect these findings. The transformation is the following:

Wait time = wait time <30 min +
0.35*(part of wait time in the 31-60 min interval) +
0.17*(part of wait time in the 61-120 min interval) +
0.12*(part of wait time in the 120- min interval)

As the variables are defined on a tour basis, a 30 minutes wait time means 15 minutes wait time single trip, corresponding to 30 minutes headway or 2 departures per hour.

The disutility of transfer is treated by using transfer time, which has the same parameter as in vehicle time. Number of transfers was tested, but was not found to be significant.

The model contains some piecewise linear variables – auxiliary travel time, walk and bicycle distance. The last two may reflect different behavioural segments in the sample (like those who have to shower after using the bicycle, and those who don't).

Destination variables include of course the number of work places as a size variable. In addition, dummy variables indicating whether the destination zone belongs to the municipality centre or not were introduced for car and bicycle. They are all negative, possibly indicating omitted (unavailable) attributes like parking costs and more unsafe cycling conditions.

The socio economic variables enter at different choice levels. The gender variable affects the disutility of cycling, the propensity to make shorter trips in general and the lower propensity to use the car. The license holding variable (of the other household members) acts as a constraint as well as (of the trip maker) an availability variable. The license holding of the trip maker was included in order to avoid time consuming looping which would be necessary if the car alternative was conditioned on license holding.

The model also reflects seasonal differences by the inclusion of a regionally differentiated dummy variable for the summer period. The variable reflects the differences in climate along the north-south axis of Sweden.

In addition to the regionally differentiated tour frequency constants, here are also three dummy variables specific to Stockholm and Gothenburg. One is a dummy for the Stockholm Saltsjö-Mälar cut (along the water in the middle of Stockholm), indicating that trips across this cut are more rare than trips within the Northern and Southern parts of Stockholm. An equivalent dummy for Gothenburg (the Göta-Älv cut) does not show a significant impact in this type. The third dummy variable relates to tour frequency, and indicates that the probability of making a trip is lower for workers in Stockholm. This may be due to non linearities not included in the model, exaggerating the accessibility in Stockholm in the current model.

Value of time

The car in vehicle time is valued to 81 SEK/h, and the public transport in-vehicle and transfer time is valued to 48 SEK/h. The public transport wait time is valued to 77 SEK/h.

Auxiliary time is valued to 37 SEK in the interval 0-30 minutes, 59 SEK/h between 30 and 60 minutes and to 10 SEK/h for times over 60 minutes. See below:

Name	Vot (SEK)	Weight
In-veh.time_C	81	1,67
In-veh.time_transfer time_BT	48	1,00
First Waittime_BT	77	1,60
Auxtime-30_Ko	37	0,76
Auxtime30-60_Ko	59	1,23
Auxtime60-_Ko	10	0,20

The data contain no parking cost information, which might have given the cost parameter a higher value, and correspondingly lower time values. The weights for first wait time and auxiliary time are lower than what is normally obtained for urban areas.

Data: non-work tours

Assumptions

Travel costs

Monthly passes for public transport have been treated in the following way: if the person has reported a monthly pass for regional trips in the travel survey, then the public transport cost is set to zero, and otherwise to the coupon cost from the coupon cost matrix.

Car costs were handled as for work trips, with the exception that no tax deductions were made.

Party size treatment

For non-work trips, the same considerations as for work trips have been made.

Segmentation

The segmentation considerations made in earlier versions were not revised in 2.1. They were as follows.

Modelling of all categories separately would not be feasible in some cases due to the limited data, and it would also lead to long run times if many segments would be used. Therefore, depending on the differences in behaviour and data needs, some aggregation was done, based on a priori considerations as well as on empirical tests.

Regional trips for different travel purposes

Travel purpose	94-00
Work	12988
School	4738
Business	764
Service	923
Health	726
Child care	703
Social	3723
Recreation	7030
Giva a ride	1370
Daily shopping	3704
Other shopping	1922
Other	1001
Total	39592

From an a priori point of view, school trips and business trips were kept as separate segments. Social trips seemed to be a fairly homogenous segment, and Recreation trips was already a large group, involving specific attraction variables such as summer house.

Daily shopping trips were the largest category in the remaining group. Tests made with different segment combinations did not justify any particular segmentation in this group, except for some partial segmentation, mainly related to size variables (such as employed in the retail sector for daily shopping trips).

Separate models were consequently estimated for the following trip purposes: School, Business, Social, Recreation and Other.

Destination alternative sampling was undertaken in the same way as for work trips.

Variable definitions - non work tours

Variables attached to a specific mode ends with letters referring to that mode. C refers to car, CPass to car passenger, Ko to public transport, W to walk and Cy to bicycle. Tr denotes the alternative to travel. Letters are used for regions. The following letters are used: Pa = Palt, Sa = Samm, Sk = Skåne, So = Sydost, Va = Väst

Variable definitions – non work tours

Name	Definition
Age-12+cartime-5min_CPass	Dummy, 1 if age <=12 and car time <= 5 minutes, CPass
Age-15_B	Dummy for Bus, 1 if age <= 15
Age-15_Cy	Dummy for Cycle, 1 if age <= 15
Age-15_Ko	Dummy for Bus and Train, 1 if age <= 15
Age-16_Cy	Dummy for Cycle, 1 if age <= 16
Age-16+dist-5km_Cy	Dummy for Cycle, 1 if age <= 16 and distance <= 5 km
Age-16+dist-5km_CPass	Dummy for Car passenger, 1 if age <= 16 and distance <= 5 km
Age16-20_B	Dummy for Bus, 1 if 16<= age <= 20
Age16-20_Ko	Dummy for Bus and Train, 1 if 16<= age <= 20
Age-18	Dummy if age <= 18
Age19-24	Dummy if 19<= age <= 24
Age25-45	Dummy if 25<= age <= 45
Age65-+dist-5km_Cy	Dummy for Cycle, 1 if age => 65and distance <= 5 km
Age*number*	Age, interval
Auxtime	Auxiliary time
Auxtime_allmodes	Auxiliary time for bus and train
Auxtime-30_allmodes	Auxiliary time up to 30 minutes (piecewise linear)
Auxtime30-_allmodes	Auxiliary time over 30 minutes (piecewise linear),
Auxtime-30_BT	Auxiliary time up to 30 minutes (piecewise linear), bus and train
Auxtime30-_BT	Auxiliary time over 30 minutes (piecewise linear), bus and train
Basic edu only - Tr	Basic education, travel alternative
Branch 4 - Tr	Branch code 4
Branches 2 and 3 - Tr	Branch code 2-3
Ccompetition_C	Car competition (licenses / cars)
Ccompetition_C_Sa	Car competition, if car, additional if region Sa
Ccompetition_man_C	Car competition if man
Ccompetition_party1_C	Car competition if party size = 1
Ccompetition_party2_C	Car competition if party size = 2
Ccompetition_Sa	Car competition, additional if region Sa
Ccompetition_woman_C	Car competition if woman
County	County centre zone
County_C	County centre zone, if car
County_CPass	County centre zone, if car passenger

Name	Definition
County_Cy	County centre zone, if bicycle
County_Ko	County centre zone, if public transport
County_W	County centre zone, if walking
Cons_age-12_CPass	Dummy for car passenger, 1 if age <= 12
Const_Ride_C	Constant if travel purpose is to give someone a ride, car
Const_B(xx)	Constant bus (xx for regions Va, Sa, Sk, So and Pa)
Const_B_dailyshopp	Dummy for bus, 1 if purpose is daily shopping
Const_CPass(xx)	Constant car passenger (xx for regions Va, Sa, Sk, So and Pa)
Const_CPass_AB	Constant car passenger, workplace-based
Const_C_dailyshopp	Constant car and purpose is daily shopping
Const_CPass_dailyshopp	Constant car passenger and purpose is daily shopping
Const_CPass_woman	Constant car passenger and woman
Const_Cwom	Constant car driver and woman
Const_Cy(xx)	Constant cycling (xx for regions Va, Sa, Sk, So and Pa)
Const_Cy_AB	Constant cycling, workplace-based
Const_Cy_dailyshopp	Dummy for cycle, 1 if purpose is daily shopping
Const_Ko_dailyshopp	Constant if purpose is daily shopping
Const_Ko(xx)	Constant public transport (xx for regions Va, Sa, Sk, So and Pa)
Const_Retired_B	Dummy for bus, 1 if retired (age >= 65)
Const_T(xx)	Constant commuter train (xx for regions Va, Sa, Sk, So and Pa)
Const_Tr(xx)	Constant travel alternative (xx for regions Va, Sa, Sk, So and Pa)
Const_W(xx)	Constant walking (xx for regions Va, Sa, Sk, So and Pa)
Const_W_dailyshopp	Dummy for walk, 1 if purpose is daily shopping
Cost	Cost
Cost_AB	Cost, work-place-based
Cost_Liinc	Cost, low individual income <250.000 kr
Cost_allmodes	Cost all modes
Cost_income-150	Cost all modes if personal income <= 150 000 SEK/year
County 20-25 - Tr	County 20-25, travel alternative
Countycenter_*mode*	County center destination zone, for *mode*
County*n*	County *number*
Dailycarwork_C	Using car often in work (daily)
Dailycarwork_C_AB	Using car often in work (daily), workplace-based
Distance-5_AB	Distance up to 5 km, workplace-based
December	Dummy for December
Distance_age-12	Distance, if age <= 12
Distance_age-15	Distance, if age <= 15
Distance_age-18	Distance, if age <= 18
Distance_Cy	Cycling distance
Distance_Cy_AB	Cycling distance, workplace-based
Distance_Cy_-5km	Cycling distance up to 5 km (piecewise linear)
Distance_Cy_5km-	Cycling distance over 5 km (piecewise linear)

Name	Definition
Distance_Cy_woman	Cycling distance if woman
Distance_dailyshopp	Distance if purpose is daily shopping or service
Distance_party2_CPass	Distance if car passenger and party size = 2
Distance_W/s25	Walking distance
Distance-10km	Dummy, 1 if distance <= 10 km
Distance-10km_childcare	Dummy, 1 if purpose is child care and distance <= 10 km
Distance-5km_allmodes	Dummy, 1 if distance <= 5 km, all modes
Distance-5km_childfam	Dummy, 1 if distance <= 5 km and family type is ”sambo med barn”
Distance-5km_childfam+woman	Dummy, 1 if ”sambo med barn” and woman, if distance <= 5 km
Distance-5km+party1_Cy	Dummy for Cycle, 1 if part size = 1 and distance <= 5 km
Distance-6km+age-12	Dummy, 1 if age <=12 and distance <= 6 km (return trip)
Distance-6km+age-12_CPass	Dummy, 1 if age <=12 and dist. <= 6 km , additional for CPass
Distance-6km+age13-15	Dummy, 1 if 13 <= age <=15 and distance <= 6 km (return trip)
Distance-5	Distance up to 5 km
Drivinglicence_C	Dummy if driving license, car
Employed in SNI3	Employed in SNI3 (manufacturing)
Employment density	Employment density
First Waittime_BT	First waittime, bus and train
Full time_Tr	Working full time, travel alternative
GÄ-cut	Göta Älv cut
Gtbg municip_Tr	Gothenburg municipality, travel alternative
HHsize_Tr	Household size, travel alternative
In-veh.time	In-vehicle time
In-veh.time_-30min_allmodes	In-vehicle time up to 30 minutes (piecewise linear), all modes
In-veh.time_30min-_allmodes	In-vehicle time over 30 minutes (piecewise linear), all modes
In-veh.time_30min-+employed	Dummy for in-vehicle time over 30 minutes and the person is employed
In-veh.time_allmodes	In vehicle time all modes
In-veh.time_allmodes_AB	In vehicle time all modes, workplace-based
In-veh.time_BT	In vehicle time bus and train
In-veh.time_C,CPass	In vehicle time car and car as passenger
In-veh+waittime_allmodes	In vehicle time and wait time, all modes
In-veh+waittime_PT	In vehicle time and wait time public transport
July	Dummy for July
June-Aug	Dummy for June-August
Linköp/Norrköp municip_Tr	Linköping or Norrköping municipality, travel alternative
LSM_BT	Logsum from the bus/train choice level
LSM_Dest	Logsum from the destination choice level
LSM_Mode	Logsum from the mode choice level

Name	Definition
LSM_Mode	Logsum form the mode choice level
Man_T	Man, train
Man_Tr	Man, travel alternative
May-Aug	Dummy for May-August
Municipality centre(xx)/s30	Dummy for municipality centre (xx for regions Va, Sa, Sk, So and Pa)
Malmoe municip	Dummy for Malmoe municipality
N:oTransfers_allmodes	Number of transfers, all modes
Palt	Dummy for the region Palt
Part time employed_T	Part time employed, train
Per Capita Inc-100	Per capita income up to 100 000 SEK/year, in thousands per year
Pop.density	Population density at destination
Retired	Age =>65
Secondary school_Tr	Secondary school education, travel alternative
Self employed_T	Self employed, train
Self employed - Tr	Self employed, trip
Self employed_Tr	Self employed, travel alternative
SingleHH	Single person household
Size- N:o employed_GIJKLMN	Number of employed persons in sector G,I,J,K,L,M,N etc SNI92
Size- N:o employed_G_AB	Number of employees in sector G , workplace-based
Size - N:o employed hotel/rest	Number of employees in sector H (hotel and restaurant)
Size - N:o employed rec. etc	Number of employees in sector 92 (recreation etc)
Size - N:o employed SNI3	Number of employed persons, sector 3 SNI92
Size - N:o employed_*s*	Number of employed persons in sector *s* SNI92
Size - N:o stud univ_large	Number of students, big universities
Size - N:o stud univ_small	Number of students, small universities
Size - N:oemployed	Number of employed persons at the destination
Size - N:oemployed_M	Number of employed persons in sector M (education) at the destination
Size - N:oemployed_OE	Number of employed persons in sectors other than those with explicitly assigned specific parameters
Size - Pop_dailyshopp	Population at destination if purpose is daily shopping
Size - Pop_not dailyshopp	Population at destination if purpose other than daily shopping
Size - Pop_not dailyshopp_AB	Population at destination if purpose other than daily shopping, workplace-based
Size - Population	Population at destination
Size - summer house area	Summer house dwelling area, square meters
SM-cut	Saltsjö-Mälar cut
Sthlm municip_Tr	Stockholm municipality, travel alternative
Stockholm county - Tr	Stockholm county, travel alternative
Student	Studentent
Summer_Cy	Dummy for Cycle, 1 if month is May – Sept

Name	Definition
Supermarket	Dummy for zone including a supermarket (shopping mall)
Transfer+auxtime	Transfer time and auxiliary time, minutes
Transfertime_BT	Transfer time, bus and train
Turistattraction	Dummy for zone containing Tourist all year attraction
Twttime	Total wait time
University edu_Tr	University education, travel alternative
Within_MCA_age16-20	Dummy, 1 if zone is included in municipality centre area and 16 <= age <= 20
Within_MCA_dailyshopp	Dummy, 1 if zone is included in municipality centre area, and purpose is daily shopping
Within_Municipality	Dummy, 1 if destination in the same municipality
Withinarea_C	Origin and destination in same area for car
Withinarea_C_AB	Origin and destination in same area for car, workplace-based
Withinarea_Cy	Origin and destination in same area for the cycle mode
Withinarea_*m*	Origin and destination in same area for mode *m*
Withinarea_W_service	Origin and destination in same area for the walk mode and purpose is service
WithinCCA	Dummy, 1 if zone is included in county centre area
WithinCCA_age19-	Dummy, 1 if zone is included in county centre area, and age >=19 (additional)
WithinSa_CCA_C	Dummy, 1 if zone is included in Sa county centre area, for car
Withinxx_MCA	Dummy, 1 if zone is included in municipality centre area, (xx for region Pa, Sa, Sk, So and Va)
Woman_C	Dummy if the person is a female and using the car driver mode
Woman_C_AB	Dummy for woman, car, workplace-based
Waittime	Waiting time, transformed by piecewise weights (all modes)

Model results - non work tours

Separate models for mode and destination on one hand and frequency models on the other hand have been estimated. The model structure is such that destination choice is at the lowest level, mode choice is at the middle level, and frequency choice is at the highest level.

The models have been estimated using data for all regions. Different trip purposes have been analysed, and finally models for business, school, social trips, recreation trips and other trips have been estimated. Below, the final models implemented in the SAMPERS system 2.1 are reported.

Business trips

Below, the model for mode and destination choice is reported. In the last column, there is an indicator of the choice level at which the variable is located. The frequency level is marked by an F, the mode level by an M, and the destination level by a D.

Mode and destination choice

Namn	2.0	t-value	2.1	t-value	Choice level
Observations	364		554		
Final log(L)	-469,488		-759,56		
D.O.F.	15		17		
Rho²(0)	0,6732		0,6528		
Const_B	-2,18555	(-6,1)	-2,3767	(-9,1)	M
Const_CP	-0,93334	(-3,1)	-1,15734	(-4,7)	M
Const_Cy	-1,73691	(-2,6)	-1,79803	(-3,5)	M
Cost_Liinc	-0,00852	(-2,7)	-0,00584	(-2,6)	D
Countycenter	-0,26993	(-1,2)	-0,30329	(-1,6)	D
Dailycarwork_C	1,15522	-2,9	0,94066	-2,6	M
Distance_Cy	-0,24573	(-2,3)	-0,26028	(-3,6)	D
Distance-5km_allmodes	0,86808	-2,3	0,96711	-3,5	D
GA-cut			-2,03815	(-1,6)	
In-veh.time_allmodes	-0,025	(-9,2)	-0,02537	(-12,6)	D
LSM_Dest	0,54967	-2,4	0,56609	-3,5	M
Size - N:o employed_G	0,42864	-0,6	0,04942	-0,1	D
Size - N:o employed_OE	1	(*)	1	(*)	D
Size - Population	-2,75102	(-2,6)	-2,74215	(-4,4)	D
SM-cut			0,39501	-0,6	
Withinarea_C	-0,18875	(-0,3)	-0,04037	(-0,1)	D
Withinarea_Cy	-1,20878	(-1,0)	-1,50446	(-1,8)	D
Woman_C	-0,91415	(-2,6)	-0,95499	(-3,4)	M

The model suffers from the low number of observations. From the time component variables, only the in-vehicle time for all modes turned out to be significant. The cost variable was significant only for the low-income group.

The size variables reflect that employees in sector G (mainly retail) attract about the same business trips as other economic sectors. The population size variable indicates that some business trips are directed to the household sector.

The logsum parameter from the destination level is significantly different from one as well as from zero.

The corresponding value of time (In-veh.time_allmodes) is 260 SEK/h.

Business frequency model

Namn	2.0	t-value	2.1	t-value
Observations	11737		16614	
Final log(L)	-1582,74		-1839,47	
D.O.F.	9		9	
$Rho^2(0)$	0,8055		0,8403	
$Rho^2(c)$	0,0898		0,2611	
Const_Tr	-2,6656	(-12,5)	-2,6506	(-28,1)
July	-1,1355	(-3,4)	-1,4045	(-4,7)
December	-0,8211	(-3,4)	-0,8006	(-4,1)
Employed in SNI3	-0,5517	(-2,2)	-0,6973	(-2,9)
Secondary school_Tr	-0,2532	(-2,2)	-0,2393	(-2,4)
May-Aug	-0,229	(-1,9)	-0,3271	(-3,1)
LSM_Mode	0,3191	(5,7)	0,0525	(12,3)
Man_Tr	0,3276	(2,5)	0,6441	(6,5)
Self employed_Tr	1,4374	(12,7)	1,5597	(15,6)

The business frequency model contains a significant logsum parameter from the mode and destination choice levels. The model parameters further show that men are more likely to make business trips than women, that persons with lower education are less likely to make business trips, and that self employed persons have a much higher propensity to do so.

The propensity to make a business trip is reduces if the trip maker belongs to economic sector SNI3 (manufacturing).

The vacation month in Sweden is obviously July. Activity is low also in the other summer months and in December.

School trips

The School tour model is shown in the next table. In the last column, there is an indicator of the choice level at which the variable is located. The frequency level is marked by an F, the general mode level by an M, and the destination level by a F.

Mode and destination

Namn	2.0	t-value	2.1	t-value	Choice level
Observations	2851		3480		
Final log(L)	-4599,7		-7751,9		
D.O.F.	43		43		
Rho²(0)	0,6284		0,4527		
Age-15_Cy	-1,0637	(-8,5)	-0,941	(-9,5)	M
Age-15_Ko	-1,6232	(-8,5)	-2,3309	(-12,6)	M
Age16-20_Ko	0,33668	-2,1	0,06011	-0,4	M
CCompetition_C	-0,9614	(-5,0)	-0,8881	(-5,4)	M
Const_CPassPa	5,34576	-7	5,27744	-10,2	M
Const_CPassSa	4,99705	-6,5	4,90994	-9,5	M
Const_CPassSk	5,06792	-6,5	5,00764	-9,4	M
Const_CPassSo	5,28051	-6,7	4,91171	-9,3	M
Const_CPassVa	5,18272	-6,7	5,00011	-9,7	M
Const_CyPa	6,26774	-8,2	6,10258	-11,7	M
Const_CySa	6,10541	-8	5,82923	-11,3	M
Const_CySk	6,68781	-8,7	6,59058	-12,6	M
Const_CySo	6,82366	-8,8	6,38641	-12,2	M
Const_CyVa	6,21325	-8,1	5,93506	-11,4	M
Const_KoPa	6,41226	-8,3	5,07393	-9,4	M
Const_KoSa	6,11253	-7,9	5,30934	-10,2	M
Const_KoSk	5,99929	-7,7	5,36883	-10	M
Const_KoSo	6,52663	-8,3	5,28298	-9,8	M
Const_KoVa	6,3298	-8,2	5,50204	-10,4	M
Const_T	-2,9633	(-12,3)			D
Const_W	6,27617	-8,2	6,19123	-12,1	M
Cost	-0,0219	(-7,2)	-0,0231	(-11,5)	D
Distance_Cy_	-0,1055	(-10,0)	-0,1326	(-16,4)	D
Distance_W_	-0,2216	(-6,7)	-0,2012	(-13,3)	D
Distance-6km+age-12	1,95656	-7,9	1,03569	-8	D
Distance-6km+age-12_CPass	1,64876	-5,5	1,44573	-8,5	D
Distance-6km+age13-15	0,53657	-2,1	0,41113	-2,7	D
Drivinglicence_C	8,16748	-11,2	7,70524	-16,3	M
GÄ-cut			-1,1892	(-2,2)	
In-veh.time_allmodes	-0,0171	(-7,5)	-0,0164	(-11,0)	D
LSM_BT	0,84431	-15,7			D
LSM_Dest	0,75278	-17,9	0,8224	-18,6	M
Municipality centre	0,56647	-3,1	-0,0362	(-0,4)	D
Size - N:o stud univ_large	-2,0837	(-4,4)	-2,5485	(-8,0)	D

Namn	2.0	t-value	2.1	t-value	Choice level
Size - N:o stud univ_small	-2,8041	(-4,4)	-3,2682	(-6,2)	D
Size - N:oemployed_M	1	(*)	1	(*)	D
Size - Population	-4,8525	(-19,7)	-3,9003	(-45,3)	D
SM-cut			-2,5016	(-4,6)	
Summer_Cy	0,62026	-6,8	0,61703	-7,6	M
Transfer+auxtime	-0,0056	(-2,4)	-0,0063	(-2,9)	D
Within_MCA_age16-20	0,79928	-2,6	1,50367	-7,4	D
Within_Municipality	4,85971	-13,8	4,12553	-38,4	D
Withinarea_Cy	0,27195	-1,4	-0,0794	(-0,6)	D
Withinarea_W	-0,4642	(-1,5)	-0,755	(-5,3)	D
WithinCCA_age19-	0,69625	-2,9	0,13125	-0,9	D
Woman_C	0,01842	-0,1	-0,0388	(-0,2)	M

The cost and some time components are significant, although transfer time and auxiliary time are constrained to have the same parameters. Wait time was not significant, probably due to the fact that school buses are not coded into the networks.

The value of time for the in-vehicle time is 41 SEK/h, and for transfer and auxiliary time 16 SEK/h. It is possible that the value for transfer and auxiliary time is lower than expected, because of the lack of school buses in the network. Shorter transfer auxiliary times would increase the parameter values. See the following table.

Name	VoT(SEK)	Weight
In-veh.time_allmodes	41	1
Transfer time+auxtime	16	0,39

From the set of attraction variables that was collected in addition to the work place statistics, the number of university students turned out to be significant.

It should be noted that the model comprises a heterogeneous group, including car driving university students as well as young individuals just having started school.

Frequency

Namn	2.0	t-value	2.1	t-value
Observations	6425		7654	
Final log(L)	-4111,96		-4669,38	
D.O.F.	4		4	
Rho²(0)	0,0768		0,1199	
Rho²©	0,0597		0,11	
Age-18	0,44569	7,3	0,62776	11,1
Const_T	-0,33002	(-6,1)	0,28826	-5,9
December	-0,28659	(-3,3)	-0,57971	(-7,3)
June-Aug	-1,47664	(-20,2)	-1,94385	(-30,4)

There is no logsum variable in this model, which is not so surprising. As most of the school trips are due to mandatory participation, accessibility does not have an obvious impact on trip frequency.

The age variable indicates that persons up to 18 year are more frequent trip makers, which corresponds to the fact that higher education less often requires daily school trips. The holiday periods are also reflected in the model by the month dummies.

Social trips

Below, the models for social trips are reported.

Mode and destination

Namn	2.0	t-value	2.1	t-value	Choice level
Observations	2115		3150		
Final log(L)	-4374,4		-6705,1		
D.O.F.	47		47		
Rho²(0)	0,5082		0,4674		
Age-15_Cy	0,51994	3,7	0,42911	3,7	M
Auxtime-30_allmodes	-0,0592	(-2,6)	-0,051	(-2,8)	D
Auxtime30-_allmodes	-0,0026	(-1,0)	-0,001	(-0,4)	D
CCompetition_C	-0,5029	(-4,4)	-0,3855	(-4,0)	M
CCompetition_C_Sa	-0,2846	(-2,4)	-0,2558	(-2,8)	M
Const_CPassPa	3,97601	7,3	4,07719	10,8	M
Const_CPassSa	3,94023	7,2	3,73538	9,9	M
Const_CPassSk	3,74488	6,7	3,70685	9,4	M

Namn	2.0	t-value	2.1	t-value	Choice level
Const_CPassSo	4,05162	7,2	4,11995	10,6	M
Const_CPassV	4,35447	8	4,04106	10,7	M
Const_CyPa	2,32561	4,2	1,98288	5,1	M
Const_CySa	2,48482	4,4	1,73643	4,5	M
Const_CySk	2,95985	5,2	2,34342	6	M
Const_CySo	2,19941	3,8	1,8293	4,6	M
Const_CyV	2,54303	4,5	1,86979	4,8	M
Const_KoPa	2,74052	3,8	1,203	2,2	M
Const_KoSa	3,07281	4,9	2,09987	5	M
Const_KoSk	2,70892	3,9	1,3521	2,7	M
Const_KoSo	3,02772	4,3	1,45962	2,8	M
Const_KoV	3,62012	5,4	2,05429	4,4	M
Const_T	-1,7012	(-3,6)			D
Const_W	2,78533	4,7	2,00566	-5,2	M
Cost	-0,0266	(-7,3)	-0,0156	(-7,0)	D
Countycenter_C	-1,0584	(-5,2)	-0,6694	(-5,0)	D
Countycenter_CPass	-0,9265	(-3,8)	-0,7004	(-4,1)	D
Countycenter_Cy	-0,783	(-3,2)	-0,9119	(-3,9)	D
Countycenter_W	-0,8842	(-2,5)	0,15522	-0,5	D
Dailycarwork_C	0,64329	2	0,67009	2,3	M
Distance_age-18	-0,0233	(-4,6)	-0,0168	(-5,7)	D
Distance_Cy	-0,1633	(-9,2)	-0,1283	(-11,8)	D
Distance_party2_CPass	-0,0112	(-2,7)	-0,004	(-1,6)	D
Distance_W	-0,1258	(-3,1)	-0,2427	(-5,4)	D
Distance-5	0,39547	3,1	0,45958	5,6	D
Drivinglicence_C	6,02522		5,731	16,6	M
GÄ-cut			-1,9184	(-3,1)	
In-veh.time_C,CPass	-0,0385	(-8,3)	-0,0351	(-12,5)	D
In-veh+waittime_allmodes	-0,019	(-4,9)	-0,018	(-6,0)	D
LSM_BT	0,82883	16,7			D
LSM_Dest	0,78958	7,7	0,45311	7,9	M
N:oTransfers_allmodes	-0,1995	(-1,9)	-0,1358	(-1,7)	D
Size - N:oemployed	1	(*)	1	(*)	D
Size - Population	2,47556	4,5	1,42919	7,1	D
Size - Summer house area	-1,1558	(-1,7)	-2,0983	(-5,8)	D
SM-cut			-0,7862	(-1,9)	
Summer_Cy	0,7977	6	0,95399	8,5	M
Withinarea_C	0,52088	2,2	0,32233	1,9	D
Withinarea_Cy	0,54056	2,3	0,70652	4,3	D
Withinarea_W	0,67481	1,3	2,45104	7,3	D
WithinSa_CCA_C	0,51378	1,8	-0,037	(-0,2)	D
Woman_C	-1,1534	(-8,6)	-1,0923	(-10,0)	M

The model contains significant cost and time component parameters, although the public transport in-vehicle and wait time parameters are constrained to have the same value. The corresponding value of time is 70 SEK/h. The value of auxiliary time is about three times as high, 196 SEK/h. The car in-vehicle time has a value of 135 SEK/h. The values are put together in the following table:

Name	VoT(SEK)	Weight
In-veh.time_C	135	1,95
In-vehicle time+waittime_Ko	70	1,00
Auxtime-30_Ko	196	2,83
Auxtime30-60_Ko	4	0,05
N:oTransfers_allmodes	8	

From the set of attraction variables that was collected in addition to the work place and population statistics, the summer house area turned out to be significant.

This model is also very heterogeneous with respect to age, which may affect the parameters. The model contains some age related variables to account for this.

Frequency

Name	2.0	t-value	2.1	t-value
Observations	25005		33869	
Final log(L)	-7307,04		-10752,4	
D.O.F.	18		18	
Rho²(0)	0,5784		0,542	
Rho²©	0,0191		0,0242	
Age-18	0,74744	-7,7	0,80037	-10,4
Age19-24	0,68302	-8,4	0,72846	-10,7
Const_Tr	-3,58176	(-28,0)	-2,8901	(-50,1)
County1	-0,34407	(-3,9)	-0,26231	(-3,8)
County12	-0,17083	(-2,1)	-0,17425	(-2,7)
County14	-0,27887	(-2,1)	-0,04839	(-0,6)
County5	-0,1291	(-1,1)	-0,08967	(-0,9)
December	0,30592	-3,9	0,27111	-4,3
Gtbg municip_Tr	-0,41937	(-2,4)	-0,42191	(-3,5)
LSM_Mode	0,19261	-7,5	0,24512	-11,1
Man_Tr	-0,25853	(-5,4)	-0,2718	(-6,8)

Name	2.0	t-value	2.1	t-value
May-Aug	0,29307	-6,1	0,27333	-7
Palt	0,18229	-3,2	0,11775	-2,5
Per Capita Inc-100	0,00152	-2,1	0,00133	-2,9
Retired	0,30597	-4,7	0,40122	-7,8
SingelHH	0,36633	-6	0,38623	-7,8
Sthlm municip_Tr	-0,2719	(-2,1)	-0,21168	(-2,1)
Student	0,0243	-0,3	0,19575	-2,9

Accessibility has an impact on the social trip frequency. Income also influences trip making to some extent. Furthermore, the model contains some region specific constants, which adjust the trip frequency. The general pattern in this model and other models is that the trip frequency is adjusted downwards for the densely populated areas, and upwards for the regions with low density. It is possible that the accessibility measure overestimates accessibility for dense areas and reverse. This may in turn depend on the linear formulation of the utility functions.

Recreation trips

Below, the recreation trip models are reported.

Mode and destination

Name	2.0	t-value	2.1	t-value	Choice level
Observations	4265		6019		
Final log(L)	-6931,5		-10423		
D.O.F.	51		51		
Rho²(0)	0,627		0,5737		
Age-16_Cy	0,12876	-0,9	0,16628	-1,5	M
Age-16+dist-5km_CPass	1,89649	-5,3	0,88228	-4,4	D
Age-16+dist-5km_Cy	1,76848	-5,2	1,0572	-4,9	D
Age65-+dist-5km_Cy	-0,5231	(-1,3)	-0,7465	(-2,4)	D
Auxtime-30_BT	-0,0218	(-1,1)	-0,0468	(-3,3)	D
Auxtime30-_BT	-0,0064	(-1,9)	-0,0076	(-2,2)	D
CCompetition_party1_C	-0,5254	(-6,0)	-0,6547	(-8,8)	M
CCompetition_party2_C	-0,327	(-4,1)	-0,2985	(-4,5)	M
Const_CPassPa	4,57405	-8,8	4,49654	-12	M
Const_CPassSa	4,53651	-8,7	4,29086	-11,5	M
Const_CPassSk	4,62168	-8,8	4,35385	-11,4	M
Const_CPassSo	4,56326	-8,6	4,37907	-11,6	M
Const_CPassV	4,55068	-8,7	4,25544	-11,4	M

Name	2.0	t-value	2.1	t-value	Choice level
Const_CyPa	2,44418	-4,6	2,27233	-5,9	M
Const_CySa	2,47152	-4,6	2,10191	-5,5	M
Const_CySk	3,29353	-6,2	2,90102	-7,5	M
Const_CySo	2,89977	-5,4	2,50569	-6,4	M
Const_CyV	2,51276	-4,7	2,13066	-5,5	M
Const_KoPa	3,72712	-6,2	2,40547	-4,8	M
Const_KoSa	3,66497	-6,6	2,70531	-6,7	M
Const_KoSk	3,53658	-6	2,27769	-5	M
Const_KoV	3,7551	-6,5	2,75267	-6,3	M
Const_T	-2,0147	(-7,7)			D
Const_W	3,88068	-6,8	2,75783	-7,2	M
Cost	-0,0303	(-8,8)	-0,021	(-10,8)	D
Countycenter_C	-1,0404	(-5,9)	-0,9796	(-9,4)	D
Countycenter_CPass	-0,9805	(-4,8)	-0,8377	(-6,8)	D
Countycenter_Cy	-0,6246	(-2,8)	-0,6099	(-3,4)	D
Countycenter_W	-0,5983	(-1,9)	0,54088	-2,6	D
Dailycarwork_C	0,41744	-2,2	0,31985	-2	M
Distance_age-18	-0,0156	(-3,9)	-0,0144	(-6,1)	D
Distance_Cy	-0,1216	(-10,6)	-0,1296	(-14,2)	D
Distance_W	-0,279	(-3,3)	-0,292	(-9,2)	D
Distance-5km+party1_Cy	1,78541	-6,9	1,21494	-7,3	D
Drivinglicence_C	6,24077	-12,4	6,01228	-16,8	M
GA-cut			-1,1392	(-3,6)	
In-veh.time_-30min_allmodes	-0,067	(-8,6)	-0,0582	(-15,0)	D
In-veh.time_30min-_allmodes	-0,0288	(-7,7)	-0,0257	(-11,8)	D
In-veh.time_30min-+employed	-0,741	(-3,9)	-0,4155	(-3,5)	D
LSM_BT	0,75564	-18,2			D
LSM_Dest	0,62558	-9,7	0,47461	-12,5	M
Municipality centreSk	0,37608	-1,4	0,1914	-1,2	D
Municipality centreSo	-0,5577	(-2,2)	-0,6691	(-4,7)	D
Size - N:o employed hotel/rest	4,49165	-11,4	3,57088	-17,4	D
Size - N:o employed rec. etc	4,1245	-9,2	3,51243	-16	D
Size - N:oemployed_OE	1	(*)	1	(*)	D
Size - Population	-0,4107	(-1,2)	-0,398	(-2,5)	D
Size - summer house area	-0,9344	(-2,7)	-1,8396	(-10,5)	D
SM-cut			-1,7466	(-3,4)	
Summer_Cy	0,67396	-7	0,77497	-9,4	M
Transfer time_BT	-0,012	(-1,4)	0,00142	-0,4	D
Waittime	-0,0407	(-3,0)	-0,0314	(-2,8)	D
Withinarea_W	-0,6772	(-1,1)	1,65062	-6,4	D
Woman_C	-1,1146	(-12,6)	-1,1218	(-15,1)	M

The model contains significant time and cost parameters, although the transfer time variable at a higher risk level. The in-vehicle time is piecewise linear, and has value of 166 SEK/h up to 30 minutes, and 73 SEK/h for time in addition to 30 minutes. Wait time is valued to 90 SEK/h. Auxiliary time is also piecewise linear, and is value to 134 SEK up to 30 minutes, and to 22 SEK for additional time. The VoT and corresponding weights are presented below:

Name	VoT(SEK)	Weight
In-veh.time_-30min_allmodes	166	2,26
In-veh.time_30min-_allmodes	73	1,00
Transfer time_T	-	-
Wait time	90	1,22
Auxtime-30_Ko	134	1,82
Auxtime30-60_Ko	22	0,30

From the set of attraction variables that was collected in addition to the work place statistics, the summer house area turned out to be significant.

Frequency

Namn	2.0	t-value	2.1	t-value
Observations	25005		33869	
Final log(L)	-10880		-15367	
D.O.F.	22		22	
Rho²(0)	0,3723		0,3454	
Rho²(c)	0,0324		0,0451	
Age-18	0,72534	-8,6	0,7559	-11,2
Age19-24	0,63339	-8,4	0,64349	-10,1
Age25-45	0,13154	-2,5	0,13732	-3,2
Const_T	-2,69871	(-34,8)	-2,153	(-37,8)
County1	-0,39862	(-5,9)	-0,3958	(-7,3)
County12	-0,32007	(-5,1)	-0,3608	(-7,0)
County14	-0,15909	(-1,7)	-0,1462	(-2,3)
County5	0,32615	-2,4	0,20321	-1,8
December	-0,13766	(-2,0)	-0,1802	(-3,2)
Full time_Tr	-0,29042	(-5,3)	-0,3412	(-7,4)
Gtbg municip_Tr	-0,25075	(-2,1)	-0,1046	(-1,2)
July	0,36841	-6,1	0,32797	-6,3
Linköp/Norrköp municip_Tr	-0,40104	(-2,3)	-0,3808	(-2,7)

Namn	2.0	t-value	2.1	t-value
LSM_Mode	0,3398	-16	0,37016	-22
May-Aug	0,27836	-7	0,27343	-8,2
Palt	0,0749	-1,6	-0,0498	(-1,3)
Per Capita Inc-100	0,00284	-4,9	0,0015	-4
Retired	0,2155	-3,2	0,20825	-3,6
Self employed_T	-0,44442	(-4,5)	-0,5526	(-6,6)
Sthlm municip_Tr	-0,1549	(-1,6)	-0,1072	(-1,4)
Student	0,19206	-2,9	0,34959	-6,3
University edu_Tr	0,22178	-4,4	0,28931	-7

Accessibility is significant also for the recreation trips, as is income. The same pattern as for social trips is present in the regional constants.

Other trips

The models for Other trips are shown below:

Mode and destination

Namn	2.0	t-value	2.1	t-value	Choice level
Observations	6073		9242		
Final log(L)	-9367,7		-15840		
D.O.F.	67		67		
Rho²(0)	0,6438		0,5733		
Age-15_Cy	0,22612	-1,6	0,42193	-3,5	M
Auxtime-30_BT	-0,0385	(-2,7)	-0,0495	(-3,7)	D
Auxtime30-_BT	-0,0009	(-0,4)	-0,0161	(-3,0)	D
CCompetition_Cman	-0,2661	(-2,7)	-0,1973	(-2,4)	M
CCompetition_Cwom	-0,7708	(-8,7)	-0,7611	(-10,7)	M
Const_age-12_CPass	1,45324	-9,8	1,54499	-11,9	M
Const_C_dailyshopp	0,25101	-2,4	0,25607	-2,9	M
Const_CPass_dailyshopp	0,35359	-3,1	0,15797	-1,7	M
Const_CPassPa	3,57416	-7,6	3,85909	-9,3	M
Const_CPassSa	3,42108	-7,3	3,68606	-8,9	M
Const_CPassSk	3,45103	-7,2	3,98196	-9,4	M
Const_CPassSo	3,43021	-7,1	3,88755	-9,1	M
Const_CPassVa	3,70119	-7,8	4,04461	-9,7	M
Const_CPassWoman	0,95684	-8,1	0,92103	-9,5	M
Const_CyPa	3,80792	-7,5	3,40254	-7,8	M
Const_Cysa	3,97066	-7,9	3,51965	-8,1	M

Namn	2.0	t-value	2.1	t-value	Choice level
Const_CySk	4,49535	-8,8	4,10752	-9,4	M
Const_CySo	4,34713	-8,5	3,88803	-8,8	M
Const_CyVa	3,98549	-7,8	3,65291	-8,4	M
Const_Ko_dailyshopp	-1,0642	(-6,8)	-1,3245	(-7,2)	M
Const_KoPa	3,84211	-6,7	3,29025	-6,2	M
Const_KoSa	4,07221	-7,9	3,6747	-8,2	M
Const_KoSk	4,2327	-7,8	3,69874	-7,7	M
Const_KoSo	4,13951	-7,1	3,41704	-6,4	M
Const_KoVa	4,28473	-7,8	3,70145	-7,7	M
Const_Ride_C	3,07077	-13,6	2,49695	-17,2	M
Const_T	-2,192	(-6,7)			M
Const_W_dailyshopp	0,58063	-6,1	0,44977	-5,9	M
Const_WPa	4,16583	-8,6	2,96947	-7,1	M
Const_WSa	4,41524	-9,2	3,59907	-8,6	M
Const_WSk	4,42354	-9,1	3,66715	-8,7	M
Const_WSo	4,35057	-8,9	3,397	-8	M
Const_WVa	4,39698	-9,1	3,60319	-8,6	M
Cost_allmodes	-0,0239	(-9,3)	-0,0215	(-11,7)	D
Countycenter_C	-0,6153	(-6,3)	-0,6858	(-9,8)	D
Countycenter_CPass	-0,4273	(-2,8)	-0,5612	(-4,8)	D
Countycenter_Ko	0,29476	-1,3	0,69764	-3,4	D
Countycenter_W	0,94152	-5,4	1,73518	-13,3	D
Distance_age-12	-0,0134	(-3,1)	-0,0106	(-3,2)	D
Distance_Cy_Woman	-0,0544	(-4,4)	-0,034	(-3,2)	D
Distance_Cy-5	-0,5106	(-7,2)	-0,4313	(-7,8)	D
Distance_Cy5-	-0,0747	(-8,7)	-0,0841	(-9,3)	D
Distance_dailyshopp	-0,0066	(-2,6)	-0,0123	(-6,5)	D
Distance_W	-0,2958	(-8,0)	-0,3251	(-13,2)	D
Distance-10km_childcare	2,44083	-10,4	2,3173	-13,9	D
Distance-5km_childfam+woman	0,74111	-6,1	0,51951	-6,5	D
Drivinglicence_C	6,03198	-14	6,07642	-15,7	M
Employment density	0,00116	-1,7	0,00039	-0,9	D
First Waittime_BT	-0,0184	(-1,9)	-0,0184	(-1,8)	D
GA-cut			-0,6146	(-2,5)	
In-veh.time_allmodes	-0,0286	(-9,9)	-0,027	(-13,1)	D
LSM_BT	0,9478	-26,8			D
LSM_Dest	0,694	-14	0,57736	-19	M
N:oTransfers_allmodes	-0,1219	(-1,6)	-0,1698	(-2,7)	D
Size - N:o employed_H	1,34096	-5,7	1,21761	-7,9	D
Size - N:o employed_L	-0,2253	(-0,8)	-0,3638	(-2,2)	D
Size - N:o employed_M	-0,2337	(-1,0)	-0,7933	(-4,0)	D
Size - N:o employed_N	-1,9894	(-5,9)	-1,9051	(-9,9)	D

Namn	2.0	t-value	2.1	t-value	Choice level
Size - N:oemployed_G	1	(*)	1	(*)	D
Size - Pop_dailyshopp	-4,2137	(-10,1)	-4,3321	(-16,9)	D
Size - Pop_not dailyshopp	-2,4579	(-13,1)	-2,4665	(-23,5)	D
SM-cut			-1,4723	(-3,2)	
Summer_Cy	0,80846	-9	0,81729	-10,9	M
Supermarket	0,82158	-4,2	0,79544	-5,8	D
Turistattraction	0,66257	-3	0,24079	-1,8	D
Within_municipality	1,73729	-15,5	1,53376	-24	D
Withinarea_Cy	-1,5205	(-4,9)	-0,6197	(-2,6)	D
Withinarea_W	-0,3519	(-1,2)	2,14277	-13	D
Withinarea_W_service	0,95742	-3	0,66153	-3,6	D
Woman_C	0,05229	-0,2	0,26492	-1,5	M

The model contains significant time and cost variables. The in-vehicle time is valued to 75 SEK/h, and wait time is valued to 51 SEK/h. Auxiliary time is valued to 138 SEK/h up to 30 minutes, and 45 SEK/h thereafter. See the table below:

Name	VoT(SEK)	Weight
In-veh.time_allmodes	75	1
First Waittime_BT	51	0,68
Auxtime-30_Ko	138	1,83
Auxtime30-_Ko	45	0,60

The model comprises many different trip purposes, which can be seen from the large number of size variables with different parameters.

From the set of attraction variables that was collected in addition to the work place statistics, the existence of supermarkets and tourist attractions turned out to be significant.

Frequency

Name	2.0	t-value	2.1	t-value
Observations	25005		33869	
Final log(L)	-11885		-17350	
D.O.F.	19		9	
Rho²(0)	0,3143		0,261	
Rho²(c)	0,0785		0,079	
Age25-45	0,10213	-2,6	0,12978	-4
Const_T	-2,1985	(-33,2)	-1,718	(-37,3)
County1	-0,4638	(-7,5)	-0,1719	(-4,0)
County12	-0,1454	(-2,3)	-0,0735	(-1,6)
County14	-0,1403	(-1,6)	0,01566	-0,3
County25	0,21584	-2,6	0,35075	-5,2
County5	0,16515	-1,2	0,38099	-3,9
Full time_Tr	-1,1984	(-26,1)	-1,2682	(-34,5)
Gtbg municip_Tr	-0,408	(-3,6)	-0,25	(-3,1)
HHSize - N:oemployed	0,08128	-6,3	0,09346	-8,9
Linköp/Norrköp municip_Tr	-0,4929	(-2,9)	-0,4567	(-3,6)
LSM_Mode	0,43054	-28,3	0,44535	-33,4
Malmoe municip	-0,4326	(-4,0)	-0,2803	(-3,1)
Man_T	-0,1952	(-5,7)	-0,2311	(-8,4)
Part time employed_T	-0,5875	(-9,8)	-0,7132	(-13,8)
Per Capita Inc-100	0,0025	-5,2	0,00247	-6,9
Self employed_T	-1,0881	(-13,4)	-1,2137	(-18,2)
Sthlm municip_Tr	-0,3419	(-3,8)	-0,4238	(-6,1)
Student	-1,1556	(-21,8)	-1,097	(-25,5)

The model was first estimated without regional dummies, and then the regional dummies were estimated with the other parameters constrained to their previous values. The t-values for these parameters relate to the first estimation stage. The accessibility is significant also in the model for other trips, as is income. The same pattern can be seen here as well as for the regional constants in previous models.

General remarks

The models contain supply, destination and socio economic variables that have the right sign and in most cases are significantly different from zero at the 5 percent risk level. Especially the time parameters vary, which is reflected in the values of time shown below (SEK/h):

Trip time component	Work	Business	School	Social	Recreation	Other
In-veh.time_C	81			135		
In-veh.time_transfer time_BT	48					
In-veh.time_allmodes		260	41			75
In-vehicle time+waittime_Ko				70		
In-veh.time_-30min_allmodes					166	
In-veh.time_30min-_allmodes					73	
First Waittime_BT	77				90	51
Auxtime-30_Ko	37			196	134	138
Auxtime30-60_Ko	59			4	22	45
Auxtime60-_Ko	10					
Transfer time+auxtime			16			

The picture is scattered, and is a result of the difficulties in each sub model. As has been said before, the population spans from children to old people. The segmentation on travel purpose is perhaps not the most efficient one – age might be a better segmentation variable. The time frame of the project did not allow for extensive testing – the test that were done considered the grouping of travel purpose only. This might be a scope for further work.

Another observation that was made during the project was that the frequency model needed a lot of region specific dummy variables to account for different trip making. This may well be caused by non linearities not in the model, which might be another scope for future work.

The revision made for Sampers 2.1 did not change this picture. The revision did however not include a general specification revision, only data enlargement and the grouping of bus and train in one single public transport mode.

Implementation

The probabilities for choosing the different alternatives in the models are calculated using data on transportation supply and data on destination zones. The probabilities are calculated by zone and for different socio-economic categories, reflecting the different behaviour that the models contain for these groups. Thus, each model is run separately for each socio-economic group in each zone. However, to actually run the model for each subgroup defined in the models would take too long time. Therefore, some aggregation has been undertaken.

The probabilities are aggregated to number of trips by the number of persons in each category. The categories are defined by variables such as age groups, occupational status, gender, car ownership and income. Results pertaining to different categories can be displayed to a large extent.

In the application, all destination alternatives are considered (up to 100 km for non work tours).

Each socio-economic category has been implemented in one of three ways listed below.

1. Correlation with other socio-economic variables taken into account (implemented as loop variables)
2. The category is implemented as a loop-variable but no correlation is taken into account
3. The category is implemented only by average values

The first category is only possible to implement if information about the correlation is available. In the SAMPERS system, socio-economic data is provided by tables and no extra information is available, which nevertheless could be obtained using prototypical sampling.

Below, the main socio-economic variables used in the models are classified into one of the three groups listed above.

Socio-economic variable classification

Variable	Way of implementation	Comment
Partysize	2	No geographical variation
Type of cost (pass/coupon)	2	Geographical variation
Car in household or not	2	Geographical variation
Driving licence or not	2	Geographical variation
Age	1	With respect to employment and sex
Employed or not	1	With respect to age and sex
Sex	1	With respect to age and employment
Types of employment	3	No geographical variation
Seasonal variables	3	No geographical variation
Car competition in household	3	Geographical variation
Income	3	Geographical variation

Two income measures are used in the models – one is the household income per capita, and the other one is the share of people with an individual income over 250 thousand SEK (used in the business models). These data are not contained in the database, and have therefore to be constructed from the individual income distribution that is contained in the data. The following procedure is used for household income per capita in each zone:

- the total sum of income is calculated by multiplying the number of persons in each income category by the category mean (for the class 400- the value 450 thousand SEK/year is used) and summing up
- the total number of persons is calculated by dividing the number of persons in the SAMSINK table by the share of persons under the age of 16. This share is calculated based on the SAMSYSS table.
- the total income is divided by the so obtained total number of persons.

For the share of employed persons having an income over 250 thousand SEK, the following procedure is used, also for each zone:

- the numbers of men and women respectively having an income over SEK 250 000 are calculated from the SAMSINK table.

- the numbers of working men and women are calculated by multiplying the total number of persons over the age of 16 in the SAMSINK table by the share of working men and women respectively over 16 in the SAMSYSS table.
- the numbers of men and women respectively having an income over SEK 250 000 are divided by the total number of working men and women respectively.

This will produce zone specific income measures, but without correlation with other variables, such as car ownership.

Other variables such as subpurposes are implemented as static average values. Variables related to the level-of-service (for instance in-vehicle time, first wait time and auxiliary time) are implemented the same way as they have been used in the estimation (origin - destination specific).

Non availibility restrictions

The alternatives in the estimated logit models are not always available. Below the restrictions are listed by mode.

Car modes are only restricted by the existence of car in the household and being old enough for driving license (implemented by using age groups since we do not use car licence as a loop-variable)

Public-transport-modes are only restricted by the appearance of in-vehicle time. If the in-vehicle time is zero, then there is no appropriate supply of public transport in that OD-pair.

Walk and bicycle is always available as an alternative in each OD-pair although it is only attractive when the distance is short.

Calibration

There are two types of corrections made in the implementation compared to the estimated models. The first type of correction is made in order to compensate for aggregation errors such as the case of driving licence, which is implemented as an average.

The other type of correction is related to remaining differences between implemented model results and the travel survey. This correction is called a calibration. A description of the calibration of the implemented models is found below.

In general, the calibration parameters imply a higher trip frequency. This is expected mainly because of the fact that the trip frequency model is restricted to one trip making alternative (one ore more trips) and therefore multiple trips have to be accounted for as an adjustment (the “ore more” factor). Also, observations that could not be used in the estimation process have to be corrected for. The trip generation constant is also calibrated. All calibrations are made specific to the different regions.

Tour frequency calibration

The adjustments that are made for the regional models are related to the general level of trip making, and to the distribution on modes. The adjustments take the form of correction factors that are added to the utility functions. This type of adjustment ensures consistency in the models.

For simplicity in the calibration procedure, all adjustments were made at the mode level (see below).

Mode split calibration

The mode split is calibrated by adding the values listed in the table below to the utility function of each mode for the different travel purposes. Changes of calibration parameters were only made to the mode constants. This means, that calibration on the frequency level was made by adding the same value to all modes. Therefore calibration parameters appear for all modes.

Region	Purpose	Bicycle	Bus	CarDr	CarPas	Walk
Palt	Business	0	0	0	0	0
	BusinessWB	-7,44	-2,87	-5,66	-7,58	-3,8
	Other	-0,18	0,67	-0,38	-0,1	-0,16
	School	0,17	2,47	2,06	0,22	0
	Sparetime	0	1,32	-0,26	-0,05	-0,49
	Visit	0,46	0,94	0,34	0,22	0,27
	Work	0,03	-0,02	0,03	0,08	-0,33
SAMM	Business	0	0	0	0	0
	BusinessWB	-4,99	-7,07	-6,76	-9,79	-4,5
	Other	-0,63	0,24	-0,75	-0,51	-0,41
	School	-0,09	1,48	0,94	0,34	0
	Sparetime	-0,47	0,24	-0,84	-0,59	-0,59

Region	Purpose	Bicycle	Bus	CarDr	CarPas	Walk
	Visit	0,15	0,34	-0,58	-0,23	-0,08
	Work	0,12	0,25	-0,1	0,19	0,25
Skane	Business	0	0	0	0	0
	BusinessWB	-13,6	-7,95	-4,2	-5,56	-3,09
	Other	-0,06	0,66	0,33	-0,19	-0,04
	School	0,08	1,95	2,45	0,14	0
	Sparetime	-0,13	0,55	-0,04	-0,12	-0,32
	Visit	0,5	0,83	0,69	0,37	0,33
	Work	0,69	0,46	0,6	0,43	0,61
SydOst	Business	0	0	0	0	0
	BusinessWB	-13,7	-7,77	-5,26	-8,55	-3,92
	Other	-0,36	0,76	-0,79	-0,74	-0,41
	School	0,16	1,94	1,31	0,29	0
	Sparetime	0,11	1,04	-0,57	-0,33	-0,23
	Visit	-0,09	0,69	-1,12	-1,24	-0,31
	Work	0,52	0,44	0,69	1,22	0,45
Väst	Business	0	0	0	0	0
	BusinessWB	-8,15	-5,32	-6,14	-9,08	-4,29
	Other	-1,14	0,31	-0,85	-0,52	-1,04
	School	0,23	2,28	2,34	0,6	0
	Sparetime	-0,37	0,43	-0,56	-0,13	-0,8
	Visit	-0,3	0,44	-0,74	-0,15	-0,78
	Work	0,21	0,93	0,36	0,6	0,24

Other adjustments

The provided information on licence holdings is not related to socioeconomic categories. This means that the license holding in car disposing households is underestimated. A correction factor of 1.14 (based on the Riks-RVU) is therfore used to obtain a more correct share of license holders in such households. This correction was not done by region.

The car competition variable is calculated by dividing the number of driving licenses by the number of cars in each zone. This means that car competition is overstated, because licences held in non car households are included. This varies by region, and the following adjustments factors are applied to the car competition variable (based on the RiksRVU):

County	Car competition adjustment factor
County NR 1	0.769
County NR 2	1
County NR 3	0.858
County NR 4	0.902
County NR 5	0.875
County NR 6	0.944
County NR 7	0.899
County NR 8	0.948
County NR 9	0.957
County NR 10	0.944
County NR 11	0.826
County NR 12	0.826
County NR 13	0.944
County NR 14	0.809
County NR 15	0.943
County NR 16	0.946
County NR 17	0.932
County NR 18	0.895
County NR 19	0.905
County NR 20	0.942
County NR 21	0.924
County NR 22	0.933
County NR 23	0.902
County NR 24	0.920
County NR 25	0.960

Extension to Denmark

The regional model for Skåne has also been extended to the Sjaelland area in Denmark. This means that trips generated in Skåne can also have a destination in Sjaelland. It also means that trips generated in Denmark are (optionally) calculated by the same model, defining destination alternatives in Denmark as well as in Sweden. To facilitate this, Danish authorities (Vejdirektoratet) have kindly provided network and land use data.

The national borders influence travel behaviour in different ways, requiring a special calibration to be undertaken for trip between Sweden and Denmark. Below, this calibration is described.

Regional models – secondary destinations & work place based tours

Introduction

Trip chaining, in the form of work-place based trips and visits of a secondary destination on the traveller's way between work-place and home, is directly treated in the regional models. An investigation reveals that such "trip-chaining" occurs at different frequencies for the various trip purposes (as can be seen from the below). Among work-based trips, business trips are most frequent as combined trips, while the choice of a secondary destination on the way from work to home is most frequent for the category "other trips", to which shopping trips belong. In order to avoid long computation times, it was decided to model secondary destinations for the "Other" travel purpose only, and work place based trips for business trips only.

Distribution of tours on tour type and purpose (Sampers 2.0 data)

Tour purpose	Home based tours	Secondary destinations	Work place based tours
School	3167	22	0
Business	506	285	740
Social	2454	181	17
Recreation	4807	247	59
Other	6694	1592	409
Total	17628	2327	1225

As this method involves longer computational time, if the models are fully implemented, it is necessary to introduce some simplification. A full implementation would be to calculate the probability to choose a secondary destination for every origin-destination pair. In the model for home-based trips, such a calculation of the probability of choosing each destination is made. In the model for secondary trip purposes, such a calculation would be necessary for each of all the pairs of home-to-work relations. This implies an

increase of the computing times with a factor proportional to the number of zones, if no simplification is made.

Various types of simplifications could be considered, such as:

- limitation of the number of destination zones to be considered (a detour of 20 km for a 2 km long journey is not realistic)
- limitation of the number of zones, for which the secondary destination is calculated (if such a limitation could be achieved)
- to rely on and utilise the relation between trips and work-trips

One could postulate three different properties for the secondary destination model, which one would like to replicate:

- to achieve a trip pattern that contains also these trips
- to allow both the destination and the mode choice for such trips to be affected by land use and transport supply measures
- to allow the distribution between home-based trips and secondary destination to be affected land use and transport supply measures.

The first point could be handled by adding a matrix, which is calculated through some growth factor for each mode of transport for the base year (1997). The second point can partly be handled by applying some growth factor on a forecast matrix, for instance the work tours. To include the second point more elaborately and also the third point more completely, the complete model has to be applied, if only in a simplified way. A way to achieve this would be to carry out the model calculation only for a restricted number of socio-economic categories as well as for a restricted number of possible destinations.

The current implementation is a full implementation, but averaged with respect to socio-economic categories.

If one wishes to consider secondary destination trips in a simpler way, it is possible to establish growth factors that can be applied to the work trip matrices. This can be done by first making a run with the work tour model, resulting in a work trip matrix, and then a run with the Other trips model with secondary destinations, giving a work trip matrix which is adjusted with respect to secondary destination choices. Growth factors can then be obtained by dividing the unadjusted work trip matrix by the adjusted one, perhaps in some aggregated way. If small changes are studied using the SAMPERS system, these factors can be assumed to be fairly stable, and can be applied to the work trip matrix in other scenarios.

Data

The data related to secondary destination choices concerned the extra effort required reaching the destination. Thus, destinations on the way between work and home would require no extra effort, and larger detours would require more effort.

A destination-sampling scheme specific for secondary destination alternatives was adopted.

Stratum	Number of zones
0-3 km extra	6
3- km extra	6
Work zone	1
Home zone	1

For all alternatives, data on the extra effort to visit the secondary destination was produced. Thus, probability to choose a secondary destination alternative is a function of the extra effort to go there, as compared to go directly between work and home. As for other destination alternatives, size variables and other destination variables were also matched to the data.

It should also be mentioned, that the problems with partial non-response hits secondary destination analysis even harder than is the case for home based tour models. The secondary destination is conditioned also on the work place location, and if this is unknown, no data on the chosen alternative or any other alternative can be produced. Therefore, the possibility to use mode choice information as for homed based models is not as good.

The "Other " model with secondary destination choice

The "Other" travel purpose model including secondary destinations is structured as is shown in the Model structure chapter. It includes mode, destination, tour type and activity frequency choices, all except activity frequency simultaneously estimated. The work based trip type alternative is not included, as very few choices were found for this alternative.

Some additional variables have been included in this model:

Additional variables

Name	Definition
BB-konst	Constant for home based trip alternative
ConstcarSD	Constant for car, SD alternative
ConstCySD	Constant for bicycle, SD alternative
ConstPTSD	Constant for public transport, SD alternative
ConstWSD	Constant for walk, SD alternative
Homezone_SD	Dummy for home zone, SD alternative
In-veh.-wait-transfer time_SD	In-vehicle, wait and transfer time for public transport SD alternative
LSM_BT_BB	Logsum from bs/train choice, home based alternative
LSM_BT_SD	Logsum from bs/train choice, SD alternative
LSM_DestBB	Logsum destination choice, home based alternative
LSM_DestSD	Logsum from destination choice, SD alternative
LSM_Trip type	Logsum from trip type choice
Umea_municip	Dummy for Umeå municipality
Woman_BB	Dummy for woman and home based trip alternative
Workzone_SD	Dummy for work zone, SD alternative

In the following tables, the parameters of the final model are shown. The abbreviation BB stands for home-based tours and SD for secondary destination.

Two models are presented. The first one is the home-based only model, and the second one includes the secondary destination choice as well as a trip type choice. The latter is implemented as the secondary destination model.

Mode, destination and trip type

Name	2.0	t-value	2.1	t-value
Observations	6585		10457	
Final log(L)	-11444		-20136	
D.O.F.	78		78	
$Rho^2(0)$	0,6075		0,5351	
Age-15_Cy	0,25011	-1,7	0,42315	-3,5

Name	2.0	t-value	2.1	t-value
Auxtime_T-30	-0,0402	(-2,6)	-0,0499	(-3,8)
Auxtime30-_T	-0,001	(-0,3)	-0,0169	(-3,2)
BB-konst	1,18775	-2,4	-1,453	(-2,5)
CCompetition_Cman	-0,2234	(-2,4)	-0,1428	(-2,0)
CCompetition_Cwom	-0,6912	(-8,2)	-0,5535	(-8,4)
Cons_age-12_CPass	1,4612	-9,9	1,49835	-11,6
Cons_CPassWoman	0,9839	-8,4	0,92032	-9,5
Const_C_dailyshopp	0,36221	-3,5	0,57405	-6,7
Const_CPass_dailyshopp	0,48958	-4,4	0,38882	-4,4
Const_CPassPa	3,33622	-7,3	4,03612	-9,7
Const_CPassSa	3,18624	-7	3,84563	-9,3
Const_CPassSk	3,19911	-6,9	4,13648	-9,8
Const_CPassSo	3,19707	-6,8	4,03746	-9,5
Const_CPassVa	3,4122	-7,5	4,22928	-10,1
Const_CyPa	3,34037	-6,9	3,60742	-8,3
Const_Cysa	3,53546	-7,4	3,66367	-8,6
Const_CySk	3,97146	-8,2	4,23024	-9,8
Const_CySo	3,88883	-8	4,05963	-9,3
Const_CyVa	3,5024	-7,3	3,8497	-8,9
Const_Ko_dailyshopp	-0,9224	(-5,9)	-0,9827	(-5,4)
Const_KoPa	3,4817	-6,3	3,33919	-6,3
Const_KoSa	3,73933	-7,6	3,66965	-8,2
Const_KoSk	3,7778	-7,3	3,70304	-7,7
Const_KoSo	3,7793	-6,8	3,44633	-6,5
Const_KoVa	3,88408	-7,4	3,78861	-7,9
Const_Ri_C	2,17679	-14,1	3,02437	-21,1
Const_T	-1,8582	(-6,5)		
Const_W_dailyshopp	0,71694	-7,8	0,80136	-10,9
Const_WPa	3,81703	-8,1	3,58536	-8,6
Const_WSa	4,09439	-8,8	4,14402	-10
Const_WSk	4,01474	-8,5	4,17875	-9,9
Const_WSo	4,01488	-8,4	3,97419	-9,4
Const_WVa	4,02812	-8,6	4,16671	-10
ConstcarSD	1,88915	-8,5	1,89778	-12
ConstCySD	-19,512	(-18,6)	0,47002	-2,1
ConstPTSD	0,04214	-0,1	0,29899	-1,4
ConstWSD	-24,193	(-19,1)	-1,0972	(-4,0)
Cost	-0,0255	(-10,1)	-0,0197	(-11,8)
Countycenter_C	-0,4396	(-5,0)	-0,4776	(-7,9)
Countycenter_CPass	-0,351	(-2,2)	-0,479	(-4,2)
Countycenter_Ko	0,50441	-2,3	0,83326	-5,1
Countycenter_W	1,18589	-6,3	1,69178	-13,8

Name	2.0	t-value	2.1	t-value
Distance_age-12	-0,0141	(-3,2)	-0,0113	(-3,3)
Distance_Cy_Woman	-0,0274	(-2,7)	-0,0234	(-2,4)
Distance_Cy-5	-0,5237	(-8,0)	-0,4551	(-9,8)
Distance_Cy5-	-0,0674	(-8,4)	-0,0901	(-10,3)
Distance_dailyshopp	-0,0055	(-2,3)	-0,007	(-3,8)
Distance_W_BB	-0,3142	(-8,1)	-0,4519	(-19,0)
Distance_W_SD			-0,9022	(-5,0)
Distance-10km_childcare	2,55219	-11,9	1,84292	-11,4
Distance-5km_childfam+woman	0,76739	-6,9	0,53921	-7,7
Drivinglicence_C	5,73512	-13,8	6,15751	-15,8
Employment density	0,00121	-1,9	0,00063	-1,5
First Waittime_BT	-0,0218	(-2,1)	-0,0134	(-1,3)
GAsnittet			-0,5092	(-2,2)
Homezone_SD	1,29968	-7,2	0,93393	-9
In-veh.time_allmodes	-0,0261	(-9,5)	-0,0313	(-16,4)
In-veh.-wait-transfer time_SD	-0,0334	(-6,2)	-0,046	(-13,9)
LSM_BT_BB	0,94467	-29,1		
LSM_BT_SD	0,91423	-21,8		
LSM_DestBB	0,60842	-16	0,57888	-21,6
LSM_DestSD	1	(*)	0,78101	-23
LSM_Mode	0,7471	-13,7	1	(*)
N:oTransfers_allmodes	-0,1431	(-1,9)	-0,1495	(-2,7)
Size - N:o employed_H	1,30597	-6,1	1,20122	-8,5
Size - N:o employed_L	-0,3389	(-1,3)	-0,4212	(-2,7)
Size - N:o employed_M	-0,4772	(-2,0)	-0,6979	(-4,0)
Size - N:o employed_N	-1,9159	(-6,6)	-1,9412	(-10,9)
Size - N:oemployed_G	1	(*)	1	(*)
Size - Pop_dailyshopp	-4,4866	(-10,9)	-4,3678	(-17,7)
Size - Pop_not dailyshopp	-2,4208	(-14,7)	-2,3358	(-25,1)
SMsnittet			-1,3828	(-3,0)
Summer_Cy	0,81196	-9,1	0,80618	-10,8
Supermarket	0,68373	-3,5	0,81174	-6
Turistattraction	0,65426	-3,2	0,25325	-2
Within_municipality	1,88178	-18,2	1,56711	-28,7
Withinarea_Cy	-1,4113	(-4,7)	-0,7423	(-3,6)
Withinarea_W	-0,3137	(-1,0)	1,24281	-9
Withinarea_W_service	1,20841	-3,6	0,95864	-5,1
Woman_BB	0,28422	-2,2	0,25907	-2,7
Woman_C	0,05415	-0,3	0,0302	-0,2
Workzone_SD	0,5911	-3,1	0,41591	-3,8

The time and cost parameters of the home based part of the model change marginally after including secondary destination. The secondary destination part contains a generic time parameter, with a corresponding time value of 140 SEK/h (see below). It seems reasonable that the value is higher than for the home based model, as the time restriction may be more binding, and as that part of the model is related to employed people only.

Name	VoT (SEK)	Weight
In-veh.time_allmodes	95	1,00
In-veh.-wait-aux.time_SD	140	1,47
First Waittime_BT	40	0,42
Auxtime-30_T	152	1,60
Auxtime-30-_T	51	0,54

The parameters of the frequency model is shown in the table below. Two models are shown, the first one being the frequency model without secondary destination, and the second model including secondary destination and tour type choice.

Trip frequency

Name	2.0	t-value	2.1	t-value
Observations	25005		33869	
Final log(L)	-12501		-20339	
D.O.F.	19		9	
Rho²(0)	0,2787		0,1336	
Rho²(c)	0,0698		0,1295	
Age25-45	0,14245	-3,8	0,0338	-1,2
Const_T	-1,3912	(-25,8)	0,84264	-18,2
County1	-0,3985	(-6,8)	-0,1841	(-4,9)
County12	-0,0418	(-0,7)	-0,1302	(-3,1)
County14	-0,1344	(-1,6)	0,02051	-0,4
County25	0,18306	-2,3	0,2655	-4,1
County5	0,13391	-1	0,32837	-3,5
Full time_Tr	-1,1285	(-25,1)	-1,3195	(-38,9)
Gtbg municip_Tr	-0,3381	(-3,1)	-0,295	(-4,1)
HHSize - N:oemployed	0,09002	-7,1	0,10205	-10,8
Linköp/Norrköp municip_Tr	-0,3951	(-2,4)	-0,5172	(-4,3)
LSM_Mode	0,56337	-26	0,34897	-30,4
Malmoe_municip	-0,4026	(-3,8)	-0,196	(-2,4)
Man_T	-0,0623	(-1,9)	-0,0164	(-0,7)

Name	2.0	t-value	2.1	t-value
Part time employed_T	-0,555	(-9,5)	-0,8328	(-17,6)
Per Capita Inc-100	0,00285	-6,1	0,00277	-9,2
Self employed_T	-1,005	(-13,0)	-1,4357	(-24,8)
Sthlm municip_Tr	-0,3192	(-3,7)	-0,3481	(-5,8)
Student	-1,1543	(-22,0)	1,26328	-30,8

Implementation

The model for Other trips including secondary destinations is implemented in a simplified way, to avoid too long computer run times. The model is implemented in the following way:

1. In a first step, the work tour model has to bee run.
2. The second step is to calculate the logsum from the secondary destination part of the model. For each origin zone, the logsum for all secondary destination alternatives (within 3 km extra distance with respect to the work trip) are calculated. The logsum is conditioned on the work place location, and since this is known only as a probability from the work tour model, the logsum is weighted according to the distribution of the work destination zones and modes. The work destination distribution is averaged over all socio-economic groups. The logsums are also averaged with respect to socio-economic category.
3. The third step is to run the tour type model, to obtain the number of home based trips and the number of secondary destinations. The number of secondary destination per origin zone is stored.
4. The fourth step is to run the home based model, with full resolution, as it is done when it is run as a home based model only.
5. The fifth step is to run the secondary destination model again, but this time the stored number of trips are allocated to modes according to the work trip mode, and to destination according to the probability for each destination, conditioned on the work place zone, given by the distribution of work destinations from the work tour model.
6. The sixth step is to update the work trips matrix by subtracting the work-home trip, and adding the two trips resulting from the secondary destination choice.

The secondary destination model can be conditioned on the work trip before or after a "Fratar" step.

Work-place based business tours

The model for work place based tours has been estimated together with the home based model. The two tour types have been considered as two tour purposes. Therefore there is no trip type choice model for business trips.

The parameters contained in the work place based model are identified by the extension AB. The abbreviation AB stands for work-based tours.

Mode and destination

The following model has been estimated and implemented for mode and destination choice:

Name	2.0	t-value	2.1	t-value
Observations	781		1101	
Final log(L)	-876,866		-1322,42	
D.O.F.	27		28	
Rho²(0)	0,6861		0,6673	
Const_B	-2,2611	(-6,5)	-2,3055	(-7,9)
Const_CPass	-0,9303	(-3,1)	-1,1721	(-4,7)
Const_CPass_AB	-1,0376	(-3,5)	-0,9135	(-3,8)
Const_Cy	-1,9134	(-3,0)	-1,958	(-4,0)
Const_Cy_AB	-3,1318	(-5,8)	-3,0676	(-7,3)
Cost_AB	-0,0092	(-2,0)	-0,0076	(-2,1)
Cost_Liinc	-0,0089	(-2,8)	-0,0057	(-2,5)
Dailycarwork_C	1,1549	-2,9	0,9316	-2,6
Dailycarwork_C_AB	1,1065	-1,9	1,3415	-2,6
Distance_Cy	-0,2455	(-2,4)	-0,2597	(-3,5)
Distance_Cy_AB	-0,3341	(-3,2)	-0,2564	(-3,0)
Distance-5_AB	0,4685	-2,5	0,4879	-3,4
Distance-5km_allmodes	0,5901	-2,3	0,8356	-3,8
In-veh.time_allmodes	-0,0247	(-9,0)	-0,0256	(-12,7)
In-veh.time_allmodes_AB	-0,0234	(-3,2)	-0,0255	(-4,4)
LSM_Dest	0,4065	-0,6	0,1182	-0,3
Municipality centre	-0,1771	(-0,6)	-0,2517	(-1,2)
Size - N:o employed_G	0	(*)	-0,0045	(-0,8)
Size - N:o employed_G_AB	-1,0754	(-2,1)	-0,4738	(-1,1)
Size - N:oemployed_EO	0,9102	-2,5	1,0047	-3,7
Size - N:oemployed_EO_AB	1	(*)	1	(*)
Size - Pop_not dailyshopp	-2,8494	(-2,7)	-2,6442	(-4,3)
Size - Pop_not dailyshopp_AB	-2,5213	(-5,9)	-2,5144	(-5,7)
Withinarea_C	-0,1827	(-0,3)	0,2797	-0,7

Name	2.0	t-value	2.1	t-value
Withinarea_C_AB	1,7773	-2,8	2,5168	-5,1
Withinarea_Cy	-1,3688	(-1,1)	-1,6645	(-1,9)
Woman_C	-0,9097	(-2,6)	-0,9435	(-3,3)
Woman_C_AB	-1,6586	(-3,8)	-1,432	(-3,9)

The value of in-vehicle time equal 270 SEK/hour, while the corresponding value for work-placed tours is 201 SEK/hour.

Name	VoT (SEK)
In-veh.time_allmodes	270
In-veh.time_allmodes_AB	201

Frequency

The following model for work based trip business frequency choice has been estimated:

Name	2.0	t-value	2.1	t-value
Observations	7338		10771	
Final log(L)	-1534,78		-1609,26	
D.O.F.	8		8	
$Rho^2(0)$	0,6984		0,7845	
$Rho^2(c)$	0,0765		0,3279	
Basic edu only - Tr	-0,3679	(-3,2)	-0,1726	(-1,7)
Branch 4 - Tr	0,7374	-4,9	0,8265	-6
Branches 2 and 3 - Tr	-0,5118	(-3,3)	-0,5662	(-4,1)
Const_Tr	-2,935	(-35,1)	-2,0742	(-23,4)
County 20-25 - Tr	0,3714	-3	0,1928	-1,7
LSM_Mode -Tr	0,516	-11,6	0,3642	-7,9
Self employed - Tr	0,291	-1,9	0,6388	-4,4
Stockholm county - Tr	-0,3628	(-2,4)	-0,1242	(-0,9)

In the work based model a richer description of trip generation is possible, as the number of observed trip is higher. For instance, persons in branch 4 (energy and water supply) has a higher propensity to make a business trip, whereas persons in branch 2 and 3 (different types of manufacturing) have a lower propensity.

Implementation

Work based business tours are generated by employed persons from their work places. The number of such persons is taken from the SAMS data base, which does not contain information on subgroups. Therefore, no loops over socioeconomic categories are performed, and averages have been used for socio economic variables.

Calibration

Calibration is made at the mode level as for the home based models. In the table below, the calibration values are reported for the “other” trips model (the values for work trips are reported in the standard model section):

Region	Bicycle	Bus	CarDr	CarPas	Frequency	Walk
Palt	-0,08	0,8	0,05	0,42	-0,59	0
SAMM	-0,26	0,7	-0,35	0,24	-0,49	0
Skane	-0,04	0,71	0,17	-0,08	-0,39	0
Sydost	0,02	1,14	-0,23	0,33	-0,71	0
Vast	-0,04	1,51	0,15	0,64	-0,68	0

Regional models – including access/egress tours

Introduction

According to the terms-of-reference of the project, separate models for the access/egress trips ("connecting trips") should be developed for the train and airline modes. The results for these models are presented in this document. The ambition has been to develop models segmented into trip purposes as well as into the origin and destination part of the trip. The revision in Sampers 2.1 only allowed for putting bus and train modes together, and did not us the additional data for the 1998-2000 period.

During the course of the original research work, it became clear that it was impossible to estimate the business sub-model divided into origin and destination. Therefore, an aggregation into a common model with respect to origin and destination has been undertaken. The train mode was too poorly represented to be included. Also the bicycle mode was sparsely represented, and consequently the slow modes were put together.

The models contain the following alternatives:

Alternative	Origin, Private	Destination Private	Origin, Business	Destination Business
Car parked at station/airport	x		x	
Kiss & Ride	x	x	x	x
Taxi and hired car	x	x	x	x
Bus	x	x	x	x
Train	x	x		
Walk and Bicycle	x	x	x	x

Variables attached to a specific mode ends with letters referring to that mode. pC refers to parked car, B to bus, T to train, Tx to taxi, GC to walk/bicycle, and S to kiss and ride.

The models concern trip using the main modes train and air only. For bus trips, the terminals are not well known, and to a large extent bus trips do not have access/egress trips, specifically in the destination part of the long distance journey.

Private trips

Model results

Model results for private trips are shown in the table below. The parameters in the left hand column are implemented for the trips at the origin and the parameters in the right hand column for the trips at the destination.

Access trips

Name	2.0	t-value	2.1	t-value
Observations	2058		2065	
Final log(L)	-2408,63		-2324,68	
D.O.F.	17		16	
Rho²(0)	0,2029		0,2044	
Rho²(c)	0,1473		0,1518	
Age-17_S	0,7846	-7,4	0,7949	-7,5
Auxtime	-0,0108	(-5,9)	-0,0104	(-5,6)
Const_B	-1,1694	(-6,1)		
Const_pC	-2,452	(-12,7)	-2,4419	(-12,7)
Const_S	-3,2896	(-14,9)	-3,3282	(-15,0)
Const_T	-2,5866	(-9,9)		
Const_Tx	-3,5281	(-14,7)	-3,5265	(-14,7)
Cost	-0,0024	(-7,5)	-0,0024	(-7,5)
Distance-GC1	-0,2963	(-10,5)	-0,2938	(-10,4)
Distance-GC2	-0,0503	(-3,3)	-0,0513	(-3,4)
HHcar_S	1,7226	-13,3	1,7212	-13,3
Income_Tx	0,0041	-6	0,0041	-6
In-veh.time	-0,004	(-5,4)	-0,0036	(-4,8)
Ko-K			-1,0785	(-5,6)
No income information	0,7502	-3,5	0,768	-3,6
Taxi-air	0,6403	-3,8	0,6138	-3,6
Twttime	-0,0049	(-4,4)	-0,0067	(-5,0)
Woman_S	0,3691	-3,6	0,3721	-3,6

Egress trips

Name	2.0	t-value	2.1	t-value
Observations	1115		1123	
Final log(L)	-1083,61		-1023,65	
D.O.F.	14		13	
Rho²(0)	0,2479		0,2472	
Rho²(c)	0,1322		0,1432	
Const_Tx	-3,882	(-10,4)	-3,917	(-10,4)
Const_T	-3,736	(-9,7)		
Const_S	-2,2713	(-7,4)	-2,3065	(-7,5)
Const_B	-1,7024	(-5,6)		
Distance-GC1	-0,3713	(-5,1)	-0,3707	(-5,1)
Distance-GC2	-0,2873	(-3,6)	-0,2886	(-3,6)
Twttime	-0,0025	(-3,8)	-0,0052	(-4,8)
In-veh.time	-0,0009	(-2,4)	-0,0006	(-1,8)
Cost	-0,0005	(-3,4)	-0,0005	(-3,1)
Auxtime	-0,0003	(-1,4)	0,0005	-0,7
Income_Tx	0,0039	-4,5	0,004	-4,5
Distance-GC3	0,0281	-0,6	0,0285	-0,7
No income information	0,2866	-0,9	0,31	-1
Visit friends_S	0,9979	-7,4	1,0058	-7,5
Ko-K			-1,5576	(-5,0)

The access model at the origin part of the trip yields a higher explanatory power. The in-vehicle travel time value is 90 SEK/h in the access model, and 72 SKE/h in the egress model.

Name	VoT(SEK) Origin	VoT(SEK) Destination
In-veh.time_allmodes	90	72
Total waittime	167	624
Auxtime	260	-

Variable definition

Name	Definition
Auxtime	Auxiliary time in minutes (bus, train)
Age-17_S	Age up to 17 years, origin, for kiss & ride
Const_pC	Parked car, constant
Const_B	Bus, constant
Const_S	Kiss & Ride, constant
Const_T	Train, constant
Const_Tx	Taxi, constant
Cost	Cost in SEK
Distance-GC1	Distance up to 5 km one way (origin), up to 3 km one way (destination), walk, bicycle
Distance-GC2	Distance up to 5 km one way (origin), Between 3 and 5 km one way (destination), walk, bicycle
Distance-GC3	Distance over 5 km one way (destination), walk, bicycle
HHcar_S	Car in household, origin, for kiss & ride
Income_Tx	Income in 1,000 SEK, taxi
In-veh.time	In-vehicle time in minutes (car, bus, train)
No income information	No income information, Taxi
Taxi-air	Taxi dummy, origin, airline
Twttime	Total wait time in minutes (bus, train)
Visit friends_S	Trip purpose to visit friends, destination, kiss & ride
Woman_S	Woman, kiss & ride

Business trips

Model results

For the business purpose, the combined model and the separate models for trips at the origin and at the destination are shown below. The parameters in the combined model were implemented:

Name	2.0	t-value	2.1	t-value
Observations	1769		1808	
Final log(L)	-2099,26		-2160,97	
$Rho^2(0)$	0,1889		0,1837	
$Rho^2(c)$	0,128		0,123	
Const_S	-2,4942	(-5,0)	-2,7103	(-6,0)
ConstEgress_S	-2,3678	(-7,8)	-2,4938	(-8,2)
ConstEgress_Tx	-1,8186	(-5,3)	-1,809	(-5,3)
Const_Tx	-1,1289	(-3,1)	-1,1513	(-4,0)
Const_B	-0,8994	(-2,4)		

Name	2.0	t-value	2.1	t-value
Const_pC	-0,8768	(-2,2)	-0,7412	(-2,2)
ConstEgress_B	-0,854	(-3,1)		
CCompetition_pC	-0,6466	(-5,0)	-0,6773	(-5,3)
Distance-GC2	-0,2377	(-7,7)	-0,2302	(-7,7)
Distance-GC1	-0,1982	(-2,7)	-0,1899	(-2,9)
Distance-GC3	-0,0061	(-1,2)	-0,0019	(-0,4)
Twttime	-0,0056	(-3,7)	-0,0068	(-4,0)
In-veh.time	-0,0045	(-4,4)	-0,0012	(-1,4)
Auxtime	-0,004	(-3,4)	-0,0042	(-2,2)
Cost	-0,0014	(-7,6)	-0,0011	(-6,2)
Income_Tx	0,0029	-3,8	0,0029	-3,8
Woman_S	0,2494	-1,6	0,2701	-1,8
Leascar-pC	0,9551	-5,7	0,9342	-5,7
Taxi to airport+inc250-	1,1472	-6,7	1,222	-7,1
HHcar_S	1,257	-3,6	1,2978	-3,7
No income information	1,5012	-3,2	1,4163	-3,1
Car parked at airport+inc250-	1,6352	-9,8	1,7377	-10,6
Ko-K			-0,747	(-2,6)

The value of in-vehicle time is approximately 65 SEK/hour, although the time parameter is only significant at high risk levels.

Name	VoT (SEK
In-veh.time_allmodes	65
Total waittime	371
Auxtime	229

Variable definition

Name	Definition
Auxtime	Auxiliary time in minutes (bus, train)
Car parked at airport+inc250-	Parked car, origin, air mode , income>250,000 SEK/year
CCompetition_pC	Car competition, parked car
Const_pC	Parked car, constant (M) = destination (egress) part
Const_T	Train, constant
ConstEgress_B	Bus, constant (M) = destination (egress) part
ConstEgress_S	Kiss & Ride, constant (M) = destination (egress) part
ConstEgress_Tx	Taxi, constant (M) = destination (egress) part
Cost	Cost in SEK

Name	Definition
Distance-GC1	Distance up to 5 km one way (origin), up to 3 km one way (destination), walk, bicycle
Distance-GC2	Distance up to 5 km one way (origin), Between 3 and 5 km one way (destination), walk, bicycle
Distance-GC3	Distance over 5 km one way (destination), walk, bicycle
HHcar_S	Car in household, origin, for kiss & ride
Income_Tx	Income in 1,000 SEK, taxi
In-veh.time	In-vehicle time in minutes (car, bus, train)
Leascar-pC	Leasing car in household, parked car
No income information	No income information, Taxi
Taxi to airport+inc250-	Taxi, air mode, origin, income>250,000 SEK/year
Taxi-air	Taxi dummy, origin, airline
Twttime	Total wait time in minutes (bus, train)
Woman_S	Woman, kiss & ride

Costs

Parked car – private trips

The cost is calculated as the two-way distance *1,13 SEK, and the parking cost is calculated in the following way:

Airport parking cost is calculated as an average from various airport parking facilities, and adjusted to the period 1994 – 1997:

If Arlanda/Bromma Airport is origin airport: PcostF = Day*0.9*(80 +130 +70)/3
If Landvetter. PcostF = Day*0.9*(90+40)/2
If Malmö: PcostF = Day*0.9*50

Average cost per day is 3,6 for private trips and 2,3 SEK for business trips.

Parked car – business trips

The cost is calculated as the two-way distance *1,3 SEK, and the parking cost is calculated in the following way:
Airport parking cost is calculated on parking houses at airports, and adjusted to the period 1994 – 1997:
If Arlanda/Bromma Airport is origin airport: PcostF = Day*0.9*130
If Landvetter: PcostF = Day*0.9*130
If Malmö: PcostF = Day*0.9*50

For railway parking at railway stations, the railway parking cost at the relevant local community has been applied (according to the national parking file: sjrikspark_sa.dat, adjusted for Stockholm)

Kiss & Ride

The cost is calculated as the two-way distance * 1.3 kr*2 (because one has to drive twice as long)

Taxi

For Taxi the kilometre cost 12 SEK per km has been used (*two-way distance).
In certain cases a limitation has been introduced:

If the staring point (origin) is located in the city of Stockholm, then the access cost to the airport has been restricted to 370 SEK (one-way), for Göteborg to 315 SEK and for Malmö to 380 SEK. This has been done both for the origin and for the destination area of the trip.

All car costs have been divided by the party size. The average party size is 2,1 for private trips, and 1,9 for business trips.

Public Transport (Train and bus)

The actual bus/train cost has been applied according to the origin community for the trip. The bus transport cost file: Busspris.dat has been used.

Implementation

The regional models for access/egress trips to airports and railway stations for inter city trips is a special case. For these models, all socio-economic variables are implemented as averages. The reason for this is that the trip generation is taken from the trip matrices for the inter city model. These matrices are only divided into OD-pairs and not subdivided into for instance sex and age. This aggregation is done to reduce the amount of data to store and to simplify the user interface. To be consistent with other models, the walk + bicycle mode result is split up in constant proportions after the model is run (83 percent walk).

Calibration

No adjustment factors have been introduced. The result of this model also depends on the station matrix, which connects the long distance origin/destination zone with a regional station zone, which will be the origin or destination of the access/egress tours. This connection is made on a one to one basis, which could be modified to include shares to two ore more station zones.

Regional models – sketch version

Introduction

The geographical detail together with the high resolution in terms of results for specific socio economic categories leads to long execution times. As the full level of detail is not required at each stage of the analysis, a set of regional models have been estimated and implemented where execution speed has been given a higher priority. This set of models consists of three models - the model for work trips, the model for business trips and then one model containing all other trip purposes. The work and business trips models are the same as before and consequently only the third model is described here.

The model specification is almost identical to the ”other” trip purpose model. The specification is slightly modified with respect to the inclusion of additional trip purposes. Specific constants for mode and the school trip purpose have been introduced, as well as a dummy, taking the value 0 for wait time for school trips. Also, the size variable ”summerhouse area”, currently contained in the ”recreation” trips model, has been introduced here.

The reason for the additional internal segmentation by trip purpose is that the central cost and time parameters are heavily affected by the inclusion of other trips purposes in the original specification, if the specification does not reflect the differences between trip purposes. This may seem somewhat contradictory to the scope for the sketch model, which is to aggregate over trip purposes. The implementation will be such that shares for the trip purpose segments will be used, causing some aggregation error but giving elasticities that are better estimated

As before, the model has been estimated in two steps – first a mode and destination choice model has been estimated, then a frequency model has been estimated.

Mode and destination

In the table below, the model for mode and destination choice for the ”non work/business” trips model i s reported. The choice levels are the same as for the current”other” model.

Name	2.0	t-value	2.1	t-value
Observations	15274		21800	
Final log(L)	-26020		-43151	
D.O.F.	71		71	
Rho²(0)	0,6063		0,5085	
Age-15_Cy	0,21716	-3,7	0,25159	-4,9
Auxtime-30_BT	-0,0153	(-1,9)	-0,0275	(-5,4)
CCompetition_Cman	-0,3071	(-4,8)	-0,246	(-4,6)
CCompetition_Cwom	-0,731	(-11,8)	-0,6847	(-13,6)
Const_age-12_CPass	0,96993	-13,3	1,16907	-18,1
Const_C_dailyshopp	-0,0116	(-0,1)	-0,0529	(-0,7)
Const_C_school	1,26945	-15,3	1,19524	-17,2
Const_CPass_dailyshopp	0,17615	-1,9	0,01642	-0,2
Const_CPassPa	3,96496	-14,6	3,80997	-18,9
Const_CPassSa	3,96981	-14,6	3,66988	-18,2
Const_CPassSk	3,81248	-13,7	3,76398	-18,1
Const_CPassSo	3,97308	-14,2	3,78749	-18,3
Const_CPassVa	4,0155	-14,7	3,77963	-18,7
Const_CPassWoman	0,68803	-10,9	0,60855	-11,2
Const_CyPa	3,60793	-12,3	3,48017	-15,2
Const_Cysa	3,88783	-13,3	3,55941	-15,7
Const_CySk	4,24865	-14,3	4,27441	-18,5
Const_CySo	4,04968	-13,6	3,85132	-16,7
Const_CyVa	3,71777	-12,6	3,58166	-15,7
Const_Ko_dailyshopp	-0,939	(-6,6)	-1,2222	(-7,1)
Const_KoPa	3,79305	-12,2	2,92454	-11
Const_KoSa	3,98039	-13,6	3,34393	-14,4
Const_KoSk	3,66946	-12	3,4327	-13,6
Const_KoSo	3,87866	-12,2	3,2096	-11,9
Const_KoVa	3,96677	-13	3,48329	-13,9
Const_Ride_C	3,12086	-14,2	2,50324	-18,1
Const_T	-2,4832	(-16,2)		
Const_W_dailyshopp	0,75459	-9,8	0,56029	-8,9
Const_W_school	1,41702	-17,2	1,27064	-17,8
Const_WPa	3,78051	-13,2	4,08811	-19,9
Const_WSa	4,20939	-14,9	4,43088	-21,9
Const_WSk	3,90884	-13,5	4,34819	-20,8
Const_WSo	3,94758	-13,6	4,27139	-20,5
Const_WVa	3,91665	-13,8	4,29786	-21,1
Constl_K_school	1,62202	-15,3	1,45314	-13,5
Cost_allmodes	-0,0278	(-18,4)	-0,0254	(-28,5)
Countycenter_C	-0,7473	(-9,8)	-0,6459	(-14,4)

Name	2.0	t-value	2.1	t-value
Countycenter_CPass	-0,7377	(-7,2)	-0,6028	(-10,0)
Countycenter_Ko	-0,0744	(-0,7)	0,25426	-3,7
Countycenter_W	0,68494	-5,5	-0,0051	(-0,1)
Distance_age-12	-0,0288	(-10,8)	-0,0345	(-17,4)
Distance_Cy_Woman	-0,022	(-3,7)	-0,025	(-5,1)
Distance_Cy-5	-0,4277	(-9,2)	-0,2714	(-9,5)
Distance_Cy5-	-0,0841	(-15,7)	-0,1052	(-22,5)
Distance_dailyshopp	-0,0147	(-6,3)	-0,0163	(-10,1)
Distance_W	-0,2488	(-10,2)	-0,1962	(-30,5)
Distance-10km_childcare	2,782	-11,7	2,33538	-15,6
Distance-5km_childfam+woman	0,82188	-9,6	0,47481	-9,5
Drivinglicence_C	6,09413	-24,5	5,76899	-32,4
Employment density	0,00039	-0,8	0,00002	-0,1
First Waittime_BT	-0,0512	(-8,2)	-0,0322	(-7,4)
GAsnittet			-1,0116	(-6,4)
In-veh.time_allmodes	-0,0182	(-12,7)	-0,0193	(-21,4)
LSM_BT	0,84884	-39,4		
LSM_Dest	0,65124	-23,4	0,87785	-33,6
N:oTransfers_allmodes	-0,1508	(-4,2)	-0,1424	(-5,8)
Size - N:o employed_H	2,78315	-12,1	1,72809	-15,6
Size - N:o employed_L	0,78214	-2,9	-0,3205	(-2,1)
Size - N:o employed_M	1,66344	-8,1	0,72199	-7,8
Size - N:o employed_N	-1,0026	(-2,9)	-1,692	(-9,8)
Size - N:oemployed_G	1	(*)	1	(*)
Size – Pop_dailyshopp	-3,1364	(-7,5)	-3,3691	(-15,4)
Size – Pop_not dailyshopp	-1,0499	(-5,6)	-1,4322	(-18,7)
Size – summer house area	-5,0857	(-13,5)	-5,1634	(-29,1)
SMsnittet			-1,2483	(-5,4)
Summer_Cy	0,72136	-15	0,75246	-18,1
Supermarket	1,28025	-5,9	0,87771	-6,7
Touristattraction	0,30386	-2	0,13187	-1,4
Within_municipality	1,9241	-23,6	1,33384	-33,4
Within_Municipality_school	0,01177	-0,1	0,08811	-1,1
Withinarea_Cy	-0,8389	(-4,0)	-0,5728	(-4,5)
Withinarea_W	-0,0728	(-0,3)	-0,8261	(-11,3)
Withinarea_W_service	1,74689	-5,4	0,71327	-3,7
Woman_C	-0,1111	(-0,8)	-0,0993	(-0,8)

Values of time are presented in the table below:

Name	VoT(SEK)	Weight
In-veh.time_allmodes	46	1
First Waittime_BT	76	0,68
Auxtime-30_Ko	65	1,83

Trip frequency

In the table below, the model for trip frequency for the ”non work/business” trips model.

Name	2.0	t-value	2.1	t-value
Observ	25005		33869	
Final log(L)	-13676,2		-19926,8	
D.O.F.	19		19	
$Rho^2(0)$	0,2109		0,1512	
Age25-45	-0,038	(-1,1)	0,005	-0,2
Const_T	-1,8501	(-29,6)	-0,8519	(-20,5)
County1	-0,9106	(-16,8)	-0,6724	(-15,5)
County12	-0,3858	(-6,6)	-0,4973	(-10,6)
County14	-0,2926	(-3,7)	-0,2002	(-3,8)
County25	0,37	-4,5	0,1677	-2,5
County5	0,1496	-1,2	0,2257	-2,3
Full time_Tr	-1,3789	(-32,3)	-1,2731	(-37,7)
Gtbg municip_Tr	-0,6744	(-6,7)	-0,5287	(-7,2)
HHSize - N:oemployed	0,0726	-6,1	0,1018	-10,6
Linköp/Norrköp municip_Tr	-0,749	(-4,8)	-0,8317	(-6,8)
LSM_Mode	0,8056	-45,9	0,4618	-42,4
Malmoe municip	-0,4739	(-4,8)	-0,3855	(-4,6)
Man_T	-0,1894	(-6,0)	-0,1949	(-7,7)
Part time employed_T	-0,8054	(-14,3)	-0,8026	(-16,7)
Per Capita Inc-100	0,0025	-5,6	0,0026	-8,4
Self employed_T	-1,1876	(-17,5)	-1,4281	(-24,4)
Sthlm municip_Tr	-0,582	(-7,4)	-0,5321	(-8,5)
Student	1,2421	-23,8	1,2049	-28,9

Effects of aggregation of trip purposes

The separate models for school, social, recreation and other trips as reported before contain supply, destination and socio economic variables that have the right sign and in most cases are significantly different from zero at the 5 percent risk level. This is the case also for the aggregated "other trips" model. The time parameters from the previous models are compared to the aggregate model ion the table below in the form of values of time (SEK/h):

Trip time component	Work	Business	School	Social	Recreation	Other	Aggr model
In-veh.time_C	81			135			
In-veh.time_transfer time_BT	48						
In-veh.time_allmodes		260	41			75	46
In-vehicle time+waittime_Ko				70			
In-veh.time_-30min_allmodes					166		
In-veh.time_30min-_allmodes					73		
First Waittime_BT	77				90	51	76
Auxtime-30_Ko	37			196	134	138	65
Auxtime30-60_Ko	59			4	22	45	
Auxtime60-_Ko	10						
Transfer time+auxtime			16				

In the aggregate model, the number of transfers becomes significant (in contrast to the disaggregate "other" model), yielding a value of 6 in vehicle time minutes per transfer. It can be noted that the in vehicle time value and the auxiliary time value of the aggregate model is lower than in any of the separately estimated models, and that the reverse is true for the first wait time variable. This may depend on the fact that the separate models are differently specified. The values of the aggregate model are within reasonable limits.

The frequency model reflects different travel propensities for different socioeconomic categories as can be expected. The pattern of dummy adjustments for different counties and municipalities remains. The logsum parameter increases moderately from about 0.4 to about 0.46. If trip purposes are aggregated, parameter increases can be expected in order to maintain elasticities, but differences between trip purposes will also affect the parameter values. The logsum parameter is about the same as for the standard "other trips" model.

Implementation

The models are implemented with less detail concerning socio economic categories. Loops over party size (50 percent reduction), gender (50 percent reduction), age (from 5 to 3 categories, 40 percent reduction), and – for non work/business trips – occupancy (50 percent reduction) have been removed. This makes the execution time about ten times less as compared to a normal full run.

Calibration

The models were calibrated by adjusting the mode specific constants in order to achieve a close replication of the Riks-RVU data on the mode/trip purpose level. As for the full home based models, calibration with respect to trip frequency was partly contained in the mode choice calibration constants. The following calibration parameters were used:

Mode choice level

Region	Purpose	Bicycle	Bus	CarDr	CarPas	Walk
Palt	Business	0	0	0	0	0
	BusinessWB	-7,44	-2,87	-5,66	-7,08	-3,8
	Other	1,3	3,17	0,91	0,94	1,18
	Work	0	-0,02	0,12	-1,14	-0,34
SAMM	Business	0	0	0	0	0
	BusinessWB	-4,99	-7,07	-6,76	-9,29	-4,5
	Other	0,42	1,51	0,01	0,09	0,3
	Work	0,15	0,28	-0,08	-0,89	0,3
Skåne	Business	0	0	0	0	0
	BusinessWB	-13,6	-7,95	-4,2	-5,06	-3,09
	Other	1,32	2,28	1,76	1,23	1,17
	Work	0,78	0,58	0,77	-0,44	0,74
Sydost	Business	0	0	0	0	0
	BusinessWB	-13,7	-7,77	-5,26	-8,45	-3,92
	Other	0,81	2,27	0,26	0,24	0,6
	Work	0,45	0,41	0,62	-0,24	0,43
Väst	Business	0	0	0	0	0
	BusinessWB	-8,15	-5,32	-6,14	-8,58	-4,29
	Other	0,27	2,07	0,38	0,54	-0,01
	Work	0,23	0,98	0,46	-0,48	0,29