Summary:

Market potential model for Oslo and Akershus (MPM23) – Documentation and user manual of version 1.0

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MPM23 is an user-friendly, spreadsheet-based modelling tool for analyses of travel mode choice in Oslo and Akershus. The model calculates changes in market share for car (drivers and passengers), walk, bicycle, train, bus and tram / metro as a result of various measures. MPM23 - unlike many other (Norwegian) demand models – can therefore be used to study competition and substitution pattern between different forms of public transportation. The first impressions of the model (version 1.0) is that it indicates a relatively strong substitution between different form of public transportation and (somewhat unexpectedly) a rather weak substitution between public transport and car, walking and cycling. MPM23 segments results by submarkets (for travel purposes, distance, and large geographical zones) and illustrates how heterogeneous travel mode choice is within Oslo/Akershus.

The Institute of Transport Economics (TØI) has - commissioned by and in cooperation with Ruter - developed a model for travel mode choice based on data from Ruter's Market Information System (MIS). The purpose of the model development has been to establish a method to elucidate the factors that influence the choice of transport for traveling in Oslo and Akershus.

We have divided the project into two main parts. In the first part, we have worked towards finding and establishing variables explaining individual transport choices (as reported in the MIS), and to estimate marginal effects of the variables (coefficients) using statistical models. In the second part, we have - based on the results from estimating - developed a tool for analysing the effects of various measures on travel mode choice. The analysis tool is implemented in Excel, and goes by the name "MPM23" (**M**arkeds**P**otensial**M**odell for Akershus (**2**) og Oslo (**3**)).

MPM23 calculates market shares between travel modes in Oslo and Akershus. This is done by calculating individual choice probabilities (for each individual trip in the dataset) using a statistical model (nested logit model). MPM23 is implemented in Excel, which makes it possible to change the model's explanatory variables and predict new (individual) choice probabilities. The individual choice probabilities can then be aggregated to illustrate (aggregated) market shares. For some segments (e.g. geographical zones or travel purposes) we have added an automatic aggregation of the results in Excel. For these segments, one can immediately read off the effects of changes in one or more of the explanatory variables. Typical measures are changes in travel costs, free parking or satisfaction with public transport services.

In table S1 we present a comparison of characteristics and analysis capabilities for transport models MPM23 and RTM 23+. RTM23 + is the network-based regional transport model adapted to Oslo and Akershus and is part of the transport authority's common model system.

Table S1: Comparison of characteristics RTM23 + and MPM23 Version 1.0.

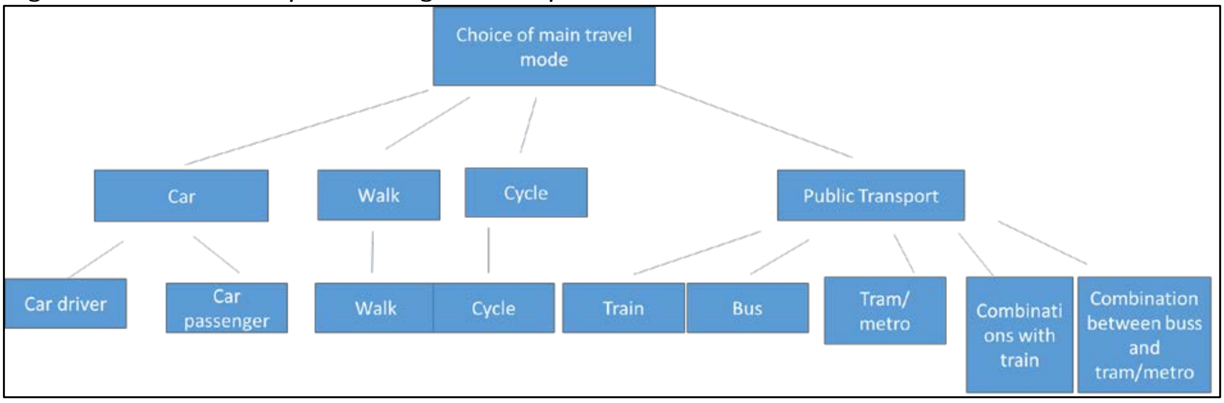
Properties	**RTM23+**	**MPM23 (Versjon 1.0)**
The geographical area covered?	Oslo and Akershus. I addition it includes parts of Buskerud, Ringerike, Hadeland og nordre Østfold («plus-area»)	Oslo and Akershus
Which days are covered?	Weekdays	Weekdays
Which types of transport covered?	Passenger transport excluding school trips (school trips and freight transport are included by fixed matrices in the travel assignment part)	Passenger transport (with school trips)
Aggregated or disaggregated estimation?	Disaggregated, based on the national and Prosam RVU (2001). Re-estimation of commuting trips on updated LoS data in 2009/2010.	Disaggregated, based on MIS (September 2014 - August 2015)
General method of prediction	Aggregation based on zonal systems	Disaggregated (sample enumeration) based on individual trips (September 2014 - August 2015)
Predicted total number of travel trips?	Yes (population growth and changes in trip frequency are included)	No, only market shares
Destination choice	Yes	No
Travel mode choice	Yes, but public transport a common alternative in the demand model (public transportation includes boat / ferry)	Yes, also distinguishes between forms of public transport (boat / ferry is omitted*)
Route choice/ traffic assignment	Yes	No
Choice of departure time	Very limited	No
LoS-data for travel time in car	Determined endogenously in equilibrium mode	From RTM23 + (given exogenously)
Modelling of satisfaction with public transport services	No	Yes (but simplified)

*) This means that all boat trips from/to Nesodden are excluded. One should avoid making specific analyses for Nesodden with MPM23 Version 1.0.

The table shows that MPM23 is subject to several simplifications compared with RTM23 +. The advantage of MPM23 is that it is a simple model, where analysis can be done with ease and quick.

In the estimation model behind MPM23 we have used the grouping ("nests") as shown in Figure S1.

Figure S1: Structure of nested logit model for MPM23 Version 1.0.



Explanatory variables in the model are:
• LoS variables (travel costs, board time, waiting time, travel time to / from the station, the number of boarding per trip)
• Trip distance
• Purpose
• Geographic large zones
• Driver's license / access to car (determines whether a car driver is an "available" choice option)
• Free parking
• Satisfaction with public transport
• Other variables (gender, season, alternative specific constant terms)
• Nest parameter (measuring correlation within groups of vehicles)

All 120 coefficients which are estimated have expected sign (and many are statistically significant). This gives a certain assurance that the model predicts the "right" direction on effects. Also the size and proportions of the variables seem reasonable, but we find that implicit Value of Time measures are rather low. This indicates that the cost is weighted higher than time. We find a relatively high nest parameter for the group "public transport". This leads to that the substitution between alternative modes within public transport (bus, train and tram/metro) is relatively strong, while the substitution between public transport (as a whole) and car/walking/biking, is relatively weak.

Table S2 shows (cross-) elasticities calculated in MPM23 (Version 1.0). Elasticities describe the impact on demand for traveling with a travel mode when changing a variable associated with that travel mode. For example the effect of increased car-driver's cost on demand for car-driving. The elasticity can be interpreted as the percentage change in demand from one percent change in costs. Crosselasticities are interpreted as a percentage change in demand for travel by one travel mode by a one percent change in a variable associated with an alternative travel mode.

Table S2: Calculated self- and cross elasticities in MPM23 Version 1.0.

Changes for car

	Car driver	Car passenger	Walk	Cycle	ic Transport	Train (including combinations)	Bus (including combinations)	Tram/metro (including combinatio
Travel time	**-0.05**	-0.10	0.02	0.08	0.09	0.13	0.10	0.06
Travel cost	**-0.08**	-0.15	0.03	0.11	0.14	0.25	0.15	0.09

Same changes for train, buss and train/metro

	Car driver	Car passenger	Walk	Cycle	ic Transport	Train (including combinations)	Bus (including combinations)	Tram/metro (including combinatio
access times	0.08	0.18	0.05	0.19	**-0.29**	**-0.42**	**-0.13**	**-0.41**
waiting times	0.02	0.06	0.01	0.04	**-0.08**	**-0.22**	**-0.07**	**-0.03**
single ticket price	0.08	0.14	0.04	0.13	**-0.26**	**-0.24**	**-0.31**	**-0.21**
# boardings	0.05	0.11	0.03	0.12	**-0.18**	**0.15**	**-0.38**	**-0.12**
invehicle time	0.05	0.11	0.01	0.09	**-0.16**	**-0.07**	**-0.20**	**-0.15**

Changes only for train

	Car driver	Car passenger	Walk	Cycle	ic Transport	Train (including combinations)	Bus (including combinations)	Tram/metro (including combinatio
access times	0.02	0.04	0.00	0.01	-0.05	**-0.77**	0.15	0.06
waiting times	0.01	0.02	0.00	0.01	-0.02	**-0.30**	0.06	0.01
single ticket price	0.02	0.03	0.00	0.01	-0.04	**-0.39**	0.05	0.01
# boardings	0.00	0.01	0.00	0.00	-0.01	**-0.15**	0.03	0.01
invehicle time	0.01	0.02	0.00	0.01	-0.03	**-0.35**	0.07	0.01

Changes only for bus

	Car driver	Car passenger	Walk	Cycle	ic Transport	Train (including combinations)	Bus (including combinations)	Tram/metro (including combinatio
access times	0.03	0.09	0.02	0.08	-0.13	0.25	**-0.66**	0.25
waiting times	0.01	0.03	0.00	0.02	-0.04	0.08	**-0.18**	0.06
single ticket price	0.04	0.07	0.02	0.07	-0.13	0.12	**-0.47**	0.11
# boardings	0.03	0.07	0.02	0.07	-0.10	0.24	**-0.58**	0.23
invehicle time	0.02	0.06	0.01	0.04	-0.07	0.22	**-0.42**	0.15

Changes only for tram/metro

	Car driver	Car passenger	Walk	Cycle	ic Transport	Train (including combinations)	Bus (including combinations)	Tram/metro (including combinatio
access times	0.03	0.05	0.03	0.10	-0.12	0.11	0.38	**-0.72**
waiting times	0.01	0.01	0.00	0.01	-0.02	0.01	0.05	**-0.11**
single ticket price	0.02	0.03	0.02	0.06	-0.09	0.02	0.10	**-0.32**
# boardings	0.02	0.03	0.01	0.05	-0.06	0.06	0.17	**-0.36**
invehicle time	0.01	0.03	0.01	0.04	-0.05	0.06	0.15	**-0.30**

The report contains a user manual for the spreadsheet model MPM23 and a chapter on the potential for improvement and further development of the model.