1 Transport

This file provides the equations defining the hybrid block on transport.

1.1 Link with the rest of the model

$$\Delta\left(\log NCH_{cea}^{AUTO}\right) = \Delta\left(\log CH_{cea}^{AUTO}\right) \tag{1.1}$$

Necessary (minimum) households' final consumption for public transport commodities cth

$$\Delta\left(\log NCH_{cth}\right) = \Delta\left(\log Km_{cth}^{traveler}\right) \tag{1.2}$$

$$NCH_{cveh} = PnewAUTO_{t_0}\ NewAUTO + UC^{M,AUTO,t_0}.AUTO \tag{1.3}$$

Price of public transport commodities cth **(train, road and air)**

$$\Delta\left(\log P_{cth}^{km,traveler}\right) = \Delta\left(\log PCH_{cth}\right) \tag{1.4}$$

Interest rate paid for an investment in a class ecl **automobile fueled with energy** cea

$$\Delta\left(R_{ecl,cea}^{I,AUTO}\right) = \Delta\left(R\right) \tag{1.5}$$

1.2 Arbitrage between transport modes

The arbitrage between transport modes is defined in 5 level. Level 1 determine the evolution of air, long and short distance transport. In level 2, the consummer may substitutie bewteen long distance transport types (automobile and train) and short distance transport types (automobile and bus). Level 3 defines the arbitrage between electric and thermic automobile whereas level 4 defines the arbitrage between automobile class. In level 5, substitution between types of thermic automobiles may be introduced.

1.2.1 Level 1: Determination of air, long and short distance transport

Kilometer-travelers for air transport

$$\Delta\left(\log Km_{cair}^{traveler}\right) = (t \\ > t_0) \tag{1.6}$$

To write explicitly

Kilometer-travelers for long distance transport (by automobile and train)

$$\Delta\left(\log km^{traveler,LD}\right) = (t \\ > t_0) \tag{1.7}$$

To write explicitly

Price of long distance Kilometer-traveler (automobile and train)

$$P^{km,traveler,LD}.km^{traveler,LD} = P_{crai}^{km,traveler}\ km_{crai}^{traveler} \\ + P^{km,trav,auto,LD}.km^{trav,auto,LD} \tag{1.8}$$

Kilometer-travelers for short distance transport (by automobile and bus)

$$\Delta\left(\log km^{traveler,SD}\right) = (t \\ > t_0) \tag{1.9}$$

To write explicitly

Price of short distance Kilometer-traveler (by automobile and bus)

$$P^{km,traveler,SD}.km^{traveler,SD} = P_{croa}^{km,traveler}\ km_{croa}^{traveler} \\ + P^{km,trav,auto,SD}.km^{trav,auto,SD} \tag{1.10}$$

1.2.2 Level 2: Arbitrage between long distance transport (automobile and train)

Share of Kilometer-travelers by automobile into the long distance Kilometer-travelers

$$\varphi^{km^{trav,auto,LD}} = P^{km,trav,auto,LD}.\frac{km^{trav,auto,LD}}{(P^{km,traveler,LD}.km^{traveler,LD})} \quad (1.11)$$

Kilometer-travelers for long distance by automobile

$$\Delta\left(\log km^{trav,auto,LD}\right) = (t > t_0) \quad (1.12)$$

To write explicitly

Kilometer-travelers for transport by train

$$\Delta\left(\log km^{traveler}_{crai}\right) = (t > t_0) \quad (1.13)$$

1.2.3 Level 2: Arbitrage between short distance transport (automobile and bus)

Kilometer-travelers for short distance by automobile

$$\Delta\left(\log km^{trav,auto,SD}\right) = (t > t_0) \quad (1.14)$$

Share of Kilometer-travelers by automobile into the short distance Kilometer-travelers

$$\varphi^{km^{trav,auto,SD}} = P^{km,trav,auto,SD}.\frac{km^{trav,auto,SD}}{(P^{km,traveler,SD}.km^{traveler,SD})} \quad (1.15)$$

Kilometer-travelers for transport by road (bus)

$$\Delta\left(\log km^{traveler}_{croa}\right) = (t > t_0) \quad (1.16)$$

To write explicitly

1.3 Transport by automobile

Kilometers for long distance by automobile

$$\Delta\left(\log km^{AUTO,LD}\right) = (t > t_0) \,.\, \left(\Delta\left(\log km^{trav,auto,LD}\right) - \Delta\left(\log travperauto^{LD}\right)\right) \tag{1.17}$$

To write explicitly

Kilometers for short distance by automobile

$$\Delta\left(\log km^{AUTO,SD}\right) = (t > t_0) \,.\, \left(\Delta\left(\log km^{trav,auto,SD}\right) - \Delta\left(\log travperauto^{SD}\right)\right) \tag{1.18}$$

Total kilometers by automobile

$$km^{AUTO} = km^{AUTO,LD} + km^{AUTO,SD} \tag{1.19}$$

Automobiles stock

$$\Delta\left(\log AUTO\right) = (t > t_0) \,.\, \left(\Delta\left(\log km^{AUTO}\right) - \Delta\left(\log kmPerAuto\right)\right) \tag{1.20}$$

$$AUTO^{bis} = \sum_{ecl} AUTO_{ecl} \tag{1.21}$$

To write explicitly

New automobiles

$$NewAUTO = \Delta\left(AUTO\right) + AUTO_{DES} \tag{1.22}$$

1.3.1 Level 3: Arbitrage between automobile price classes

New automobiles of class ecl

$$NewAUTO_{ecl} = \varphi_{ecl}^{NewAUTO}\ NewAUTO \tag{1.23}$$

Utility of a automobile of class *ecl*

$$\begin{aligned} \Delta\left(U_{ecl}^{AUTO}\right) = (t \\ > t_0) \end{aligned} \tag{1.24}$$

This utility is a function of the gain from the rehabilitation. For convenience it is calibrated as equal to $\log \varphi_{ecl}^{NewAUTO}$ at the base year. The coefficients of the utility function are derived from the study of Durmeyer (2017).

Exponential sum of the utilities of automobile per class

$$SUM^{EXP,U,AUTO} = \sum_{ecl} \mathrm{EXP}\, U_{ecl}^{AUTO} \tag{1.25}$$

Notional share of class *ecl* **automobile**

$$\varphi_{ecl}^{NewAUTO^n} = \frac{\mathrm{EXP}\, U_{ecl}^{AUTO}}{SUM^{EXP,U,AUTO}} \tag{1.26}$$

Share of class *ecl* **automobiles**

$$\varphi_{ecl}^{NewAUTO} = \alpha^{phi,NewAUTO}.\varphi_{ecl}^{NewAUTO^n} + \left(1 - \alpha^{phi,NewAUTO}\right).\varphi_{ecl,t-1}^{NewAUTO} \tag{1.27}$$

Notice that $\alpha^{phi,NewAUTO}$ is common to every class transition. This ensures that $\sum_{ecl2}(\varphi_{ecl}^{NewAUTO} = 1$.

1.3.2 Level 4: Arbitrage between electric and thermic automobile per classes

New electric automobiles of class *ecl*

$$NewAUTO_{ecl,cele} = \varphi_{ecl,cele}^{NewAUTO}\ NewAUTO_{ecl} \tag{1.28}$$

Every class of electric car has no emission. But their energy consumption vary per km.

Share of class *ecl* **electric automobile**

$$\begin{aligned} \varphi_{ecl,cele}^{NewAUTO} &= \varphi_{ecl,cele}^{NewAUTO^n}\ \left(\varphi_{ecl,cele}^{NewAUTO^n}\right. \\ &< \\ &= 1\left.\right) \end{aligned} \tag{1.29}$$

Notional share of class ecl **electric automobile**

$$\frac{\Delta\left(\varphi_{ecl,cele}^{NewAUTO^n}\right)}{\left(1-\varphi_{ecl,cele,t-1}^{NewAUTO^n}\right)} = innovation_{ecl}^{exo} + innovation_{ecl} + imitation_{ecl}\ \varphi_{ecl,cele,t-1}^{NewAUTO^n} \tag{1.30}$$

The adoption of electric automobile is modeled according to Bass Diffusion Model (Bass, 1969). The parameters of the model are calibrated using the study of Taszka (2017) .

Bass innovation parameter for class ecl **electric automobile**

$$\Delta\left(innovation_{ecl}\right) = \sigma_{ecl}^{BASS}\ \Delta\left(\frac{\left(2.UC_{ecl,cele}^{AUTO}\right)^{-nu_{ecl}^{diffusion}}}{\left(2.UC_{ecl,cele}^{AUTO}\right)^{\left(-nu_{ecl}^{diffusion}\right)}+\left(UC_{ecl,th}^{AUTO}\right)^{\left(-nu_{ecl}^{diffusion}\right)}}\right) \tag{1.31}$$

To write explicitly

New thermic automobiles of class ecl

$$NewAUTO_{ecl,th} = NewAUTO_{ecl} - NewAUTO_{ecl,cele} \tag{1.32}$$

New thermic automobiles of class ecl **(for verification)**

$$NewAUTO_{ecl,th}^{bis} = NewAUTO_{ecl,coil} + NewAUTO_{ecl,cgas} \tag{1.33}$$

1.3.3 Level 5: Arbitrage between types of thermic automobiles

New thermic automobiles fueled with oil of class ecl

$$NewAUTO_{ecl,coil} = \varphi_{ecl,coil}^{NewAUTO}\ NewAUTO_{ecl,th} \tag{1.34}$$

New thermic automobiles fueled with gas of class ecl

$$NewAUTO_{ecl,cgas} = NewAUTO_{ecl,th} - NewAUTO_{ecl,coil} \tag{1.35}$$

Share of New thermic automobiles fueled with oil of class ecl

$$\Delta\left(\varphi_{ecl,coil}^{NewAUTO}\right) = 0 \tag{1.36}$$

For simplicity, the share of the different types of thermic automobiles is assumed constant. Arbitrage between types of thermic automobiles can be added by modifying the above equation.

1.3.4 Level 5: Stock of automobiles

Stock of automobiles of class *ecl* **fueled with energy** *cea*
To write explicitly

Class *ecl* **fueled with energy** *cea* **automobiles destroyed**
Automobiles fueled with energy *cea*
Stock of class *ecl* **automobiles**

$$AUTO_{ecl} = AUTO_{ecl,cele} + AUTO_{ecl,th} \tag{1.37}$$

Thermic automobiles

$$AUTO_{th} = \sum_{ecl} AUTO_{ecl,th} \tag{1.38}$$

Stock of class *ecl* **thermic automobiles**

$$AUTO_{ecl,th} = AUTO_{ecl,coil} + AUTO_{ecl,cgas} \tag{1.39}$$

Automobiles fueled with energy *cea* **destroyed**
Automobiles destroyed
Class *ecl* **automobiles destroyed**
Class *ecl* **thermic automobiles destroyed**
Thermic automobiles destroyed

1.3.5 User cost of automobile

User energy cost of a class *ecl* **automobile fueled with energy** *cea*

$$UC^{E,AUTO}_{ecl,cea} = PE^{AUTO}_{ecl,cea} \frac{\left(1 + GR^{PE,AUTO,e}_{ecl,cea}\right)^{AUTO^{D}_{ecl,cea}-1}}{GR^{PE,AUTO,e}_{ecl,cea}\ AUTO^{D}_{ecl,cea}} \tag{1.40}$$

Energy price of a class *ecl* **automobile fueled with energy** *cea*

$$PE^{AUTO}_{ecl,cea}\ AUTO_{ecl,cea} = PCH_{cea}\ CH^{AUTO}_{cea}\ \frac{CH^{AUTO,toe}_{ecl,cea}}{CH^{AUTO,toe}_{cea}} \tag{1.41}$$

Growth rate of the energy price of an automobile of class *ecl* **fueled with energy** *cea*

$$\begin{aligned} GR^{PE,AUTO,e}_{ecl,cea} = {} & \alpha^{GR,PE,AUTO,e,1}.\ @\text{pchy}\ PE^{AUTO}_{ecl,cea,t-1} \\ & + \left(1 - \alpha^{GR,PE,AUTO,e,1}\right).GR^{PE,AUTO,e}_{ecl,cea,t-1} \end{aligned} \tag{1.42}$$

User capital cost of a class *ecl* **automobile fueled with energy** *cea*

$$UC^{K,AUTO}_{ecl,cea} = \Big(1 - R^{SUB,AUTO}_{ecl,cea}\Big) \frac{PNewAUTO_{ecl,cea}}{AUTO^{D}_{ecl,cea} \left(R^{CASH,AUTO}_{ecl,cea} + R^{LOAN,AUTO}_{ecl,cea} \; R^{I,AUTO}_{ecl,cea,t-1} \frac{LD^{AUTO}_{ecl,cea}}{\left(1-\left(1+R^{I,AUTO}_{ecl,cea,t-1}\right)^{\left(-LD^{AUT}_{ecl,c}\right.}\right.} \right.} \tag{1.43}$$

To write explicitly

Price of a new thermic automobiles fueled with oil of class *ecl*

$$\Delta\left(\log PNewAUTO_{ecl,coil}\right) = \Delta\left(\log PCH_{cveh}\right) \tag{1.44}$$

Price of a new thermic automobiles fueled with gas of class *ecl*

$$\Delta\left(\log PNewAUTO_{ecl,cgas}\right) = \Delta\left(\log PCH_{cveh}\right) \tag{1.45}$$

Price of a new electric automobiles of class *ecl*

$$PNewAUTO_{ecl,cele} = PNewAUTO_{ecl,coil} + Pbattery + overcost^{elec} \tag{1.46}$$

Price of a new automobiles of class *ecl*

$$\begin{aligned} PNewAUTO_{ecl} \; NewAUTO_{ecl} = {} & PNewAUTO_{ecl,cele} \; NewAUTO_{ecl,cele} \\ & + PNewAUTO_{ecl,th} \; NewAUTO_{ecl,th} \end{aligned} \tag{1.47}$$

Price of a new thermic automobiles of class *ecl*

$$\begin{aligned} & PNewAUTO_{ecl,th} \; NewAUTO_{ecl,th} \\ & = PNewAUTO_{ecl,coil} \; NewAUTO_{ecl,coil} \\ & \quad + PNewAUTO_{ecl,cgas} \; NewAUTO_{ecl,cgas} \end{aligned} \tag{1.48}$$

Price of a new automobiles

$$PNewAUTO.NewAUTO = \sum_{ecl} PNewAUTO_{ecl} \; NewAUTO_{ecl} \tag{1.49}$$

User maintenance cost of a class *ecl* **automobile fueled with energy** *cea*

$$UC^{M,AUTO}_{ecl,cea} = PCH_{cveh} \; \frac{MCperkm_{ecl,cea}}{100.\frac{kmPerAuto}{1000}} \tag{1.50}$$

User cost of an automobile

$$UC^{AUTO}.AUTO = \sum_{ecl} UC_{ecl}^{AUTO}\ AUTO_{ecl} \tag{1.51}$$

User cost of an automobile (for verification)

$$UC^{AUTO,bis} = UC^{K,AUTO} + UC^{E,AUTO} + UC^{M,AUTO} \tag{1.52}$$

User capital cost of an automobile

$$UC^{K,AUTO}.AUTO = \sum_{ecl} UC_{ecl}^{K,AUTO}\ AUTO_{ecl} \tag{1.53}$$

User energy cost of an automobile

$$UC^{E,AUTO}.AUTO = \sum_{ecl} UC_{ecl}^{E,AUTO}\ AUTO_{ecl} \tag{1.54}$$

User maintenance cost of an automobile

$$UC^{M,AUTO}.AUTO = \sum_{ecl} UC_{ecl}^{M,AUTO}\ AUTO_{ecl} \tag{1.55}$$

User cost of an automobile of class ecl

$$UC_{ecl}^{AUTO} = UC_{ecl}^{K,AUTO} + UC_{ecl}^{E,AUTO} + UC_{ecl}^{M,AUTO} \tag{1.56}$$

User cost of a class ecl **automobile fueled with energy** cea

$$UC_{ecl,cea}^{AUTO} = UC_{ecl,cea}^{K,AUTO} + UC_{ecl,cea}^{E,AUTO} + UC_{ecl,cea}^{M,AUTO} \tag{1.57}$$

User cost of a thermic automobile of class ecl

$$UC_{ecl,th}^{AUTO} = UC_{ecl,th}^{K,AUTO} + UC_{ecl,th}^{E,AUTO} + UC_{ecl,th}^{M,AUTO} \tag{1.58}$$

User capital cost of an automobile of class ecl

$$UC_{ecl}^{K,AUTO}\ AUTO_{ecl} = UC_{ecl,cele}^{K,AUTO}\ AUTO_{ecl,cele} + UC_{ecl,th}^{K,AUTO}\ AUTO_{ecl,th} \tag{1.59}$$

User capital cost of a thermic automobile of class ecl

$$UC_{ecl,th}^{K,AUTO}\ AUTO_{ecl,th} = UC_{ecl,coil}^{K,AUTO}\ AUTO_{ecl,coil} + UC_{ecl,cgas}^{K,AUTO}\ AUTO_{ecl,cgas} \tag{1.60}$$

User energy cost of an automobile of class ecl

$$UC_{ecl}^{E,AUTO}\ AUTO_{ecl} = UC_{ecl,cele}^{E,AUTO}\ AUTO_{ecl,cele} + UC_{ecl,th}^{E,AUTO}\ AUTO_{ecl,th} \tag{1.61}$$

User energy cost of a thermic automobile of class ecl

$$UC_{ecl,th}^{E,AUTO}\ AUTO_{ecl,th} = UC_{ecl,coil}^{E,AUTO}\ AUTO_{ecl,coil} + UC_{ecl,cgas}^{E,AUTO}\ AUTO_{ecl,cgas} \tag{1.62}$$

User maintenance cost of an automobile of class ecl

$$UC_{ecl}^{M,AUTO}\ AUTO_{ecl} = UC_{ecl,cele}^{M,AUTO}\ AUTO_{ecl,cele} + UC_{ecl,th}^{M,AUTO}\ AUTO_{ecl,th} \tag{1.63}$$

User maintenance cost of a thermic automobile of class ecl

$$UC_{ecl,th}^{M,AUTO}\ AUTO_{ecl,th} = UC_{ecl,coil}^{M,AUTO}\ AUTO_{ecl,coil} + UC_{ecl,cgas}^{M,AUTO}\ AUTO_{ecl,cgas} \tag{1.64}$$

1.3.6 Households' energy consumption related to transport

Kilometers by a class ecl **automobile fueled with energy** cea

$$km_{ecl,cea}^{AUTO} = km^{AUTO}.\frac{AUTO_{ecl,cea}}{AUTO} \tag{1.65}$$

Kilometers by class ecl **automobile**

$$km_{ecl}^{AUTO} = \sum_{cea} km_{ecl,cea}^{AUTO} \tag{1.66}$$

Total kilometers by automobile

$$km^{AUTO,bis} = \sum_{ecl} km_{ecl}^{AUTO} \tag{1.67}$$

Energy consumption of a class ecl **automobile fueled with energy** cea **expressed in tonne of oil equivalent**

$$CH_{ecl,cea}^{AUTO,toe} = km_{ecl,cea}^{AUTO}\ toePerKm_{ecl,cea} \tag{1.68}$$

Energy consumption of automobiles fueled with energy cea expressed in tonne of oil equivalent

$$CH_{cea}^{AUTO,toe} = \sum_{ecl} CH_{ecl,cea}^{AUTO,toe} \tag{1.69}$$

Households' final consumption of electricity (expressed in monetary unit)

$$\Delta\left(\log CH_{cea}^{AUTO}\right) = \Delta\left(\log CH_{cea}^{AUTO,toe}\right) \tag{1.70}$$

1.3.7 Debts and expenditures related to automobile

Debt related to the purshase of a class ecl automobile fueled with energy cea

$$\begin{aligned} DEBT_{ecl,cea}^{AUTO,VAL} = {} & DEBT_{ecl,cea,t-1}^{AUTO,VAL}\left(1 - R_{ecl,cea,t-1}^{RMBS,AUTO}\right) \\ & + R_{ecl,cea}^{LOAN,AUTO}\, PNewAUTO_{ecl,cea}\, NewAUTO_{ecl,cea}\left(1 \right. \\ & \left. - R_{ecl,cea}^{SUB,AUTO}\right) \end{aligned} \tag{1.71}$$

Expenditures related to the use of a class ecl automobile fueled with energy cea (in value)

$$\begin{aligned} EXP_{ecl,cea}^{AUTO,VAL} = {} & DEBT_{ecl,cea,t-1}^{AUTO,VAL}\left(R_{ecl,cea,t-1}^{I,AUTO} + R_{ecl,cea,t-1}^{RMBS,AUTO}\right) \\ & + R_{ecl,cea}^{CASH,AUTO}\, PNewAUTO_{ecl,cea}\, NewAUTO_{ecl,cea}\left(1 \right. \\ & \left. - R_{ecl,cea}^{SUB,AUTO}\right) \\ & + PCH_{cea}\, CH_{cea}^{AUTO}\, \frac{CH_{ecl,cea}^{AUTO,toe}}{CH_{cea}^{AUTO,toe} + UC_{ecl,cea}^{M,AUTO}\, AUTO_{ecl,cea}} \end{aligned} \tag{1.72}$$

Expenditures related to the use of a class ecl automobile (in value)

$$EXP_{ecl}^{AUTO,VAL} = \sum_{cea} EXP_{ecl,cea}^{AUTO,VAL} \tag{1.73}$$

Expenditures related to the use of an automobile fueled with energy *cea* (in value)

$$EXP_{cea}^{AUTO,VAL} = \sum_{ecl} EXP_{ecl,cea}^{AUTO,VAL} \tag{1.74}$$

Expenditures related to the use of an automobile (in value)

$$EXP^{AUTO,VAL} = \sum_{ecl} EXP_{ecl}^{AUTO,VAL} \tag{1.75}$$

Expenditures related to the use of an automobile (for verification)

$$EXP^{AUTO,VAL,bis} = \sum_{cea} EXP_{cea}^{AUTO,VAL} \tag{1.76}$$

Price of kilometer-travelers for short distance by automobile

$$P^{km,AUTO}.km^{AUTO} = EXP^{AUTO,VAL}.1000 \tag{1.77}$$

Price of kilometer-travelers for short distance by automobile

$$P^{km,trav,auto,SD}.km^{trav,auto,SD} = P^{km,AUTO}.\frac{km^{AUTO,SD}}{1000} \tag{1.78}$$

Price of kilometer-travelers for short distance by automobile

$$P^{km,trav,auto,LD}.km^{trav,auto,LD} = P^{km,AUTO}.\frac{km^{AUTO,LD}}{1000} \tag{1.79}$$

Price of kilometer-travelers for automobile transportation

$$\begin{aligned} P^{km,trav,auto}.km^{trav,auto} = {} & P^{km,trav,auto,LD}.km^{trav,auto,LD} \\ & + P^{km,trav,auto,SD}.km^{trav,auto,SD} \end{aligned} \tag{1.80}$$

Total kilometer-travelers by automobile

$$km^{trav,auto} = km^{trav,auto,LD} + km^{trav,auto,SD} \tag{1.81}$$

$$verif^{EXP,AUTO,VAL,bis} = \left(\frac{EXP^{AUTO,VAL,bis}}{EXP^{AUTO,VAL} - 1} \right).100 \tag{1.82}$$

$$verif^{AUTO,bis} = \left(\frac{AUTO^{bis}}{AUTO - 1} \right) .100 \tag{1.83}$$

$$verif^{km,AUTO,bis} = \left(\frac{km^{AUTO,bis}}{km^{AUTO} - 1} \right) .100 \tag{1.84}$$

$$verif_{ecl,th}^{NewAUTO,bis} = \left(\frac{NewAUTO_{ecl,th}^{,bis}}{NewAUTO_{ecl,th} - 1} \right) \ 100 \tag{1.85}$$

$$verif^{UC,AUTO,bis} = \left(\frac{UC^{AUTO,bis}}{UC^{AUTO} - 1} \right) .100 \tag{1.86}$$

2 Glossary

$AUTO$	Automobiles stock	1.20,	4
$AUTO_{ecl,th}$	Stock of class *ecl* thermic automobiles	1.39,	7
$AUTO_{ecl}$	Stock of class *ecl* automobiles	1.37,	7
$AUTO_{th}$	Thermic automobiles	1.38,	7
$AUTO^{bis}$		1.21,	4
$CH_{cea}^{AUTO,toe}$	Energy consumption of automobiles fueled with energy *cea* expressed in tonne of oil equivalent	1.69,	11
$CH_{ecl,cea}^{AUTO,toe}$	Energy consumption of a class *ecl* automobile fueled with energy *cea* expressed in tonne of oil equivalent	1.68,	10
CH_{cea}^{AUTO}	Households' final consumption of electricity (expressed in monetary unit)	1.70,	11
$DEBT_{ecl,cea}^{AUTO,VAL}$	Debt related to the purshase of a class *ecl* automobile fueled with energy *cea*	1.71,	11
$EXP^{AUTO,VAL}$	Expenditures related to the use of an automobile (in value)	1.75,	12
$EXP_{cea}^{AUTO,VAL}$	Expenditures related to the use of an automobile fueled with energy *cea* (in value)	1.74,	12
$EXP_{ecl,cea}^{AUTO,VAL}$	Expenditures related to the use of a class *ecl* automobile fueled with energy *cea* (in value)	1.72,	11
$EXP_{ecl}^{AUTO,VAL}$	Expenditures related to the use of a class *ecl* automobile (in value)	1.73,	11
$EXP^{AUTO,VAL,bis}$	Expenditures related to the use of an automobile (for verification)	1.76,	12
$GR_{ecl,cea}^{PE,AUTO,e}$	Growth rate of the energy price of an automobile of class *ecl* fueled with energy *cea*	1.42,	7
$innovation_{ecl}$	Bass innovation parameter for class *ecl* electric automobile	1.31,	6
km^{AUTO}	Total kilometers by automobile	1.19,	4

$km^{AUTO,LD}$	Kilometers for long distance by automobile	1.17,	4
$km^{AUTO,SD}$	Kilometers for short distance by automobile	1.18,	4
$km^{AUTO}_{ecl,cea}$	Kilometers by a class *ecl* automobile fueled with energy *cea*	1.65,	10
km^{AUTO}_{ecl}	Kilometers by class *ecl* automobile	1.66,	10
$km^{AUTO,bis}$	Total kilometers by automobile	1.67,	10
$km^{trav,auto}$	Total kilometer-travelers by automobile	1.81,	12
$km^{trav,auto,LD}$	Kilometer-travelers for long distance by automobile	1.12,	3
$km^{trav,auto,SD}$	Kilometer-travelers for short distance by automobile	1.14,	3
$km^{traveler,LD}$	Kilometer-travelers for long distance transport (by automobile and train)	1.7,	2
$km^{traveler,SD}$	Kilometer-travelers for short distance transport (by automobile and bus)	1.9,	2
$Km^{traveler}_{cair}$	Kilometer-travelers for air transport	1.6,	2
$km^{traveler}_{crai}$	Kilometer-travelers for transport by train	1.13,	3
$km^{traveler}_{croa}$	Kilometer-travelers for transport by road (bus)	1.16,	3
NCH^{AUTO}_{cea}		1.1,	1
NCH_{cth}	Necessary (minimum) households' final consumption for public transport commodities *cth*	1.2,	1
NCH_{cveh}		1.3,	1
$NewAUTO$	New automobiles	1.22,	4
$NewAUTO^{,bis}_{ecl,th}$	New thermic automobiles of class *ecl* (for verification)	1.33,	6
$NewAUTO_{ecl,cele}$	New electric automobiles of class *ecl*	1.28,	5
$NewAUTO_{ecl,cgas}$	New thermic automobiles fueled with gas of class *ecl*	1.35,	6
$NewAUTO_{ecl,coil}$	New thermic automobiles fueled with oil of class *ecl*	1.34,	6
$NewAUTO_{ecl,th}$	New thermic automobiles of class *ecl*	1.32,	6

$NewAUTO_{ecl}$	New automobiles of class *ecl*	1.23,	4
$P^{km,AUTO}$	Price of kilometer-travelers for short distance by automobile	1.77,	12
$P^{km,trav,auto}$	Price of kilometer-travelers for automobile transportation	1.80,	12
$P^{km,trav,auto,LD}$	Price of kilometer-travelers for short distance by automobile	1.79,	12
$P^{km,trav,auto,SD}$	Price of kilometer-travelers for short distance by automobile	1.78,	12
$P^{km,traveler,LD}$	Price of long distance Kilometer-traveler (automobile and train)	1.8,	2
$P^{km,traveler,SD}$	Price of short distance Kilometer-traveler (by automobile and bus)	1.10,	2
$P_{cth}^{km,traveler}$	Price of public transport commodities *cth* (train, road and air)	1.4,	1
$PE_{ecl,cea}^{AUTO}$	Energy price of a class *ecl* automobile fueled with energy *cea*	1.41,	7
$\varphi^{km^{trav,auto,LD}}$	Share of Kilometer-travelers by automobile into the long distance Kilometer-travelers	1.11,	3
$\varphi^{km^{trav,auto,SD}}$	Share of Kilometer-travelers by automobile into the short distance Kilometer-travelers	1.15,	3
$\varphi_{ecl,cele}^{NewAUTO^n}$	Notional share of class *ecl* electric automobile	1.30,	6
$\varphi_{ecl}^{NewAUTO^n}$	Notional share of class *ecl* automobile	1.26,	5
$\varphi_{ecl,cele}^{NewAUTO}$	Share of class *ecl* electric automobile	1.29,	5
$\varphi_{ecl,coil}^{NewAUTO}$	Share of New thermic automobiles fueled with oil of class *ecl*	1.36,	6
$\varphi_{ecl}^{NewAUTO}$	Share of class *ecl* automobiles	1.27,	5
$PNewAUTO$	Price of a new automobiles	1.49,	8
$PNewAUTO_{ecl,cele}$	Price of a new electric automobiles of class *ecl*	1.46,	8
$PNewAUTO_{ecl,cgas}$	Price of a new thermic automobiles fueled with gas of class *ecl*	1.45,	8

$PNewAUTO_{ecl,coil}$	Price of a new thermic automobiles fueled with oil of class *ecl*	1.44,	8
$PNewAUTO_{ecl,th}$	Price of a new thermic automobiles of class *ecl*	1.48,	8
$PNewAUTO_{ecl}$	Price of a new automobiles of class *ecl*	1.47,	8
$R^{I,AUTO}_{ecl,cea}$	Interest rate paid for an investment in a class *ecl* automobile fueled with energy *cea*	1.5,	1
$SUM^{EXP,U,AUTO}$	Exponential sum of the utilities of automobile per class	1.25,	5
U^{AUTO}_{ecl}	Utility of a automobile of class *ecl*	1.24,	5
UC^{AUTO}	User cost of an automobile	1.51,	9
$UC^{AUTO}_{ecl,cea}$	User cost of a class *ecl* automobile fueled with energy *cea*	1.57,	9
$UC^{AUTO}_{ecl,th}$	User cost of a thermic automobile of class *ecl*	1.58,	9
UC^{AUTO}_{ecl}	User cost of an automobile of class *ecl*	1.56,	9
$UC^{AUTO,bis}$	User cost of an automobile (for verification)	1.52,	9
$UC^{E,AUTO}$	User energy cost of an automobile	1.54,	9
$UC^{E,AUTO}_{ecl,cea}$	User energy cost of a class *ecl* automobile fueled with energy *cea*	1.40,	7
$UC^{E,AUTO}_{ecl,th}$	User energy cost of a thermic automobile of class *ecl*	1.62,	10
$UC^{E,AUTO}_{ecl}$	User energy cost of an automobile of class *ecl*	1.61,	10
$UC^{K,AUTO}$	User capital cost of an automobile	1.53,	9
$UC^{K,AUTO}_{ecl,cea}$	User capital cost of a class *ecl* automobile fueled with energy *cea*	1.43,	8
$UC^{K,AUTO}_{ecl,th}$	User capital cost of a thermic automobile of class *ecl*	1.60,	9
$UC^{K,AUTO}_{ecl}$	User capital cost of an automobile of class *ecl*	1.59,	9
$UC^{M,AUTO}$	User maintenance cost of an automobile	1.55,	9
$UC^{M,AUTO}_{ecl,cea}$	User maintenance cost of a class *ecl* automobile fueled with energy *cea*	1.50,	8

$UC_{ecl,th}^{M,AUTO}$	User maintenance cost of a thermic automobile of class ecl	1.64, 10
$UC_{ecl}^{M,AUTO}$	User maintenance cost of an automobile of class ecl	1.63, 10
$verif^{AUTO,bis}$		1.83, 13
$verif^{EXP,AUTO,VAL,bis}$		1.82, 12
$verif^{km,AUTO,bis}$		1.84, 13
$verif_{ecl,th}^{NewAUTO,bis}$		1.85, 13
$verif^{UC,AUTO,bis}$		1.86, 13