Appendix C: Equations of the model

This appendix provides all the equations of the model. Note that there are two versions of the household block: (1) the standard version where a LES utility function is assumed for all commodities; (2) the hybrid version where transport, car, housing and energy consumption are modeled separately.

In this appendix, lower-case variables are in logarithm $x_t = ln(X_t)$. t as an index is the time operator. Variable in first difference and growth rate are respectively referred as : $\Delta X_t = X_t - X_{t-1}$ and $\dot{X}_t = \frac{X_t}{X_{t-1}} - 1 \approx \Delta x_t$. All parameters written in Greek letter are positive. n as an exponent refers to notional value of a given variable that is the optimal value desired by the maximization agent: e.g. X_t^n is the notional value of variable X_t. Because of adjustment constraint, effective values adjust slowly to their notional value. The time index t is omitted when no confusion arises, e.g. $X = X_t$.

1 Aggregate equilibrium

Since each relation is written in value and in volume, the value equation defines the price.

Equilibrium for domestically produced commodities (value & volume):

$$PQD_c.QD_c = PCID_c.CID_c + PCHD_c.CD_c + PGD_c.GD_c + PID_c.ID_c + PXD_c.XD_c + PDSD_c.DSD_c \tag{1.1}$$

$$QD_c = CID_c + CHD_c + GD_c + ID_c + XD_c + DSD_c \tag{1.2}$$

Equilibrium for imported commodities (value & volume):

$$PQM_c.QM_c = PCIM_c.CIM_c + PCHM_c.CHM_c + PGM_c.GM_c + PIM_c.IM_c + PXM_c.XM_c + PDSM_c.DSM_c \tag{1.3}$$

$$QM_c = CIM_c + CHM_c + GM_c + IM_c + XM_c + DSM_c \tag{1.4}$$

Aggregate equilibrium : calculation for variable " Var" :

var= {Q (production of commodities at market price); CH (households'consumption); G (public spendings); I (private investiment); DS (change in inventories); }

$$Pvar_c.var_c = PvarD_c.varD_c + PvarM_c.varM_c \tag{1.5}$$

$$var_c = varD_c + varM_c \tag{1.6}$$

Equilibrium for exports c (value):

$$PX_c.X_c = PXD_c.XD_c + PXM_c.XM_c \tag{1.7}$$

The volume of export per commodities is defined by the foreign demand.

Calculation of aggregates for variable "var":

var = {Q (Production of commodities at market price); CH (Households'consumption); G (Public spendings); X (Export); DS (Change in inventories); CI (Intermediate raw material); MT (Transport margins); MC (Commercial margins)}

Aggregate domestically produced variable "var" (value & volume):

$$PvarD.varD = \sum_c PvarD_c.varD_c \tag{1.8}$$

$$varD = \sum_c varD_c \tag{1.9}$$

Aggregate imported variable "var" (value & volume):

$$PvarM.varM = \sum_c PvarM_c.varM_c \tag{1.10}$$

$$varM = \sum_c varM_c \tag{1.11}$$

Aggregate variable "var" (value & volume):

$$Pvar.var = PvarD.varD + PvarM.varM \tag{1.12}$$

$$var = varD + varM \tag{1.13}$$

Equilibrium for intermediary raw material consumption domestically produced (value & volume):

$$PCID_c.CID_c = \sum_a PCID_{c,a}.CID_{c,a} \tag{1.14}$$

$$CID_c = \sum_a CID_{c,a} \tag{1.15}$$

Equilibrium for imported intermediary raw material (value & volume):

$$PCIM_c.CIM_c = \sum_a PCIM_{c,a}.CIM_{c,a} \tag{1.16}$$

$$CIM_c = \sum_a CIM_{c,a} \tag{1.17}$$

Domestic intermediary raw material consumption c by activity a (value & volume):

$$\begin{aligned} PCID_{c,a} &= PMATD_c \quad if\ c = \{1, ..., 20\} \\ PCID_{c,a} &= PED_c \quad if\ c = \{21, ..., 24\} \end{aligned} \tag{1.18}$$

$$\begin{aligned} CID_{c,a} &= MATD_{c,a} \quad if\ c = \{1, ..., 20\} \\ CID_{c,a} &= ED_{c,a} \quad if\ c = \{21, ..., 24\} \end{aligned} \tag{1.19}$$

Imported intermediary raw material consumption c by activity a (value & volume):

$$\begin{aligned} PCIM_{c,a} &= PMATD_c \quad if\ c = \{1, ..., 20\} \\ PCIM_{c,a} &= PED_c \quad if\ c = \{21, ..., 24\} \end{aligned} \tag{1.20}$$

$$\begin{aligned} CIM_{c,a} &= MATD_{c,a} \quad if\ c = \{1, ..., 20\} \\ CIM_{c,a} &= ED_{c,a} \quad if\ c = \{21, ..., 24\} \end{aligned} \tag{1.21}$$

Aggregation of importations at base price (value & volume)

$$PM.M = \sum_c PM_c.M_c \tag{1.22}$$

$$M = \sum_c M \tag{1.23}$$

GDP (value & volume):

Product definition:

$$PGDP.GDP = PCH.CH + PI.I + PG.G + PDS.DS + PX.X - PM.M \tag{1.24}$$

$$GDP = CH + I + IG + G + DS + X - M \tag{1.25}$$

Product definition 2 (verification):

$$PGDP_c.GDP_c = PCH_c.CH_c + PI_c.I_c + PG_c.G_c + PDS_c.DS_c + PX_c.X_c - PM_c.M_c \tag{1.26}$$

$$GDP_c = CH_c + I_c + GD_c + DS_c + XD_c - M_c \tag{1.27}$$

$$PGDPbis.GDPbis = \sum_c PGDP_c.GDP_c \tag{1.28}$$

$$GDPbis = \sum_c GDP_c \tag{1.29}$$

Value-added definition:

$$PGDPter.GDPter = PVA.VA + PTAX.TAX + PSUB.SUB \tag{1.30}$$

$$GDPter = VA + TAX + SUB \tag{1.31}$$

Subventions are negative.

Equilibrium for production for domestically produced commodities at basic price (volume):

$$\begin{aligned} YQ_c.PYQ_c \quad = \quad & PQD_c.QD_c - PVATD_c.VATD_c - POTHTD_c.OTHTD_c - PSUB_c.SUB_c \\ & - (PMCD_c.MCD_c + PMTD_c.MTD_c) - PENERTD_c.ENERTD_c \end{aligned} \tag{1.32}$$

$$YQbis_c = QD_c - VATD_c - OTHTD_c - SUB_c - (MCD_c + MTD_c) - ENERTD_c \tag{1.33}$$

Equilibrium for imported produced commodities at basic price (volume):

$$\begin{aligned} M_c.PM_c \quad = \quad & PQM_c.QM_c - PVATM_c.VATM_c - POTHTM.OTHTM_c \\ & - (PMCM_c.MCM_c + PMTM_c.MTM_c) - PENERTM_c.ENERTM_c \end{aligned} \tag{1.34}$$

$$Mbis_c = QM_c - VATM_c - OTHTM_c - (MCM_c + MTM_c) - ENERTM_c \tag{1.35}$$

Aggregate transport margins paid on the domesticaly produced commodity $c \neq \{14, ..., 18\}$ (value & volume):

$$PMTD_c.MTD_c = \sum_{m=14}^{18} PMTD_{m,c}.MTD_{m,c} \tag{1.36}$$

$$MTD_c = \sum_{m=14}^{18} MTD_{m,c} \tag{1.37}$$

Aggregate transport margins paid on imported commodity $c \neq \{14, ..., 18\}$ (value & volume):

$$PMTM_c.MTM_c = \sum_{m=14}^{18} PMTM_{m,c}.MTM_{m,c} \tag{1.38}$$

$$MTM_c = \sum_{m=14}^{18} MTM_{m,c} \tag{1.39}$$

Aggregate transport margins for the commodities c (value & volume):

$$PMT_c.MT_c = PMTD_c.MTD_c + PMTM_c.MTM_c \tag{1.40}$$

$$MT_c = MTD_c + MTM_c \tag{1.41}$$

Domestically produced agregate investment (value & volume):

$$PID_c.ID_c = \sum_a PIAD_c.IAD_{c,a} \tag{1.42}$$

$$ID_c = \sum_a IAD_{c,a} \tag{1.43}$$

Imported agregate investment (value & volume):

$$PIM_c.IM_c = \sum_a PIAM_c.IAM_{c,a} \tag{1.44}$$

$$IM_c = \sum_a IAM_{c,a} \tag{1.45}$$

Value-added in activity a (value & volume)

$$PVA_aVA_a = PY_aY_a - PMAT_a.MAT_a - PE_a.E_a \tag{1.46}$$

$$VA_a = Y_a - MAT_a - E_a \tag{1.47}$$

Aggregate value-added (value & volume)

$$PVA.VA = \sum_a PVA_aVA_a \tag{1.48}$$

$$VA = \sum_a VA_a \tag{1.49}$$

EBE in activity a (value & volume)

$$PEBE_aEBE_a = PVA_aVA_a - CL\_S_a.L\_S_a.PROG_a - PSY_a.SY_a - PIY_a.IY_a \tag{1.50}$$

$$EBE_a = VA_a - \frac{CL\_S_a.L\_S_a.PROG_a}{PEBE_a} - SY_a - IY_a \tag{1.51}$$

Aggregate EBE (value & volume)

$$PEBE.EBE = \sum_a PEBE_aEBE_a \tag{1.52}$$

$$EBE = \sum_a EBE_a \tag{1.53}$$

Aggregate production (value & volume)

$$PY.Y = \sum_a PY_aY_a \tag{1.54}$$

$$Y = \sum_a Y_a \tag{1.55}$$

2 The Producer

Domestic production of commodity c by activity a (value and volume):

$$PYQ_c.YQ_c = \sum_c PY_a.Y_{c,a} \tag{2.1}$$

$$Y_{c,a} = \varphi_{c,a}YQ_c \tag{2.2}$$

To facilitate the calibration this equation can be written: $ln\left(Y_{c,a}\right) = ln\left(YQ_c\right) + ln\left(\varphi_{c,a}\right)$. E-views will calculate automatically $ln\left(\varphi_{c,a}\right)$ as an add factor. There is no need to calibrate the share of commodity c produced by activity a $\varphi_{c,a}$. To verify that $\sum_a \varphi_{c,a} = 1$, one can check that $\sum_a ln\left(\varphi_{c,a}\right) = 0$.

Aggregate (domestic) production of activity a (volume):

$$Y_a = \sum_a Y_{c,a} \tag{2.3}$$

Level I:

Demand for input in activity a:

$$\Delta k^n_{a,t} = \Delta y_{a,t} - \Delta prog^K_{a,t} + \Delta SUBST\_K_{a,t} \tag{2.4}$$
$$\Delta SUBST\_K^n_{a,t} = -\eta^{KL}_a \varphi^L_{a,t-1} \Delta(c^K_{a,t} - c^L_{j,t}) - \eta^{KE}_a \varphi^E_{a,t-1} \Delta(c^K_{a,t} - p^E_{a,t}) - \eta^{KMat}_a \varphi^{Mat}_{a,t-1} \Delta(c^K_{a,t} - p^{Mat}_{a,t})$$

$$\Delta l^n_{a,t} = \Delta y_{a,t} - \Delta prog^L_{a,t} + \Delta SUBST\_L_{a,t} \tag{2.5}$$
$$\Delta SUBST\_L^n_{a,t} = -\eta^{KL}_a \varphi^K_{a,t-1} \Delta(c^L_{a,t} - c^K_{a,t}) - \eta^{LE}_a \varphi^E_{a,t-1} \Delta(c^L_{a,t} - p^E_{a,t}) - \eta^{LM}_j \varphi^{Mat}_{a,t-1} \Delta(c^L_{a,t} - p^{Mat}_{a,t})$$

Assuming that the adjustment process is defined according to Equations (8.1), (8.2) and (8.3), the full dynamic for labor is also defined by the three following additional relations:

$$ln(L_{a,t}) = \lambda^L_0 . ln(L^n_{a,t}) + (1 - \lambda^L_0) ln(L_{a,t-1} + \Delta ln(L^e_{a,t}))$$
$$\Delta ln(L^e_{a,t}) = \lambda^L_1 . \Delta ln(L^e_{a,t-1}) + \lambda^L_2 . \Delta ln(L_{a,t-1}) + \lambda^L_3 . \Delta ln(L^n_{a,t}) + \lambda^L_4 . \Delta ln(L_{a,t+1})$$
$$SUBST\_L_{a,t} = \lambda^L_5 . SUBST\_L^n_{a,t} + (1 - \lambda^L_5) . SUBST\_L_{a,t-1}$$

For the sake of concision, the representation of adjustment dynamic [Equations(8.1),(8.2) and(8.3)] is not reproduced for each variable. Only notional variables are presented in the rest of the document.

$$\Delta e^n_{a,t} = \Delta y_{a,t} - \Delta prog^E_{a,t} + \Delta SUBST\_E_{a,t} \tag{2.6}$$
$$\Delta SUBST\_E^n_{a,t} = -\eta^{KE}_a \varphi^K_{a,t-1} \Delta(p^E_{a,t} - c^K_{a,t}) - \eta^{LE}_a \varphi^L_{a,t-1} \Delta(p^E_{a,t} - c^L_{a,t}) - \eta^{EMat}_a \varphi^{Mat}_{a,t-1} \Delta(p^E_{a,t} - p^{Mat}_{a,t})$$

$$\Delta mat^n_{a,t} = \Delta y_{a,t} - \Delta prog^{Mat}_{a,t} + \Delta SUBST\_Mat_{a,t} \tag{2.7}$$
$$\Delta SUBST\_Mat^n_{a,t} = -\eta^{KLMat}_j \varphi^K_{a,t-1} \Delta(p^{Mat}_{a,t} - c^K_{a,t}) - \eta^{LMat}_a \varphi^L_{a,t-1} \Delta(p^{Mat}_{a,t} - c^L_{a,t}) - \eta^{EMat}_a \varphi^E_{a,t-1} \Delta(p^E_{a,t} - p^{Mat}_{a,t})$$

with $\varphi^j_a = \frac{P^{Input}_{j,a} I^{Input}_{j,a}}{\sum_j P^{Input}_{j,a} I^{Input}_{j,a}}$ and $j = \{K, L, E, Mat\}$

Commodity type c investment in activity a:

$$\Delta ia_{c,a} = \Delta ia_a \tag{2.8}$$

Aggregate capital stock in activity a (value & volume):

$$PK_{a,t}.K_{a,t} = PK_{a,t-1}K_{a,t-1}(1-\delta_a) + PIA_{a,t}.IA_{a,t} \tag{2.9}$$

$$K_{a,t} = K_{a,t-1}(1-\delta_a) + IA_{a,t} \tag{2.10}$$

$$\Delta ia_{a,t} = \rho_1^{IA}.\Delta ia_{a,t-1} + \rho_2^{IA}\Delta y_{a,t}^e + \rho_3^{IA}(k_{a,t-1}^n - k_{a,t-1}) + \rho_4^{IA}.\Delta SUBST_a^K \tag{2.11}$$

$$y_{a,t}^e = \rho_1^{ye}.\Delta y_{a,t-1}^e + \rho_2^{ye}\Delta y_{a,t} \tag{2.12}$$

The equation gives the average price of the installed capital capacity. Because the capital depreciation rate is lower that 1, the average price of the installed capital is lower than the investment price. When the economy is at the steady state $PK_a = PIA_a \frac{(\delta_a+\mu)(1+\pi)}{\delta_a - 1 + (1+\mu)(1+\pi)}$. This relation was used to calibrate the base year.

Transport margins $m = \{14, ..., 18\}$ paid on domestic commodities $c \neq m$ (volume):

$$\Delta mtd_{m,c} = \Delta yq_c + \Delta SUBST\_MTD_{m,c} \; for \; c \neq m \tag{2.13}$$

$$\Delta SUBST\_MTD_{m,c}^n = -\sum_{m'=14}^{18} \eta^{m,m'} \varphi_{mtd',c} \Delta(p_m^E - p_{m'}^E)$$

Transport margins $m = \{14, ..., 18\}$ paid on imported commodities $c \neq m$ (volume):

$$\Delta mtm_{m,c} = \Delta m_c + \Delta SUBST\_MTM_{m,c} \; for \; c \neq m \tag{2.14}$$

$$\Delta SUBST\_MTM_{m,c}^n = -\sum_{m'=14}^{18} \eta^{m,m'} \varphi_{mtd',c} \Delta(p_m^E - p_{m'}^E)$$

Commercial margins $m = 19$ paid on domestic commodities $c \neq 19$ (volume):

$$\Delta mcd_c = \Delta yq_c \; for \; c \neq 19 \tag{2.15}$$

Commercial margins $m = 19$ paid on imported commodities $c \neq 19$ (volume):

$$\Delta mcm_c = \Delta m_c \; for \; c \neq 19 \tag{2.16}$$

Stock/inventories for commodity c (domestic & imported):

We assume that inventories are equal to a share of the annual production $\alpha_c^S = (Number\, of\, days\, of\, sales)/365$.

$$DSD_c = \Delta SD_c \tag{2.17}$$

$$SD_c^n = \alpha_c^S (CID_c + CHD_c + GD_c + ID_c + XD_c) \tag{2.18}$$

$$DSM_c = \Delta SM_c \tag{2.19}$$

$$SM_c^n = \alpha_c^S (CIM_c + CHM_c + GM_c + IM_c + XM_c) \tag{2.20}$$

Level II:

Notional demand in energy c by activity a

$$\Delta e_{c,a} = \Delta e_a + \Delta SUBST\_E_{c,a} \tag{2.21}$$

$$\Delta SUBST\_E_{c,a,t}^n = -\sum_{c'=21}^{24} \eta^{cc'} \varphi_{c',a,t-1} \Delta \left(\frac{P_{c,a,t-1}^{TEP}}{P_{c',a,t-1}^{TEP}} . p_{c,a,t}^E - \frac{P_{c',a,t-1}^{TEP}}{P_{c,a,t-1}^{TEP}} . p_{c',a,t}^E \right)$$

Note that here the notional variable is not presented since we assume that the adjustment is instantaneous. However there is still a dynamic for substitution according to the adjustment process defined by Equation (8.3):

Self employed and employed

$$\begin{aligned} \Delta L\_S_a &= \Delta L_a \\ L\_SE_a &= L_a - L\_S_a \end{aligned} \tag{2.22}$$

$$L\_S = \sum_a L\_S_a \tag{2.23}$$

$$L\_SE = \sum_a L\_SE_a \tag{2.24}$$

Notional demand for material i of the sector a

$$\Delta mat_{c,a} = \Delta mat_a + \Delta SUBST\_MAT_{c,a} \tag{2.25}$$

$$\Delta SUBST\_MAT_{c,a,t}^n = -\sum_{c'=14}^{18} \eta^{cc'} \varphi_{c',a,t-1} \Delta (p_{c,a,t}^{Mat} - p_{c',a,t}^{Mat})$$

Level III:

Demand for imported material c of the sector a (for c=1...20)

$$\Delta matm^{n}_{c,a} = \Delta mat_{c,a} + \Delta SUBST\_MATM_{c,a} \tag{2.26}$$
$$\Delta SUBST\_MATM^{n}_{c,a,t} = -\eta^{cd,cm}\varphi_{c,a,t-1}\Delta(p^{MatM}_{c,t} - p^{MatD}_{c,t})$$

Demand for domestic material c of the sector a (for c=1...20)

$$\Delta matd^{n}_{c,a,t} = \Delta mat_{c,a,t} + \Delta SUBST\_MATD_{a,t} \tag{2.27}$$
$$\Delta SUBST\_MATD^{n}_{c,a,t} = -\eta^{cd,cm}\varphi_{c,a,t-1}\Delta(p^{MatD}_{c,t} - p^{MatM}_{c,t})$$

Demand for imported energy c of the sector a (for c=21...24)

$$\Delta em_{c,a,t} = \Delta e_{c,a,t} + \Delta SUBST\_EM_{c,a,t} \tag{2.28}$$
$$\Delta SUBST\_EM^{n}_{c,a,t} = -\eta^{cm,cd}\varphi^{EM}_{c,a,t-1}\Delta(p^{EM}_{c,t} - p^{ED}_{c,t})$$

Demand for domestic energy c of the sector a (for c=21...24)

$$\Delta ed_{c,a} = \Delta e_{c,a} + \Delta SUBST\_ED_{c,a} \tag{2.29}$$
$$\Delta SUBST\_ED^{n}_{c,a,t} = -\eta^{cd,cm}\varphi^{ED}_{c,a,t-1}\Delta(p^{ED}_{c,t} - p^{EM}_{c,t})$$

Allocation of Investment between Import and Domestic:

Import:

$$\Delta iam_{c,a} = \Delta ia_{c,a} + \Delta SUBST\_IAM_{c,at} \tag{2.30}$$
$$\Delta SUBST\_IAM^{n}_{c,a,t} = -\eta^{cd,cm}\varphi^{IAM}_{c,a,t-1}\Delta(p^{IAM}_{c,t} - p^{IAD}_{c,t})$$

Domestic:

$$\Delta iad_{c,a,t} = \Delta ia_{c,a,t} + \Delta SUBST\_IAD_{c,a,t} \tag{2.31}$$
$$\Delta SUBST\_IAD^{n}_{c,a,t} = -\eta^{cd,cm}\varphi^{IAM}_{c,a,t-1}\Delta(p^{IAD}_{c} - p^{IAM}_{c})$$

Transport margins $m = \{14, ..., 18\}$ domesticly produced (value & volume):

$$PMTD_m.MTD_m = -\frac{YQ_m}{YQ_m + M_m}\sum_c (PMTD_{m,c}.MTD_{m,c} + PMTM_{m,c}.MTM_{m,c}) \;\; for\; c \neq m \tag{2.32}$$

$$MTD_m = -\frac{YQ_m}{YQ_m + M_m} \sum_c (MTD_{m,c} + MTM_{m,c}) \ \ for\ c \neq m \qquad (2.33)$$

Imported transport margins $m = \{14, ..., 18\}$ (value & volume):

$$PMTM_m.MTM_m = -\frac{M_m}{YQ_m + M_m} \sum_c (PMTD_{m,c}.MTD_{m,c} + PMTM_{m,c}.MTM_{m,c}) \ \ for\ c \neq m \qquad (2.34)$$

$$MTM_m = -\frac{M_m}{YQ_m + M_m} \sum_c (MTD_{m,c} + MTM_{m,c}) \ \ for\ c \neq m \qquad (2.35)$$

Commercial margins domesticly produced (value & volume):

$$PMCD_{19}.MCD_{19} = -\frac{YQ_{19}}{YQ_{19} + M_{19}} \sum_c (PMCD_c.MCD_c + PMCM_c.MCM_c) \ \ for\ c \neq 19 \qquad (2.36)$$

$$MCD_{19} = -\frac{YQ_{19}}{YQ_{19} + M_{19}} \sum_c (MCD_c + MCM_c) \ \ for\ c \neq 19 \qquad (2.37)$$

Imported commercial margins (value & volume):

$$PMCM_{19}.MCM_{19} = -\frac{M_{19}}{YQ_{19} + M_{19}} \sum_c (PMCD_c.MCD_c + PMCM_c.MCM_c) \ \ for\ c \neq 19 \qquad (2.38)$$

$$MCM_{19} = -\frac{M_{19}}{YQ_{19} + M_{19}} \sum_c (MCD_c + MCM_c) \ \ for\ c \neq 19 \qquad (2.39)$$

Export

$$\begin{aligned} \Delta x_{c,t} &= \Delta wd_{c,t} + \Delta SUBST\_X_{c,t} \qquad (2.40) \\ \Delta SUBST\_X^n_{c,t} &= -\eta^x \Delta(p^X_{c,t} - tc.p^W_{c,t}) \end{aligned}$$

Exportations of domestic products:

$$\begin{aligned} \Delta xd_{c,t} &= \Delta x_{c,t} + \Delta SUBST\_XD_{c,t} \qquad (2.41) \\ \Delta SUBST\_XD^n_{c,t} &= -\eta^{xd} \varphi^{XM}_{c,t-1} \Delta(p^{XD}_{c,t} - p^{XM}_{c,t}) \end{aligned}$$

Exportations of imported products:

$$\Delta xm_{c,t} = \Delta x_{c,t} + \Delta SUBST\_XM_{c,t} \tag{2.42}$$
$$\Delta SUBST\_XM^{n}_{c,t} = -\eta^{xd}\varphi^{XD}_{c,t-1}\Delta(p^{XM}_{c,t} - p^{XD}_{c,t})$$

External balance

$$DC\_VAL_a = PX_a.X_a - PM_a.M_a \tag{2.43}$$

$$DC\_VAL = \sum_a DC\_VAL_a \tag{2.44}$$

3 The government

Tax on energy c domestically produced (value & volume):

$$PENERTD_{c,t}.ENERTD_{c,t} = T^{ENERTD}_{c,t}.YQ_{c,t} \tag{3.1}$$

$$ENERTD_{c,t} = T^{ENERTD}_{c,0}.YQ_{c,t} \tag{3.2}$$

We assume that the tax is proportional to the quantity produced. Only the 4 energy sectors pay this tax: TIPP, TICE, etc.

Tax on imported energy c (value & volume):

$$PENERTM_{c,t}.ENERTM_{c,t} = T^{ENERTM}_{c,t}.M_{c,t} \tag{3.3}$$

$$ENERTM_{c,t} = T^{ENERTM}_{c,0}.M_{c,t} \tag{3.4}$$

Tax on energy c (value & volume):

$$PENERT_c.ENERT_c = PENERTM_c.ENERTM_c + PENERTD_c.ENERTD_c \tag{3.5}$$

$$ENERT_c = ENERTM_c + ENERTD_c \tag{3.6}$$

Agregate tax on energy (value & volume):

$$PENERT.ENERT = \sum_c PENERT_c.ENERT_c \tag{3.7}$$

$$ENERT = \sum_c ENERT_c \tag{3.8}$$

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VAT tax on commodity c (value & volume):

$$PVATD_{c,t}.VATD_{c,t} = \frac{PCHD_{c,t}.CHD_{c,t}}{1+T_{c,t}^{VATD}} + T_{c,t}^{VATD_{oth}} \frac{PID_{c,t}.ID_{c,t} + PCID_{c,t}.CID_{c,t} + PGD_{c,t}.GD_{c,t}}{1+T_{c,t}^{VATD_{oth}}} \tag{3.9}$$

$$VATD_{c,t} = T_{c,0}^{VATD} \frac{CHD_{c,t}}{1+T_{c,0}^{VATD}} + T_{c,o}^{VATD_{oth}} \frac{ID_{c,t} + CID_{c,t} + GD_{c,t}}{1+T_{c,0}^{VATD_{oth}}} \tag{3.10}$$

$$PVATM_{c,t}.VATM_{c,t} = T_{c,t}^{VATM} \frac{PCHM_{c,t}.CHM_{c,t}}{1+T_{c,t}^{VATM}} + T_{c,t}^{VATM_{oth}} \frac{PIM_{c,t}.IM_{c,t} + PCIM_{c,t}.CIM_{c,t} + PGM_{c,t}.GM_{c,t}}{1+T_{c,t}^{VATM_{oth}}} \tag{3.11}$$

$$VATM_{c,t} = T_{c,0}^{VATM} \frac{CHM_{c,t}}{1+T_{c,0}^{VATM}} + T_{c,0}^{VATM_{oth}} \frac{IM_{c,t} + CIM_{c,t} + GM_{c,t}}{1+T_{c,0}^{VATM_{oth}}} \tag{3.12}$$

VAT tax on commodity c (value & volume):

$$PVAT_c.VAT_c = PVATD_c.VATD_c + PVATM_c.VATM_c \tag{3.13}$$

$$VAT_c = VATD_c + VATM_c \tag{3.14}$$

Agregate VAT (value & volume):

$$PVAT.VAT = \sum_c PVAT_c.VAT_c \tag{3.15}$$

$$VAT = \sum_c VAT_c \tag{3.16}$$

Other tax on commodity c (value & volume):

$$POTHTD_{c,t}.OTHTD_{c,t} = T_{c,t}^{OTHTD}.PYQ_{c,t}.YQ_{c,t} \tag{3.17}$$

$$OTHTD_{c,t} = T_{c,0}^{OTHTD}.YQ_{c,t} \tag{3.18}$$

$$POTHTM_{c,t}.OTHTM_{c,t} = T_{c,t}^{OTHTM}.PM_{c,t}.M_{c,t} \tag{3.19}$$

$$OTHTM_{c,t} = T_{c,0}^{OTHTM}.M_{c,t} \tag{3.20}$$

Other tax on commodity c (value & volume):

$$POTHT_c.OTHT_c = POTHTD_c.OTHTD_c + POTHTM_c.OTHTM_c \tag{3.21}$$

$$OTHT_c = OTHTD_c + OTHTM_c \tag{3.22}$$

Agregate other tax (value & volume):

$$POTHT.OTHT = \sum_c POTHT_c.OTHT_c \tag{3.23}$$

$$OTHT = \sum_c OTHT_c \tag{3.24}$$

Total tax on commodity (value & volume):

$$PTAX._cTAX_c = PVAT_c.VAT_c + PENERT_c.ENERT_c + POTHT_c.OTHT_c \tag{3.25}$$

$$TAX_c = VAT_c + ENERT_c + OTHT_c \tag{3.26}$$

Agregate tax (value & volume):

$$PTAX.TAX = \sum_c PTAX_c.TAX_c \tag{3.27}$$

$$TAX = \sum_c TAX_c \tag{3.28}$$

Taxes on benefits (value & volume):

$$PIS_a.IS_{a,t} = T_t^{IS}.PEBE_{a,t-1}.EBE_{a,t-1} \tag{3.29}$$

$$IS_{a,t} = T_0^{IS}.EBE_{a,t-1} \tag{3.30}$$

Agregate tax on benefits (value & volume):

$$PIS.IS = \sum_a PIS_a.IS_a \tag{3.31}$$

$$IS = \sum_a PIS_a \tag{3.32}$$

Taxes on income (value):

$$IR_{h,t}\_VAL = T_0^{IR}.DISPINC_{h,t}^{AI}\_VAL \tag{3.33}$$

Agregate tax on income (value):

$$IR\_VAL = \sum_h IR_{h,t}\_VAL \tag{3.34}$$

Taxes on capital (value):

$$AIC_{h,t}\_VAL = T_t^{AIC}.DISPINC_{h,t}^{AI}\_VAL \tag{3.35}$$

Agregate tax on Capital (value):

$$AIC\_VAL = \sum_h AIC_{h,t}\_VAL \tag{3.36}$$

Subvention on commodity c (value & volume):

$$PSUB_{c,t}.SUB_{c,t} = T_{c,t}^{SUB}.YQ_{c,t} \tag{3.37}$$

$$SUB_{c,t} = T_{c,0}^{SUB}.YQ_{c,t} \tag{3.38}$$

We assume that the subvention is proportional to the quantity produced which is true in most cases (in particular for agriculture). Consequently the price of the subvention grows at the same rate as the subvention. For simplicity, we assume that in equilibrium, the subvention rate grows at the rate of inflation.

Subvention on commodity c (value & volume):

$$PSUB.SUB = \sum_c PSUB_c.SUB_c \tag{3.39}$$

$$SUB = \sum_c SUB_c \tag{3.40}$$

Tax on activities (value & volume)

$$PIY_a.IY_a = TIYN_{a,t}.PY_a.Y_a \tag{3.41}$$

$$IY_a = TIYN_{a,0}.Y_a \tag{3.42}$$

Aggregate Tax on activities (value & volume)

$$PIY.IY = \sum_a PIY_a.IY_a \tag{3.43}$$

$$IY = \sum_a IY_a \tag{3.44}$$

Subventions on activities (value & volume)

$$PSY_a.SY_a = TSYN_a.PY_a.Y_a \tag{3.45}$$

$$SY_a = TSYN_{a,0}.Y_a \tag{3.46}$$

Aggregate subventions on activities (value & volume)

$$PSY.SY = \sum_a PSY_a.SY_a \tag{3.47}$$

$$SY = \sum_a SY_a \tag{3.48}$$

Social Security Accounting:Employer Social Contribution

$$CSE_a.PCSE_a = T^{CSE}_{a,t}.L\_S_a.W\_S_a \tag{3.49}$$

$$PCSE_a = PCH_{19} \tag{3.50}$$

Aggregate Employer Social Contribution (value & volume)

$$PCSE.CSE = \sum_a PCSE_a.CSE_a \tag{3.51}$$

$$CSE = \sum_a CSE_a \tag{3.52}$$

Employer Social Contribution from the rest of the world

$$CSE^{ROW}.PCSE^{ROW} = T^{CSE^{ROW}}_{a,t} SB^{ROW} \tag{3.53}$$

$$PCSE^{ROW} = PCH_{19} \tag{3.54}$$

Total employer Social Contribution (in value & volume)

$$PCSE^{TOT}.CSE^{TOT} = PCSE.CSE + PCSE^{ROW}.CSE^{ROW} \tag{3.55}$$

$$CSE^{TOT} = CSE + CSE^{ROW} \tag{3.56}$$

Social Security Accounting:Salary Social Contribution

$$CSS_a.PCSS_a = T_t^{CSS}.L_a.W\_S_a \tag{3.57}$$

$$PCSS_a = PCH_{19} \tag{3.58}$$

Social Security Accounting:Salary Social Contribution of self-employed labor

$$CSS\_SE.PCSS^{SE} = T_t^{CSS\_SE}.L\_SE.W\_SE_{19} \tag{3.59}$$

$$PCSS^{SE} = PCH_{19} \tag{3.60}$$

Aggregate Employer Social Contribution (value & volume)

$$PCSS.CSS = \sum_a PCSS_a.CSS_a \tag{3.61}$$

$$CSS = \sum_a CSS_a \tag{3.62}$$

$$PCSS\_SE.CSS\_SE = \sum_a PCSS_a^{SE}.CSS_a^{SE} \tag{3.63}$$

$$CSS\_SE = \sum_a CSS_a^{SE} \tag{3.64}$$

Total Employer Social Contribution (value & volume)

$$PCSS^{TOT}.CSS^{TOT} = PCSS.(CSS + CSS^{ROW}) + PCSS\_SE.CSS\_SE \tag{3.65}$$

$$CSS^{TOT} = CSS + CSS\_SE + CSS^{ROW} \tag{3.66}$$

Receipts from the private activity (in value and volume)

$$DIV^{GOV}\_VAL = \sum_a DIV_a^{GOV}\_VAL \tag{3.67}$$

Public receipts (in value & volume)

$$\begin{aligned} REC\_VAL \quad = \quad & PY_{20}.Y_{20} + PTAX.TAX + PIY.IY + PSY.SY + PIS.IS \\ & + IR\_VAL + AIC\_VAL + PCSE^{TOT}.CSE^{TOT} + PCSS^{TOT}.CSS^{TOT} \\ & + DIV^{GOV\_VAL} + TCO^{VAL} \end{aligned} \tag{3.68}$$

Social Prestations

$$PRESOC\_DOM^{U}\_VAL = 0.3.W\_S.Un\_TOT \tag{3.69}$$

$$PRESOC\_DOM^{Oth}\_VAL = PRESOC\_DOM^{Oth}_{t-1}.(1+\dot{P}+\Delta pop)-\eta^{prest}.\Delta un \tag{3.70}$$

$$PRESOC\_DOM\_VAL = PRESOC\_DOM^{U}\_VAL+PRESOC\_DOM^{Oth}\_VAL \tag{3.71}$$

Decomposition of Social Prestation between domestic and foreign destinations

$$PRESOC\_VAL = PRESOC\_DOM\_VAL + PRESOC\_ROW\_VAL \tag{3.72}$$

Total expenditure by product c:

PEXP_{13,h}

$$PEXPG.EXPG = \sum_{c} PEXPG_c.EXPG_c \tag{3.73}$$

$$EXPG = \sum_{c} EXPG_c \tag{3.74}$$

$$PEXPG_c = PG_c \tag{3.75}$$

$$\Delta expg_{c,t} = \Delta expg_t \tag{3.76}$$

Domestic and imported government consumptions in commodity c:

$$\Delta gd_{c,t} = \Delta expg_{c,t} + \Delta SUBST\_GD_{c,t} \tag{3.77}$$
$$\Delta SUBST\_GD^{n}_{c,t} = \eta^{cd,cm}\varphi_{chm,c}\Delta(p^{GD} - p^{GM})$$

$$\Delta gm_{c,t} = \Delta expg_{c,t} + \Delta SUBST\_GM_{c,t} \tag{3.78}$$
$$\Delta SUBST\_GM^{n}_{c,t} = \eta^{cd,cm}\varphi_{chd,c}\Delta(p^{GM}_{c} - p^{GD}_{c})$$

Public spendings (in value & volume)

$$\begin{aligned} DEP\_VAL \;=\; & (NCU_{20}.Y_{20}) + PRESOC\_VAL \\ & + PRESOC\_VAL + PG.G + R\_G_{t-1}.DEBT\_G\_VAL_{t-1} \\ & - PSUB.SUB + DEP^{TCO\_VAL} + CIDD + (BONUS - MALUS) \end{aligned} \tag{3.79}$$

Public Deficit (in value & volume)

$$BF\_G\_VAL = DEP\_VAL - REC\_VAL + BF\_G\_VAL\_ajust \tag{3.80}$$
$$DP\_G\_VAL = BF\_G\_VAL/PGDP * GDP \tag{3.81}$$

Dynamic of the public debt (in value & volume):

$$DEBT\_G\_VAL = DEBT_{T-1}\_G\_VAL + BF\_G\_VAL \tag{3.82}$$

The Carbon Tax

$$TCOD\_VAL_{e} = T^{TCO}.IC_{e}.YQ_{e} \tag{3.83}$$

$$TCOM\_VAL_{e} = T^{TCO}.IC_{e}.M_{e} \tag{3.84}$$

$$TCO\_VAL_{e} = TCOM\_VAL_{e} + TCOD\_VAL_{e} \tag{3.85}$$

$$TCO\_VAL = \sum TCO\_VAL_{e} \tag{3.86}$$

$$REC\_TCO\_VAL = TCO\_VAL \tag{3.87}$$

$$RTCO\_H = \alpha^{TCO}.REC\_TCO\_VAL \tag{3.88}$$

$$RTCO_{h} = \varphi^{TCO_{h}} RTCO\_H \tag{3.89}$$

$$RTCO_{E} = \varphi^{TCO_{h}} REC\_TCO\_VAL \tag{3.90}$$

4 The consumer: households and households hybrid

Average wage:

$$W\_S.L\_S = \sum_a W\_S_a.L\_S_a \tag{4.1}$$

$$W\_SE.L\_SE = \sum_a W\_SE_a.L\_SE_a \tag{4.2}$$

$$CL\_S.L\_S = \sum_a CL\_S_a.L\_S_a \tag{4.3}$$

$$CL\_SE.L\_SE = \sum_a CL\_SE_a.L\_SE_a \tag{4.4}$$

$$W.L = W\_S.L\_S + W\_SE.L\_SE \tag{4.5}$$

$$CL.L = CL\_S.L\_S + CL\_SE.L\_SE \tag{4.6}$$

$$L = L\_S + L\_SE \tag{4.7}$$

Decomposition of Financial Wealth:

$$DIV^{HH}\_VAL = \sum_a DIV_a^{HH} \tag{4.8}$$

$$FW\_VAL = DIV^{HH}\_VAL + INT^{HH}\_VAL \tag{4.9}$$

Total disposable income before taxes:

$$DISPINC^{AI}\_VAL = (W\_S.L\_S + SB^{ROW}).(1 - TCSS) + W\_SE.L\_SE * (1 - TCSS\_SE) + PRESOC^{DOM}\_VAL + FW\_VAL + TR^{ROW}\_VAL \tag{4.10}$$

Disposable income before taxes for household h:

$$DISPINC_h^{AI}\_VAL = \varphi_h^{DISPINC}.DISPINC^{AI}\_VAL \tag{4.11}$$

In a future version, we may assume that φ varies according the the components of the disposable income.

Net Disposable income for household h:

$$DISPINC_h\_VAL = DISPINC_h^{AI}\_VAL - IR_h\_VAL - AIC_h\_VAL + RTCO_h \tag{4.12}$$

$$DISPINC\_VAL = \sum DISPIN_h\_VAL \tag{4.13}$$

Household h's total expenditures (value & volume):

$$PEXP_h.EXP_h = \sum_c PEXP_{c,h}.EXP_{c,h} \tag{4.14}$$

$$EXP_h = \sum_c .EXP_{c,h} \tag{4.15}$$

$$EXPH = \sum_h .EXP_h \tag{4.16}$$

$$PEXPH.EXPH = \sum PEXP_h.EXP_h \tag{4.17}$$

Marginal propension to save:

$$\Delta MPS_h = \beta_1 \Delta(UNR\_TOT) + \beta_2 \Delta(R - \dot{infl}\_FR) + \beta_3 \Delta\left(\frac{DEBT\_G^{VAL}}{PGDP.GDP}\right) \tag{4.18}$$

Savings equation:

$$S_h = DISPINC_h\_VAL - PEXP_h.EXP_h \tag{4.19}$$

$$TS_h = \frac{DISPINC_h\_VAL - PEXP_h.EXP_h}{DISPINC_h\_VAL} \tag{4.20}$$

$$S_h = DISPINC_h\_VAL - PEXP_h.EXP_h \tag{4.21}$$

$$TS = \frac{S}{DISPINC\_VAL} \tag{4.22}$$

4.1 The households (LES)

c={01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24}

Notional household h's expenditures in commodity c:

$$EXP_{c,h}^n.PEXP_{c,h} = PEXP_{c,h}.NEXP_{c,h} + \beta_{c,h}^{EXP}(DISPINC\_VAL_h.(1 - MPS_h) - PNEXP_h.NEXP_h) \tag{4.23}$$

$\beta_{c,h,0}^{EXP} = (PEXP_{c,h,0}.EXP_{c,h,0} - PEXP_{c,h,0}.NEXP_{c,h,0})/(PEXP_{h,0}EXP_{h,0} - PNEXP_{h,0}.NEXP_{h,0})$ is calibrated by inversing the above equation at the base year.

Household h's marginal propension to spend in commodity c:

$$\Delta\beta_{c,h}^{EXP} = (1 - \eta^{LES\_CES}).\Delta\frac{PEXP_{c,h}}{PEXP_h^{CES}} \tag{4.24}$$

$$PEXP_h^{CES} = \left[\sum_c \beta_{c,h,0}^{EXP}.PEXP_{c,h}{}^{(1-\eta^{LES\_CES})}\right]^{\frac{1}{1-\eta^{LES\_CES}}} \tag{4.25}$$

Household h's total necessary expenditures (value & volume):

$$PNEXP_h.NEXP_h = \sum_c PEXP_{c,h}.NEXP_{c,h} \tag{4.26}$$

$$NEXP_h = \sum_c NEXP_{c,h} \tag{4.27}$$

Total expenditure by product c:

$$PEXP_c.EXP_c = \sum_h PEXP_{c,h}.EXP_{c,h} \tag{4.28}$$

$$EXP_c = \sum_h EXP_{c,h} \tag{4.29}$$

$$\phi_{c,h}^{EXP} = EXP_{c,h}/EXP_c \tag{4.30}$$

Household h's expenditures price c:

$$PEXP_{c,h} = PCH_c \tag{4.31}$$

Domestic and imported households' consumption in commodity c:

$$\Delta CHD_{c,t} = \Delta EXP_{c,t} + \Delta SUBST\_CHD_{c,t} \tag{4.32}$$

$$\Delta SUBST\_CHD_{c,t}^n = \eta^{LVL4\_HH}\Delta(pchd_c - pchm_c).\frac{PCHD_{c,t-1}.CHD_{c,t-1}}{PCH_{c,t-1}.CH_{c,t-1}}$$

$$\Delta CHM_{c,t} = EXP_{c,t} - CHD_c \tag{4.33}$$

$$\Delta SUBST\_CHM_{c,t}^n = \eta^{LVL4\_HH}\Delta(pchm_c - pchd_c).\frac{PCHM_{c,t-1}.CHM_{c,t-1}}{PCH_{c,t-1}.CH_{c,t-1}}$$

Ajustment LES:

$$exp_{c,h,t} = \mu_1 exp^n_{c,h,t} + (1-\mu_1).(exp_{c,h,t-1} + \Delta exp^e_{c,h}) \tag{4.34}$$

$$\Delta exp^e_{c,h,t} = \mu_2 \Delta exp^e_{c,h,t-1} + \mu_3 \Delta exp_{c,h,t-1} + \mu_4 \Delta exp^n_{c,h,t} \tag{4.35}$$

4.2 Household Hybrid

Building stock dynamic

$$\begin{aligned} \Delta BUIL_{h,k,t} &= \varphi^{NewBUIL}_{h,k}(\Delta BUIL_{h,t} + BUIL_{h,0,t}) \\ &+ \sum_{k'=0}^{k-1} REHAB_{h,k',k} - \sum_{k'=k+1}^{K} REHAB_{h,k,k'} \\ &- \sum_{k'=0}^{k-1} \delta^{BUIL}_{h,k,k'} BUIL_{h,k,t-1} + \sum_{k'=k+1}^{K} \delta^{BUIL}_{h,k',k} BUIL_{h,k',t-1} \end{aligned} \tag{4.36}$$

$$BUIL_{h,0,t} = \sum_k \delta^{BUIL}_{h,k,0} BUIL_{h,k,t-1} \tag{4.37}$$

$$\Delta BUIL = \Delta pop + \Delta M2percapita \tag{4.38}$$

Aggregation of building stock

$$BUIL_k = \sum_h BUIL_{h,k}$$

$$BUIL = \sum_h BUIL_h$$

Proportion of the the category K's rehabilitated building

$$\Delta \tau^{REHAB\_n}_{h,k} = \Delta \tau^{REHAB\_trend}_{h,k} + \eta_{h,k} \frac{UC^{REHAB}_{h,k}}{UC_{h,k}} \tag{4.39}$$

$$\begin{aligned} \tau^{REHAB}_{h,k} &= \tau^{REHAB\_*}_{h,k} \quad (* = L, H, n) \\ 0 \leqslant \tau^{REHAB\_L}_{h,k} &\leqslant \tau^{REHAB}_{h,k} \leqslant \tau^{REHAB\_H}_{h,k} \leqslant 1 \end{aligned} \tag{4.40}$$

Rehabilitation of building

$$REHAB_{h,k,k'} = \varphi^{REHAB}_{h,k,k'}.\tau^{REHAB}_{h,k} BUIL_{h,k,t-1} \quad (4.41)$$

$$\sum_{k'} \varphi^{REHAB}_{h,k,k'} = 1 \quad (4.42)$$

The user cost of building rehabilitation

$$UC^{REHAB}_{h,k} = UC^{K\_REHAB}_{h,k} + UC^{E\_REHAB}_{h,k} \quad (4.43)$$

$$UC^{E\_REHAB}_{h,k} = \sum_{k'=k+1}^{K} \varphi^{REHAB}_{h,k,k'}.UC^{E}_{h,k'} \quad (4.44)$$

$$UC_{h,k} = UC^{K}_{h,k} + UC^{E}_{h,k} \quad (4.45)$$

$$UC^{K\_REHAB}_{h,k} = P^{REHAB\_\delta^{BUIL}}_{h,k}(R^{CASH\_REHAB}_{h,k} + \frac{R^{LOAN\_REHAB}_{h,k} R^{I\_REHAB}_{h,k,t-1} LD^{REHAB}_{h,k}}{1-(1+R^{BUIL\_REHAB}_{h,k,t-1})^{-LD^{REHAB}_{h,k}}}) \quad (4.46)$$

$$R^{LOAN\_REHAB}_{h,k} = 1 - R^{CASH\_REHAB}_{h,k} \quad (4.47)$$

$$LD^{REHAB}_{h,k} \leqq \theta^{LD\_REHAB}_{h,k} / \delta^{REHAB}_{h,k} \quad (4.48)$$

$$UC^{K}_{h,k} = P^{REHAB}_{h,k,k} \delta^{BUIL}_{h,k}(R^{CASH}_{h,k} + \frac{R^{LOAN}_{h,k} R^{I\_BUIL}_{h,k,t-1} LD_{h,k}}{1-(1+R^{I\_BUIL}_{h,k,t-1})^{-LD_{h,k}}}) \quad (4.49)$$

$$R^{LOAN}_{h,k} = 1 - R^{CASH}_{h,k} \quad (4.50)$$

$$LD_{h,k} \leqq \theta^{LD}_{h,k} / \delta^{REHAB}_{h,k} \quad (4.51)$$

$$\delta^{REHAB}_{h,k} = \sum_{k'=k+1}^{K} \varphi^{REHAB}_{h,k,k'} \delta^{BUIL}_{h,k'} \quad (4.52)$$

$$\delta^{BUIL}_{h,k} = \sum_{k'=0}^{k-1} \delta^{BUIL}_{h,k,k'} \quad (4.53)$$

$$PENER^{BUIL}_{h,k,e}.ENER^{BUIL}_{h,k,e} = PEXP_{e,h}.EXP^{BUIL}_{h,k,e}$$

$$UC^{E}_{h,k} = P^{Ener\_m^2}_{h,k} . \frac{\left(1 + \dot{P}^{Ener\_m^2\_e}_{h,k}\right)^{1/\delta^{BUIL}_{h,k}} - 1}{\dot{P}^{Ener\_m^2\_e}_{h,k} / \delta^{BUIL}_{h,k}} \quad (4.54)$$

$$P^{Ener\_m^2}_{h,k} . BUIL_{h,k} = PENER^{BUIL}_{h,k} . ENER^{BUIL}_{h,k} \quad (4.55)$$

$$\dot{P}^{Ener\_m^2\_e}_{h,k,t} = \lambda_0^{Ener\_BUIL} \dot{P}^{Ener\_m^2\_e}_{h,k,t-1} + (1 - \lambda_0^{Ener\_BUIL}) \dot{P}^{Ener\_m^2}_{h,k,t-1} \quad (4.56)$$

The average price of the investment in renovation

$$P^{REHAB\_\delta^{BUIL}}_{h,k} . REHAB_{h,k} = \sum_{k'=k+1}^{K} \left(1 - R^{SUB}_{h,k,k'}\right) P^{REHAB}_{h,k,k'} . REHAB_{h,k,k'} . \delta^{BUIL}_{h,k'} \quad (4.57)$$

$$P^{REHAB\_\delta^{BUIL}\_bis}_{h,k} = \sum_{k'=k+1}^{K} \left(1 - R^{SUB}_{h,k,k'}\right) \varphi^{REHAB}_{h,k,k'} P^{REHAB}_{h,k,k'} \delta^{BUIL}_{h,k'}$$

$$VER\_P^{REHAB\_\delta}_{h,k} . REHAB_{h,k} = -P^{REHAB\_\delta}_{h,k} + \sum_{k'=k+1}^{K} \left(1 - R^{SUB}_{h,k,k'}\right) P^{REHAB}_{h,k,k'} . \varphi^{REHAB}_{h,k,k'} \delta^{BUIL}_{h,k'} \quad (4.58)$$

The expenditure related to housing for building K

$$\begin{aligned} EXP\_HOUSING_{h,k}^{VAL} &= DEBT_{h,k,t-1}^{REHAB\_VAL}(R_{h,k,t-1}^{I\_REHAB} + R_{h,k,t-1}^{RMBS\_REHAB}) \\ &+R_{h,k,t}^{CASH\_REHAB} P_{h,k}^{REHAB} REHAB_{h,k} \\ &+DEBT_{h,k,t-1}^{NewBUIL\_VAL}(R_{h,k,t-1}^{I\_NewBUIL} + R_{h,k,t-1}^{RMBS\_NewBUIL}) \\ &+R_{h,k,t}^{CASH\_NewBUIL}.P_{h,k}^{NewBUIL}.NewBUIL_{h,k} \\ &+PENER_{h,k}^{BUIL}.ENER_{h,k}^{BUIL} \end{aligned} \tag{4.59}$$

$$\begin{aligned} DEBT_{h,k,t}^{REHAB\_VAL} &= DEBT_{h,k,t-1}^{REHAB\_VAL}(1 - R_{h,k,t-1}^{RMBS\_REHAB}) \\ &+R_{h,k,t}^{LOAN\_REHAB}.P_{h,k}^{REHAB}.REHAB_{h,k} \end{aligned} \tag{4.60}$$

$$\begin{aligned} DEBT_{h,k,t}^{NewBUIL\_VAL} &= DEBT_{h,k,t-1}^{NewBUIL\_VAL}(1 - R_{h,k,t-1}^{RMBS\_NewBUIL}) \\ &+R_{h,k,t}^{LOAN\_REHAB}.P_{h,k}^{NewBUIL}.NewBUIL_{h,k} \end{aligned} \tag{4.61}$$

$$R_{h,k}^{RMBS\_X} = \frac{1}{LD_{h,k}^{X}}$$

$$\triangle p_{h,k,k'}^{REHAB} = \triangle pch_{13} \tag{4.62}$$

$$\triangle p_{h,k}^{NewBUIL} = \triangle pch_{13} \tag{4.63}$$

$$R_{h,k}^{REHAB\_DEBT} = \frac{P_{h,k}^{REHAB}.REHAB_{h,k}}{DEBT_{h,k}^{REHAB\_VAL}} \tag{4.64}$$

Aggregation of equations

$$REHAB_{h,k} = \sum_{k'=k+1}^{K} REHAB_{h,k,k'}$$

$$REHAB_{h} = \sum_{k} .REHAB_{h,k}$$

$$REHAB = \sum_{h} .REHAB_{h}$$

$$P_{h,k}^{REHAB}.REHAB_{h,k} = \sum_{k'} P_{h,k,k'}^{REHAB}.REHAB_{h,k,k'}$$

$$EXP\_HOUSING_h^{VAL} = \sum_k EXP\_HOUSING_{h,k}^{VAL}$$

$$EXP\_HOUSING^{VAL} = \sum_k EXP\_HOUSING_h^{VAL}$$

$$EXP_h^{REHAB\_VAL} = P_h^{REHAB}.REHAB_h$$

$$EXP^{REHAB\_VAL} = \sum EXP_h^{REHAB\_VAL}$$

$$EXP_h^{NEWBUIL\_VAL} = P_h^{NEWBUIL}.NEWBUIL_h$$

$$EXP^{NEWBUIL\_VAL} = \sum EXP_h^{NEWBUIL\_VAL}$$

$$\phi_{13bis,h}^{EXP} = \frac{EXP_h^{NEWBUIL\_VAL} + EXP_h^{REHAB\_VAL}}{EXP^{NEWBUIL\_VAL} + EXP^{REHAB\_VAL}} \tag{4.65}$$

$$EXP_{13}^{OTH\_VAL} = \sum EXP_{13,h}^{OTH\_VAL} \tag{4.66}$$

$$\Delta exp_{13,h}^{OTH\_VAL} = \Delta dispinc_h^{VAL}.(1 - MPS\_HH_h) \tag{4.67}$$

$$EXP_{13,h}^{OTH\_VAL} = \phi_{13bis,h}^{EXP}.EXP_{13}^{OTH\_VAL} \quad at \quad base\ year$$

$$EXP_{13,h} = P_{h,0}^{NEWBUIL}.NEWBUIL_h + P_{h,0}^{REHAB}.REHAB_h + \frac{EXP_{13,h}^{OTH\_VAL}}{PEXP_{13,h}} \tag{4.68}$$

$$EXP_{13} = \sum EXP_{13,h} \tag{4.69}$$

$$NEWBUIL_{h,k} = \varphi_{h,k}^{NewBUIL}(\Delta BUIL_h + BUIL_{h,0}) \tag{4.70}$$

$$NEWBUIL_h = \sum_k NEWBUIL_{h,k}$$

$$P_h^{NEWBUIL}.NEWBUIL_h = \sum_k P_{h,k}^{NEWBUIL} NEWBUIL_{h,k}$$

$$NEWBUIL = \sum_h NEWBUIL_h$$

$$P^{NEWBUIL}.NEWBUIL = \sum_h P_h^{NEWBUIL} NEWBUIL_h$$

$$P_h^{EXPH}.EXPH_h = \sum_k P_{h,k}^{EXPH}.EXPH_{h,k}$$

Verification for the initial period

$$BUIL\_VERIF_h = \sum_k BUIL_{h,k} \tag{4.71}$$

$$BUIL\_VERIF = \sum_h BUIL\_VERIF_h \tag{4.72}$$

$$VERIF\_BUIL = \sum_h (BUIL\_VERIF_h - BUIL_h) = 0 \tag{4.73}$$

$$VERIF\_\varphi_{h,k}^{REHAB} = \sum \varphi_{h,k}^{REHAB} - 1 \tag{4.74}$$

$$EXP\_HOUSING_h^{bisVAL} = PEXP_{13,h}.EXP_{13,h} + PENER_h^{BUIL}.ENER_h^{BUIL} \tag{4.75}$$

$$EXP\_HOUSING_h^{verVAL} = EXP\_HOUSING_h^{bisVAL} - (EXP\_HOUSING_h^{VAL} + EXP_{13,h}^{OTH\_VAL}) = 0 \tag{4.76}$$

Automobile stock dynamic

$$\begin{aligned} \Delta AUTO_{h,k,t} &= \varphi_{h,k}^{NewAuto}(\Delta AUTO_{h,t} + AUTO_{h,t}^{DES}) \\ &\quad -\delta_{h,k}^{AUTO} AUTO_{h,k,t-1} \end{aligned} \tag{4.77}$$

$$AUTO_{h,t}^{DES} = \sum_{k} \delta_{h,k}^{AUTO} AUTO_{h,k,t-1} \tag{4.78}$$

$$NewAUTO_{h,k} = \varphi_{h,k}^{NewAUTO}(\Delta AUTO_{h} + AUTO_{h}^{DES}) \tag{4.79}$$

$$\Delta p_{h,k}^{NewAUTO} = \Delta pch_{03} \tag{4.80}$$

The expenditure related to automobile

$$\begin{aligned} EXP\_MOB_{h,k}^{AUTO\_VAL} &= DEBT_{h,k,t}^{AUTO\_VAL}(R_{h,k,t-1}^{I} + R_{h,k,t-1}^{RMBS\_AUTO}) \\ &\quad + R_{h,k,t}^{CASH\_AUTO} P^{NewAUTO}.NewAUTO_{h,k}(1 - R_{h,k}^{SUB\_AUTO}) \\ &\quad + PEXP_{h}^{22}.EXP_{h,k}^{AUTO} \end{aligned} \tag{4.81}$$

$$\begin{aligned} UC_{h,k}^{auto} &= P_{h,k}^{REHAB} \delta_{h,k}^{BUIL} \left(R_{h,k}^{CASH\_AUTO} + \frac{R_{h,k}^{LOAN} R_{h,k,t-1}^{I} LD_{h,k}}{1 - (1 + R_{h,k,t-1}^{I})^{-LD_{h,k}}} \right) \\ &\quad + \frac{\left(1 + \dot{P}_{k}^{Ener\_auto\_e}\right)^{1/\delta_{k}^{auto}} - 1}{\dot{P}_{k}^{Ener\_auto\_e}/\delta_{k}^{auto}} . \dot{P}_{k}^{Ener\_auto} \end{aligned} \tag{4.82}$$

$$\begin{aligned} DEBT_{h,k,t}^{AUTO\_VAL} &= DEBT_{h,k,t-1}^{AUTO\_VAL}(1 - R_{h,k,t-1}^{RMBS\_AUTO}) \\ &\quad + R_{h,k,t}^{LOAN\_AUTO} P_{h,k}^{NewAUTO}.NewAUTO_{h,k}(1 - R_{h,k}^{SUB\_AUTO}) \end{aligned} \tag{4.83}$$

$$EXP_{h,k}^{NewAUTO\_VAL} = P_{h,k}^{NewAuto}.NewAUTO_{h,k}(1 - R_{h,k}^{SUB}) \tag{4.84}$$

$$\Delta km_h^{traveler} = \Delta pop^{TOT} \tag{4.85}$$

$$\Delta km_h^{traveler\_auto} = \Delta km_h^{traveler} \tag{4.86}$$

$$\Delta km_h^{AUTO} = \Delta km_h^{traveler\_auto} \tag{4.87}$$

$$\Delta AUTO_h = \Delta km_h^{AUTO} \tag{4.88}$$

$$Km_{h,k}^{AUTO} = Km_h^{AUTO}.\frac{AUTO_{h,k}}{auto_h} \tag{4.89}$$

$$\begin{aligned}\Delta exp_{h,k,e}^{AUTO} = \quad & \alpha^{AUTO}\left(\Delta km_{h,k}^{auto} - \eta^{MOB\_TRSP\_COL}.(1-\varphi^{AUTO}).(pch_{03} - pch_{14})\right) \\ & +(1-\alpha^{AUTO})\Delta exp_{h,k}\end{aligned} \tag{4.90}$$

$$EXP_{h,t}{}^{AUTO\_elec} = EXP_{h,t-1}{}^{AUTO\_elec}.(1+\Delta exp_h).T^{gth\_elec}$$

$$\begin{aligned}EXP_{h,t}{}^{AUTO\_elec} = \quad & +\eta^{AUTO\_elec}.\varphi_{t-1}^{EXP\_AUTO_{22}}.\Delta\left(pexp_{22} - pexp_{23}\right) \\ & +\eta^{BONUS\_elec}.\varphi_{t-1}^{EXP_{03}}.\Delta pi_{03}^{eff}.T^{BONUS\_elec} \\ & +\eta^{BONUS\_elec}.\varphi_{t-1}^{EXP_{03}}.\Delta pi_{03}^{eff}.T^{BONUS\_elec} \\ & if\ \left(EXP_{03}^{eff} - EXP_{03}^{elec}\right) > 0\end{aligned}$$

$$EXP_{h,t}{}^{AUTO\_elec} = EXP_{h,t-1}{}^{AUTO\_elec}\ \ if\ \left(EXP_{03}^{eff} - EXP_{03}^{elec}\right) \leqslant 0$$

Aggregation of automobile expenditure

$$EXP_{h,k}^{AUTO} = \sum_{e} EXP_{h,k,e}^{AUTO} \quad (4.91)$$

$$EXP_{h}^{AUTO} = \sum_{k} EXP_{h,k}^{AUTO} \quad (4.92)$$

$$EXP_{h,e}^{AUTO} = \sum_{k} EXP_{h,k,e}^{AUTO} \quad (4.93)$$

$$EXP_{k,e}^{AUTO} = \sum_{h} EXP_{h,k,e}^{AUTO} \quad (4.94)$$

$$EXP^{AUTO} = \sum_{h} EXP_{h}^{AUTO} \quad (4.95)$$

Aggregation of automobile

$$AUTO_k = \sum_{h} AUTO_{h,k} \quad (4.96)$$

$$AUTO = \sum_{k} AUTO_k \quad (4.97)$$

$$NewAUTO_h = \sum_{k} NewAUTO_{h,k} \quad (4.98)$$

$$P_h^{NewAUTO}.NewAUTO_h = \sum_{k} P_{h,k}^{NewAUTO}.NewAUTO_{h,k} \quad (4.99)$$

$$EXP_h^{NewAUTO\_VAL} = \sum EXP_{h,k}^{NewAUTO\_VAL} \quad (4.100)$$

$$EXP^{NewAUTO\_VAL} = \sum EXP_h^{NewAUTO\_VAL} \quad (4.101)$$

$$\phi_{03bis,h}^{EXP} = \frac{EXP_h^{NewAUTO\_VAL}}{EXP^{NewAUTO\_VAL}} \quad (4.102)$$

$$EXP\_MOB_h^{AUTO\_VAL} = \sum EXP\_MOB_{h,k}^{AUTO\_VAL} \quad (4.103)$$

$$EXP\_MOB^{AUTO\_VAL} = \sum EXP\_MOB_h^{AUTO\_VAL} \quad (4.104)$$

$$EXP_{03}^{OTH\_VAL} = \sum_h EXP_{03,h}^{OTH\_VAL} \quad (4.105)$$

$$EXP_{03}^{OTH\_VAL} = PEXP_{03}.EXP_{03} - EXP^{NewAUTO\_VAL} \quad for \quad base \quad year$$

$$EXP_{03} = \sum_h EXP_{03,h} \quad (4.106)$$

$$\Delta exp_{03,h}^{OTH\_VAL}) = \Delta dispinc_h^{VAL}.(1 - MPS_h^{HH}) \quad (4.107)$$

$$EXP_{03,h}^{OTH\_VAL} = \phi_{03bis,h}^{EXP}.EXP_{03}^{OTH\_VAL} \qquad for \quad base \quad year$$

$$EXP_{03,h} = P_{h,k,0}^{NewAuto}.NewAUTO_{h,k} + \frac{EXP_{03}^{OTH\_VAL}}{PEXP_{03,h}} \quad (4.108)$$

Verification of automobile

$$EXP\_MOB_h^{AUTObis\_VAL} = PEXP_{03,h}.EXP_{03,h} + PEXP_{03,h}.EXP_h^{AUTO} \quad (4.109)$$

$$EXP\_MOB^{AUTObis\_VAL} = \sum EXP\_MOB_h^{AUTObis\_VAL} \quad (4.110)$$

$$EXP\_MOB_h^{AUTOver\_VAL} = EXP\_MOB_h^{AUTObis\_VAL} - (EXP\_MOB_h^{AUTO\_VAL} + EXP_{03,h}^{OTH\_VAL}) \quad (4.111)$$

$$EXP\_MOB^{AUTOver\_VAL} = EXP\_MOB^{AUTObis\_VAL} - (EXP\_MOB^{AUTO\_VAL} + EXP_{03,h}^{OTH\_VAL}) \quad (4.112)$$

Other transports:

c={14 15 16 17 18}

$$EXP\_MOB_h^{OTH\_VAL} = \sum_{c=14,15,16,17,18} PEXP_{c,h}.EXP_{c,h} \quad (4.113)$$

$$\Delta km_{c,h}^{traveler} = \Delta km_h^{traveler} \quad (4.114)$$

$$\Delta exp_{c,h} = \Delta km_{c,h}^{traveler} \quad (4.115)$$

$$EXP_c = \sum_h EXP_{c,h} \quad (4.116)$$

Total Mobility

$$EXP\_MOB_h^{VAL} = EXP\_MOB_h^{AUTO\_VAL} + EXP\_MOB_h^{OTH\_VAL} + EXP_{03,h}^{OTH\_VAL} \quad (4.117)$$

4.2.1 Energy Consumption

Energy of building

$$ENER_{h,k,e}^{BUIL} = ENER_{h,k,e}^{perM2}.BUIL_{h,k} \quad (4.118)$$

$$\Delta ener_{h,k,e}^{perM2} = 0 \quad (4.119)$$

$$\Delta exp_{h,k,e}^{BUIL} = \Delta ener_{h,k,e}^{BUIL} \quad (4.120)$$

$$\Delta exp\_buil_{h,k,22} = \Delta ener\_buil_{h,k,22} + \Delta standard\_BUIL + \eta^{\overline{EXP}_{h,k,22}}.(\Delta pexp_{22} - \Delta pexp) + \eta^{Buil_{h,k,24\_22}}.\left(\frac{PEXP_{24,t-1}^{TEP}}{PEXP_{22,t-1}^{TEP}}.\Delta pexp_{24} - \frac{PEXP_{22,t-1}^{TEP}}{PEXP_{24,t-1}^{TEP}}.\Delta pexp_{22}\right) \cdot \frac{EXP_{24\_BUIL\_eff,t-1}}{EXP_{22\_BUIL\_eff,t-1} + EXP_{24\_BUIL\_eff,t-1}} \quad if\ ener\_buil_{h,k,22} > 0$$

$$\Delta exp\_buil_{h,k,22} = \Delta ener\_buil_{h,k,22} + \Delta standard\_BUIL \ \ if\ ener\_buil_{h,k,22} \leqslant 0$$

$$\begin{aligned}\Delta exp\_buil_{h,k,23} &= \Delta ener\_buil_{h,k,23} + \Delta standard\_BUIL \\ &\quad + \eta^{EXP_{h,k,23}}.(\Delta pexp_{23} - \Delta pexp) \\ &\quad + \eta^{Buil_{h,k,24\_23}}.\left(\frac{PEXP^{TEP}_{24,t-1}}{PEXP^{TEP}_{22,t-1}}.\Delta pexp_{24} - \frac{PEXP^{TEP}_{23,t-1}}{PEXP^{TEP}_{23,t-1}}.\Delta pexp_{23}\right) \\ &\quad \cdot \frac{EXP_{24\_BUIL\_eff,t-1}}{EXP_{23\_BUIL\_eff,t-1} + EXP_{24\_BUIL\_eff,t-1}} \qquad if\ ener\_buil_{h,k,23} > 0\end{aligned}$$

$$\begin{aligned}\Delta exp\_buil_{h,k,23} &= \Delta ener\_buil_{h,k,23} \\ &\quad + \Delta standard\_BUIL\ \ if\ ener\_buil_{h,k,23} \leqslant 0\end{aligned}$$

$$\begin{aligned}\Delta exp\_buil_{h,k,24} &= \Delta ener\_buil_{h,k,24} + \Delta standard\_BUIL \\ &\quad + \eta^{EXP_{h,k,24}}.(\Delta pexp_{24} - \Delta pexp) \\ &\quad + \eta^{Buil_{h,k,22\_24}}.\left(\frac{PEXP^{TEP}_{22,t-1}}{PEXP^{TEP}_{24,t-1}}.\Delta pexp_{22} - \frac{PEXP^{TEP}_{24,t-1}}{PEXP^{TEP}_{22,t-1}}.\Delta pexp_{24}\right) \\ &\quad \cdot \frac{EXP_{22\_BUIL\_eff,t-1}}{EXP_{22\_BUIL\_eff,t-1} + EXP_{24\_BUIL\_eff,t-1}} \\ &\quad + \eta^{Buil_{h,k,23\_24}}.\left(\frac{PEXP^{TEP}_{23,t-1}}{PEXP^{TEP}_{24,t-1}}.\Delta pexp_{23} - \frac{PEXP^{TEP}_{24,t-1}}{PEXP^{TEP}_{23,t-1}}.\Delta pexp_{24}\right) \\ &\quad \cdot \frac{EXP_{23\_BUIL\_eff,t-1}}{EXP_{22\_BUIL\_eff,t-1} + EXP_{24\_BUIL\_eff,t-1}} \qquad if\ ener\_buil_{h,k,23} > 0\end{aligned}$$

$$\begin{aligned}\Delta exp\_buil_{h,k,24} &= \Delta ener\_buil_{h,k,24} \\ &\quad + \Delta standard\_BUIL\ \ if\ ener\_buil_{h,k,24} \leqslant 0\end{aligned}$$

$$PENER^{BUIL}_{h,k,e}.ENER^{BUIL}_{h,k,e} = PEXP_{e,h}.EXP^{BUIL}_{h,k,e} \tag{4.121}$$

Aggregation Energy consumption in building

$$PENER^{BUIL}_{h,k}.ENER^{BUIL}_{h,k} = \sum_{e}(PENER^{BUIL}_{h,k,e}.ENER^{BUIL}_{h,k,e}) \tag{4.122}$$

$$ENER^{BUIL}_{h,k} = \sum_{e} ENER^{BUIL}_{h,k,e} \tag{4.123}$$

$$PENER^{BUIL}_{h}.ENER^{BUIL}_{h} = \sum_{k} PENER^{BUIL}_{h,k}.ENER^{BUIL}_{h,k} \tag{4.124}$$

$$ENER^{BUIL}_{h} = \sum_{k} ENER^{BUIL}_{h,k} \tag{4.125}$$

$$PENER^{BUIL}.ENER^{BUIL} = \sum_h PENER_h^{BUIL}.ENER_h^{BUIL} \tag{4.126}$$

$$ENER^{BUIL} = \sum_h ENER_h^{BUIL} \tag{4.127}$$

$$PENER_{h,e}^{BUIL}.ENER_{h,e}^{BUIL} = \sum_k PENER_{h,k,e}^{BUIL}.ENER_{h,k,e}^{BUIL} \tag{4.128}$$

$$ENER_{h,e}^{BUIL} = \sum_k ENER_{h,k,e}^{BUIL} \tag{4.129}$$

$$PENER_e^{BUIL}.ENER_e^{BUIL} = \sum_h PENER_{h,e}^{BUIL}.ENER_{h,e}^{BUIL} \tag{4.130}$$

$$ENER_e^{BUIL} = \sum_h ENER_{h,e}^{BUIL} \tag{4.131}$$

Agregation of total energy expenditure (automobile + building)

$$ENER_{h,k} \quad = \quad PENER_{h,k,0}^{BUIL}.ENER_{h,k}^{BUIL} + EXP_{h,k}^{AUTO} \tag{4.132}$$

$$\begin{aligned} PENER_{h,k}.ENERh_{h,k} = PENER_{h,k}^{BUIL}.ENER_{h,k}^{BUIL} \\ +PEXP_{03,h}.EXP_{h,k}^{AUTO} \end{aligned} \tag{4.133}$$

$$ENER_h \quad = \quad PENER_{h,0}^{BUIL}.ENER_h^{BUIL} + EXP_h^{AUTO} \tag{4.134}$$

$$PENER_h.ENER_h = PENER_h^{BUIL}.ENER_h^{BUIL} \quad + PEXP_{03,h}.EXP_h^{AUTO} \tag{4.135}$$

$$PENER.ENER = PENER^{BUIL}.ENER^{BUIL} \quad + PEXP_{03}.EXP^{AUTO} \tag{4.136}$$

$$EXP_{h,e} \quad = \quad PENER_{h,e}^{BUIL}.ENER_{h,e}^{BUIL} + EXP_{h,e}^{AUTO} \tag{4.137}$$

$$EXP_e = \sum_h EXP_{h,e} \tag{4.138}$$

Notional household h's expenditures in commodity c:

c={01 02 04 05 06 07 08 09 10 11 12 19 20}

$$\begin{aligned} EXP^{n}_{c,h}.PEXP_{c,h} &= PEXP_{c,h}.NEXP_{c,h} \\ &+\beta^{EXP}_{c,h}(DISPINC_h\_VAL.(1-MPS_h) - PNEXP_h.NEXP_h) \end{aligned} \tag{4.139}$$

$$\begin{aligned} \beta^{EXP}_{c,h,0} &= (PEXP_{c,h,0}.EXP_{c,h,0} - PEXP_{c,h,0}.NEXP_{c,h,0})/ \\ &(DISPINC_h\_VAL.(1-MPS^{HH}_h P_{h,0}) - PNEXP_{h,0}.NEXP_{h,0} - EXP^{HOUSING\_VAL}_{h,0} \\ &-EXP^{OTH\_VAL}_{13,h,0} - EXP^{MOB\_VAL}_{h,0}) \end{aligned}$$

is calibrated by inversing the above equation at the base year.

Household h's marginal propension to spend in commodity c:

$$\Delta ln(\beta^{EXP}_{c,h}) = (1-\eta^{LES\_CES}).\Delta ln(\frac{PEXP_{c,h}}{PEXP^{CES}_h}) \tag{4.140}$$

The marginal propension to spend in commodity c is assumed constant. In a future version, it may depend on the relative price to account for substitution effects.

$$PEXP^{CES}_h = \left[\sum_c \beta^{EXP}_{c,h,0}.PEXP_{c,h}{}^{(1-\eta^{LES\_CES})}\right]^{\frac{1}{1-\eta^{LES\_CES}}} \tag{4.141}$$

Household h's total necessary expenditures (value & volume):

$$PNEXP_h.NEXP_h = \sum_c PEXP_{c,h}.NEXP_{c,h} \tag{4.142}$$

$$NEXP_h = \sum_c NEXP_{c,h} \tag{4.143}$$

Total expenditure by product c:

$$PEXP_c.EXP_c = \sum_h PEXP_{c,h}.EXP_{c,h} \tag{4.144}$$

$$EXP_c = \sum_h EXP_{c,h} \tag{4.145}$$

$$\phi_{c,h}^{EXP} = \frac{EXP_{c,h}}{EXP_c} \tag{4.146}$$

Household h's expenditures price c:

c={01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24}

$$PEXP_{c,h} = PCH_c \tag{4.147}$$

Domestic et imported households' consumption in commodity c:

$$\Delta CHD_{c,t} = \Delta EXP_{c,t} + \Delta SUBST\_CHD_{c,t} \tag{4.148}$$

$$\Delta SUBST\_CHD_{c,t}^n = \eta^{LVL4\_HH} \Delta(pchd_c - pchm_c).\frac{PCHD_{c,t-1}.CHD_{c,t-1}}{PCH_{c,t-1}.CH_{c,t-1}}$$

$$\Delta CHM_{c,t} = EXP_{c,t} - CHD_c \tag{4.149}$$

$$\Delta SUBST\_CHM_{c,t}^n = \eta^{LVL4\_HH} \Delta(pchm_c - pchd_c).\frac{PCHM_{c,t-1}.CHM_{c,t-1}}{PCH_{c,t-1}.CH_{c,t-1}}$$

Ajustment :

c={01 02 04 05 06 07 08 09 10 11 12 19 20}

$$exp_{c,h,t} = \mu_1 exp_{c,h,t}^n + (1-\mu_1).exp_{c,h,t-1} + \Delta exp_{c,h}^e \tag{4.150}$$

$$\Delta exp_{c,h,t}^e = \mu_2 \Delta exp_{c,h,t-1}^e + \mu_3 \Delta exp_{c,h,t-1} + \mu_4 \Delta exp_{c,h,t}^n \tag{4.151}$$

5 Prices

Production price in activity a

$$PY_a^n = NCU_a.(1 + TMD_a) \tag{5.1}$$

Net cost per unit of production in activity a

$$NCU_a.Y_a = CU_a.Y_a + PIY_a IY_a + PIS_a IS_a - PSY_a SY_a + DIV_a^{HH}\_VAL + DIV_a^{GOV}\_VAL + DIV_a^{ROW}\_VAL + DIV_a^{BK}\_VAL - \frac{L_a}{L}.RTCO_E \tag{5.2}$$

Cost per unit of production in activity a

$$CU_a.Y_a = CK_a K_a + CL_a L_a PROG_a + PE_a E_a + PMAT_a MAT_a \tag{5.3}$$

$$CL_a.L_a = CL\_SE_a.L\_SE_a + CL\_S_a.L\_S_a \tag{5.4}$$

Mark-up in activity a

$$TMD_a = \alpha_a^{TMD} \frac{Y_a}{YOPT_a} \tag{5.5}$$

Potential production in activity a

$$\Delta yopt_{a,t} = \frac{CK_{a,t-1}K_{a,t-1}}{CU_{a,t-1}.Y_{a,t-1}}\Delta k_{a,t} + \frac{CL_{a,t-1}L_{a,t-1}PROG_{a,t-1}}{CU_{a,t-1}.Y_{a,t-1}}\Delta(l_{a,t} + prog_{a,t}) + \frac{PE_{a,t-1}E_{a,t-1}}{CU_{a,t-1}.Y_{a,t-1}}\Delta e_{a,t} + \frac{PMAT_{a,t-1}MAT_{a,t-1}}{CU_{a,t-1}.Y_{a,t-1}}\Delta mat_{a,t} \tag{5.6}$$

Labor cost in activity a

$$CL\_S_a = \frac{W\_S_a(1 + TCE_a)}{PROG_a} \tag{5.7}$$

$$CL\_SE_a = \frac{W\_SE_a}{PROG_a} \tag{5.8}$$

Capital cost in activity a

$$CK_{a,t}K_{a,t} = PI_{a,t}K_{a,t-1}(\delta_a + \varphi_a^{autof}\dot{K}_{a,t}) + PDEBT_{a,t-1}DEBT_{a,t-1}r_{a,t} \tag{5.9}$$

$$PDEBT_{a,t} = PIA_a \tag{5.10}$$

Composite intermediary consumption price in activity a

$$PMAT_a.MAT_a = \sum_{c=1}^{20} PMAT_{c,a}.MAT_{c,a} \tag{5.11}$$

$$PE_a.E_a = \sum_{c=21}^{24} PE_{c,a}.E_{c,a} \tag{5.12}$$

$$DEBT_a = K_a \tag{5.13}$$

In a future version, we may assume that capital is not integrally financed by the debt.

Material price for commodity c paid by activity a (c=1,...,20)

$$PMAT_{c,a}.MAT_{c,a} = PMATD_c.MATD_{c,a} + PMATM_c.MATM_{c,a} \quad for c = \{1, ..., 20\} \tag{5.14}$$

Energy price for commodity c paid by activity a (c=21,...,24)

$$PE_{c,a}.E_{c,a} = PED_c.ED_{c,a} + PEM_c.EM_{c,a} \quad for\ c = \{21, ..., 24\} \tag{5.15}$$

Aggregate investment price for activity a:

$$PIA_a.IA_a = \sum_c PIA_{c,a}.IA_{c,a} \tag{5.16}$$

Selling price (including margins, exclusive of VAT) for domestic commodity c

$$\begin{aligned} PYQS_c.YQS_c =& PYQ_c.YQ_c.(1 + T_c^{ENERTD}) + YQ_c(T_c^{OTHD} + T_c^{SUB}) \\ &+ PMTD_c.MTD_c + PMCD_c.MCD_c \quad if\ c \neq \{14, ..., 19\} \end{aligned} \tag{5.17}$$

$$PYQS_c.YQS_c = PYQ_c.YQ_c.(1 + T_c^{ENERTD}) + YQ_c(T_c^{OTHD} + T_c^{SUB}) \quad if\ c = \{14, ..., 19\}$$

$$\Delta yqs_c = \Delta yq_c \tag{5.18}$$

YQS_c is the volume of the production expressed at market price before VAT. It should not be seen as a composite of several "goods": production at base price and margins. Indeed, its does not increase when the volume of the commercial and transport margins increase. The price does instead. Its specification is $YQS_{c,t} = YQ_{c,t}\left(1 + T_{c,0}^{ENERT} + T_{c,0}^{OTHD} + T_{c,0}^{SUB} + \frac{MTD_{c,0}}{YQ_{c,0}} + \frac{MCD_{c,0}}{YQ_{c,0}}\right)$ which is equivalent to 5.18, that is to assuming that YQS_c is always proportionnal to YQ_c. Writing it following the specification composite of several goods,

$YQS_{c,t} = YQ_{c,t}\left(1 + T_{c,0}^{ENERT} + T_{c,0}^{OTHD} + T_{c,0}^{SUB} + \frac{MTD_{c,t}}{YQ_{c,t}} + \frac{MCD_{c,t}}{YQ_{c,t}}\right)$, would lead to inacurate results since a decrease in the quantity of transport used per unit of production would not lead to a decrease of the selling price. Notice that the similarity with the specification of the volume of a tax or a subvention. As specified earlier, we assume that an increase in the tax rate does not increase the volume of the tax but increases its price. The volume of the tax increases only when the volume of the taxe bases (e.g. consumption, production) increases.

Selling price (including margins, exclusive of VAT) for imported commodity c

$$\begin{aligned} PMS_c.MS_c &= PM_c.M_c.(1 + T_c^{OTHM}) + M_c.T_c^{ENERTM} + PMTM_c.MTM_c \\ &\quad + PMCM_c.MCM_c \quad if\ c \neq \{14, ..., 19\} \end{aligned} \tag{5.19}$$

$$PMS_c.MS_c = PM_c.M_c.(1 + T_c^{OTHM}) + M_c.T_c^{ENERTM} \quad if\ c = \{14, ..., 19\}$$

$$\Delta ms_c = \Delta m_c \tag{5.20}$$

Price of the domestically produced intermediary consumption c

$$PMATD_{c,t} = PYQS_{c,t}\frac{\left(1 + T_{c,t}^{VATD_{oth}}\right)}{\left(1 + T_{c,0}^{VATD_{oth}}\right)} \quad if\ c = \{1, ..., 20\} \tag{5.21}$$

$$PED_{c,t} = PYQS_{c,t}\frac{\left(1 + T_{c,t}^{VATD_{oth}}\right)}{\left(1 + T_{c,0}^{VATD_{oth}}\right)} \quad if\ c = \{21, ..., 24\} \tag{5.22}$$

Price of the imported intermediary consumtion c

$$PMATM_{c,t} = PMS_{c,t}\frac{\left(1 + T_{c,t}^{VATM_{oth}}\right)}{\left(1 + T_{c,0}^{VATM_{oth}}\right)} \quad if\ c = \{1, ..., 20\} \tag{5.23}$$

$$PEM_{c,t} = PMS_{c,t}\frac{\left(1 + T_{c,t}^{VATM_{oth}}\right)}{\left(1 + T_{c,0}^{VATM_{oth}}\right)} \quad if\ c = \{21, ..., 24\} \tag{5.24}$$

Domesticly produced households' consumption price for commodity c

$$PCHD_{c,t} = PYQS_{c,t}\frac{\left(1 + T_{c,t}^{VATD}\right)}{\left(1 + T_{c,0}^{VATD}\right)} \tag{5.25}$$

Imported households' consumption price for commodity c

$$PCHM_{c,t} = PMS_{c,t}\frac{\left(1+T_{c,t}^{VATD}\right)}{\left(1+T_{c,0}^{VATD}\right)} \tag{5.26}$$

Domesticly produced public spending price for commodity c

$$PGD_{c,t} = PYQS_{c,t}\frac{\left(1+T_{c,t}^{VATD_{oth}}\right)}{\left(1+T_{c,0}^{VATD_{oth}}\right)} \tag{5.27}$$

Imported public spending price for commodity c

$$PGM_{c,t} = PMS_{c,t}\frac{\left(1+T_{c,t}^{VATM_{oth}}\right)}{\left(1+T_{c,0}^{VATM_{oth}}\right)} \tag{5.28}$$

Domesticly produced investment price for commodity c bought by activity a

$$PIAD_{c,t} = PYQS_{c,t}\frac{\left(1+T_{c,t}^{VATD_{oth}}\right)}{\left(1+T_{c,0}^{VATD_{oth}}\right)} \tag{5.29}$$

Imported investment price for commodity c

$$PIAM_{c,t} = PMS_{c,t}\frac{\left(1+T_{c,t}^{VATM_{oth}}\right)}{\left(1+T_{c,0}^{VATM_{oth}}\right)} \tag{5.30}$$

Domesticly produced export price for commodity c

$$PXD_c = PYQS_c \tag{5.31}$$

Imported export price for commodity c

$$PXM_c = PMS_c \tag{5.32}$$

Domesticly produced changes in inventories price for commodity c

$$PDSD_c = PYQS_c \tag{5.33}$$

Imported changes in inventories price for commodity c

$$PDSM_c = PMS_c \tag{5.34}$$

Price of transport margins m paid on domesticly produced commodity c

$$PMTD_{m,c} = \frac{YQ_m}{YQ_m + M_m} PYQS_m + \frac{M_m}{YQ_m + M_m} PMS_m \quad if m = \{14, ..., 18\} and c \neq \{14, ..., 18\} \tag{5.35}$$

Price of transport margins m paid on imported commodity c

$$PMTM_{m,c} = PMTD_{m,c} \quad if\ m = \{14, ..., 18\}\ and\ c \neq \{14, ..., 18\} \tag{5.36}$$

Price of commercial margins paid on domesticly produced commodity c

$$PMCD_c = \frac{YQ_{19}}{YQ_{19} + M_{19}} PYQS_{19} + \frac{M_{19}}{YQ_{19} + M_{19}} PMS_{19} \quad if\ c \neq 19 \tag{5.37}$$

Price of the imported transport margins m paid on commodity c

$$PMCM_{m,c} = PMCD_c \quad if\ c \neq 19 \tag{5.38}$$

Import price at base cost for commodity c

$$PM_c = PWD_c.TC \tag{5.39}$$

Notional wage by activity:

$$\Delta w^n_{a,t} = \rho_{1,a} + \rho_{2,a} \Delta p_t + \rho_3 \Delta p^{rog}_{a,t} - \rho_{4,a} \Delta (p^m_{a,t} - p^y_{a,t}) - \rho_5 U_t - \rho_6 \Delta U_t + \rho_7 \Delta (l_{a,t} - l_t) \tag{5.40}$$

$$\Delta w\_se_{a,t} = \Delta w\_s_{a,t} \tag{5.41}$$

Taylor Rule

$$R\_Dir = \theta_1 \Delta \dot{P}_t - \theta_2 \Delta U_t \tag{5.42}$$

6 Green House Gases Emissions and Energy

Carbon intensity of the energy commodities e:

$$IC_e = \frac{EMS_e}{QD_e + M_e - X_e} \qquad for \quad e = 21, 22, 23 \tag{6.1}$$

Emissions by activity and by type :

$$\Delta ems_{e,a} = \Delta e_a \tag{6.2}$$

Aggregate emissions by activity :

$$EMS_a = \sum_e EMS_{e,a} \tag{6.3}$$

Decarbonation :

$$\Delta ems\_dc_a = \Delta mat_a \tag{6.4}$$

GHG emissions of Households :

$$\Delta ems_{e,h} = \Delta exp_{e,h} \tag{6.5}$$

GHG emissions from building of Households

$$\Delta ems\_hh^{BUIL}_{e,h,k} = \Delta \varphi^{EXP}_e + \Delta ener\_buil_{e,h,k} \tag{6.6}$$

$$EMS\_HH\_BUIL_{h,k} = \sum_e EMS\_HH\_BUIL_{e,h,k} \tag{6.7}$$

$$EMS\_HH\_BUIL_h = \sum_k EMS\_HH\_BUIL_{h,k} \tag{6.8}$$

$$EMS\_HH\_BUIL_k = \sum_h EMS\_HH\_BUIL_{h,k} \tag{6.9}$$

$$EMS\_HH\_BUIL = \sum_h EMS\_HH\_BUIL_h \tag{6.10}$$

GHG emissions from building of Households

$$\Delta ems\_hh_{e,h,k}^{AUTO} = \Delta \varphi_e^{EXP} + \Delta ener\_auto_{e,h,k} \tag{6.11}$$

$$EMS\_HH\_AUTO_{h,k} = \sum_e EMS\_HH\_AUTO_{e,h,k} \tag{6.12}$$

$$EMS\_HH\_AUTO_h = \sum_k EMS\_HH\_AUTO_{h,k} \tag{6.13}$$

$$EMS\_HH\_AUTO_k = \sum_h EMS\_HH\_AUTO_{h,k} \tag{6.14}$$

$$EMS\_HH\_AUTO = \sum_h EMS\_HH\_AUTO_h \tag{6.15}$$

Aggregation of automobile and housing emissions

$$EMS\_HH_{h,k,e} = EMS\_HH\_AUTO_{e,h,k} + EMS\_HH\_BUIL_{e,h,k} \tag{6.16}$$

$$EMS\_HH_{h,k} = \sum_e EMS\_HH_{e,h,k} \tag{6.17}$$

$$EMS\_HH_h = \sum_k EMS\_HH_{h,k} \tag{6.18}$$

$$EMS\_HH_k = \sum_h EMS\_HH_{h,k} \tag{6.19}$$

$$EMS\_HH = \sum_h EMS\_HH_h \tag{6.20}$$

Total of GHG emissions :

$$EMS = EMS\_S + EMS\_HH \tag{6.21}$$

Aggregate emissions by source e:

$$EMS_e = \sum_a EMS_{e,a} + \sum_h EMS_{e,h} \tag{6.22}$$

Energetic Consumption in Mtep of Households :

$$\Delta q\_Mtep\_H_{e,h} = \Delta ener\_buil_{e,h} \tag{6.23}$$

$$Q\_Mtep\_H_e = \sum_h Q\_Mtep\_H_{e,h} \tag{6.24}$$

$$Q\_Mtep\_H = \sum_e Q\_Mtep\_H_{e,h} \tag{6.25}$$

$$\Delta q\_Mtep\_TRSP_{e,h} = \Delta ener\_auto_{e,h} \tag{6.26}$$

$$Q\_Mtep\_TRSP_e = \sum_h Q\_Mtep\_TRSP_{e,h} \tag{6.27}$$

$$Q\_Mtep\_TRSP = \sum_e Q\_Mtep\_TRSP_{e,h} \tag{6.28}$$

Energetic Production in Mtep :

$$\Delta q\_Mtep_{e,a} = \Delta e_{e,a} \tag{6.29}$$

$$Q\_Mtep_e = \sum_a Q\_Mtep_{e,a} + Q\_Mtep\_TRSP_e + Q\_Mtep\_H_e \tag{6.30}$$

Energetic consumption of automobile of households :

$$\Delta q\_Mtep\_autoparc_{e,h} = \Delta ener\_auto_{e,h} \tag{6.31}$$

$$Q\_Mtep\_AUTOPARC_e = \sum_h Q\_Mtep\_AUTOPARC_{e,h} \tag{6.32}$$

$$Q\_Mtep\_AUTOPARC = \sum Q\_Mtep\_AUTOPARC_e \tag{6.33}$$

Energetic Production in Mtep by subsectors:

$$\begin{array}{rcll} ED_{ena} & = & \sum_e ED_{ena,e} & for \quad ena \in a = 21, 2201, \ldots, 2406 \\ EM_{ena} & = & \sum_e EM_{ena,e} & \end{array} \tag{6.34}$$

$$E_{ena} = EM_{ena} + ED_{ena} \tag{6.35}$$

$$Q\_Mtep_{ena,e} = \varphi^Y_{ena,e}.(Q\_Mtep\_H_e + Q\_Mtep\_TRSP_e + Q\_Mtep_{e,a}) \qquad for \quad e = 22, 23, 24 \tag{6.36}$$

Conversion between primary energy and final energy:

$$Q\_Mtep_{ena}^{EP} = \zeta_{ena}^{ENE}.Q\_Mtep_{ena} \tag{6.37}$$

$$Q\_Mtep^{EP} = \sum_{ena} Q\_Mtep_{ena}^{EP} \tag{6.38}$$

Aggregation of energy consumption

$$Q\_Mtep_e = Q\_Mtep\_H_e + \sum_a Q\_Mtep_{e,a} + Q\_Mtep\_H\_TRSP_e \tag{6.39}$$

$$Q\_Mtep = Q\_Mtep_e \tag{6.40}$$

Unitary energy prices in euro per Mtep :

$$PE_e^{TEP}.Q\_Mtep_{a,e} = PE_e.E_{e,a} \tag{6.41}$$

$$PEXP_e^{TEP}.Q\_Mtep\_H_{,e} = PENER\_BUIL_e.ENER\_BUIL_e \tag{6.42}$$

$$PEXP_e^{TEP}.Q\_Mtep\_H_{,e} = PEXP_e.EXP_e \tag{6.43}$$

$$PEXP\_TRSP_e^{TEP}.Q\_Mtep\_TRSP_{,h,e} = PEXP_{03} \sum_k EXP\_AUTO_{h,k,e} \tag{6.44}$$

$$PEXP_e^{TEP}.Q\_Mtep\_H_e = \sum_k PENER\_BUIL_{k,e}.PE_e.E_{e,a} \tag{6.45}$$

Special Contribution to the Electricity's Public services:

$$CSPE = CSPE\_elec + CSPE\_heat + CSPE\_biocarb \tag{6.46}$$

$$CSPE\_elec_{ena} = \left(CU_a - CU_{23\_foss}\right).Y_{ena} \quad for\ a = 2305, 2306, 2307, 2308 > 0 \tag{6.47}$$

$$\begin{aligned} CSPE\_elec \quad = \quad & CSPE\_elec_{2305} + CSPE\_elec_{2306} + \\ & CSPE\_elec_{2307}.\frac{Q\_Mtep_{2307,t} - Q\_Mtep_{2307,0}}{Q\_Mtep_{2307,t}} + CSPE\_elec_{2308} \end{aligned} \tag{6.48}$$

$$CSPE\_heat_{ena} = (CU_a - CU_{2401}).Y_{ena} \quad for\ a = 2402, 2403, 2404, 2405, 2406 > 0 \tag{6.49}$$

$$CSPE\_heat = CSPE\_heat_{2402}.\left(\frac{Q\_Mtep_{2302,t} - Q\_Mtep_{2302,0}}{Q\_Mtep_{2302,t}}\right) + CSPE\_heat_{2403} + CSPE\_heat_{2404} + CSPE\_heat_{2405} + CSPE\_heat_{2406} \tag{6.50}$$

$$CU_{23}^{foss} = \frac{\sum_{ena} CU_{ena}.Y_{ena}}{\sum_{ena} Y_{ena}} \quad for\ ena = 2301, 2302, 2303, 2304 > 0 \tag{6.51}$$

$$CSPE\_biocarb = (CU_{2202} - CU_{2201}).Y_{2202} \tag{6.52}$$

7 Demography

Total employment (Full Time Employment equivalent):

$$L = \sum_a (L\_S_a + L\_SE_a) \tag{7.1}$$

Employment level by sex and age (International Labor Organisation definition):

$$\Delta empl_{sex,age} = \Delta l \tag{7.2}$$

Where sex = {Men, Women} and age = {15-19, 20-24, 25-54, 60-64, 65+}

Labor force by sex and age:

$$LF_{sex,age} = PARTR_{sex,age}.POP_{sex,age} \tag{7.3}$$

Labor force participation ratio by sex and age:

$$\Delta PARTR^n_{sex,age} = \Delta PARTR^{Trend}_{sex,age} + \beta_{sex,age}\Delta U \tag{7.4}$$

Unemployment level by sex and age:

$$UN_{sex,age} = LF_{sex,age} - EMPL_{sex,age} \tag{7.5}$$

Unemployment rate by sex and age:

$$U_{sex,age} = UN_{sex,age}/LF_{sex,age} \tag{7.6}$$

$$U_{sex} = UN_{sex}/LF_{sex} \tag{7.7}$$

$$U_{age} = UN_{age}/LF_{age} \tag{7.8}$$

$$UNR\_TOT = UN\_TOT/LF\_TOT \tag{7.9}$$

Aggregation for unemployment:

$$UN_{age} = \sum_{sex}(UN\_M_{age} + UN\_W_{age}) \tag{7.10}$$

$$UN_{sex} = \sum_{age} UN_{sex,age} \tag{7.11}$$

$$UN\_TOT = \sum_{sex} UN_{sex} \tag{7.12}$$

Aggregation for labor force:

$$LF_{age} = \sum_{sex}(LF\_M_{age} + LF\_W_{age}) \tag{7.13}$$

$$LF_{sex} = \sum_{age} LF_{sex,age} \tag{7.14}$$

$$LF\_TOT = \sum_{sex} LF_{sex} \tag{7.15}$$

8 Other equations

Adjustment process and expectations:

For quantity and prices, the adjustment process and expectations are specified according to the following equations.

$$ln(X_t) = \lambda_0^X.ln(X_t^n) + (1 - \lambda_0^X)(ln(X_{t-1}) + \Delta ln(X_t^e)) \tag{8.1}$$

$$\Delta ln(X_t^e) = \lambda_1^X.\Delta ln(X_{t-1}^e) + \lambda_2^X.\Delta ln(X_{t-1}) + \lambda_3^X.\Delta ln(X_t^n) + \lambda_4^X.\Delta ln(X_{t+1}) \tag{8.2}$$

Where X_t is the effective value of a given variable (e.g. the production price, labor, capital, etc), X_t^n its notional (or desired) level, X_t^e its expected (anticipated) value at period t. The first equation assumes a geometric adjustment process. The taking into account of the anticipation warrants that in the long run the effective variable converge to their desired levels. The second equation

assumes a general specification for expectation that combines backward-looking and forward-looking expectation. We assume further that in the long run expectation are accurate: $\sum_{i=1}^{4} \lambda_i^X = 1$. We also assume that substitution effect adjust slowly:

$$SUBST\_X_t = \lambda_5^X . SUBST\_X_t^n + (1 - \lambda_5^X) . SUBST\_X_{t-1} \tag{8.3}$$

Appendix D Glossary of terms used

Sets

$a \in A$	Activities
$c \in C$	Commodities
$ena \in ENA$	Energetic activities $ENA \subset A$
$m \in M$	Margins $M \subset A$
$h, h' \in H$	Households
$k, k' \in K$	Energetic Class
$e, e' \in E$	Energetic commodities $E \subset C$

Endogenous variables

AIC_VAL	Taxes on capital (in value)
AIC_VAL_h	Taxes on capital per quintile (in value)
$AUTO_{h,k}$	Automobile stock of household h per energy class k
$AUTO_k$	Automobile stock per energy class k
$AUTO_h$	Automobile stock of household h
$AUTO_t$	Total automobile stock
$AUTO_t^{DES}$	Stock of automobile destroyed
$AUTO_{h,t}^{DES}$	Stock of automobile destroyed of household h
$\beta_{c,h}^{EXP}$	Variable of household h's marginal propension to spend in commodity c
$BONUS\_ELEC_h$	Bonus received by the household h for buying an electric car
$BUIL_{h,k}$	Building stock of household h per energy class k (in m2)
$BUIL_k$	Building stock per energy class k (in m2)
$BUIL_h$	Building stock of household h (in m2)
$BUIL_t$	Total building stock (in m2)
$BUIL_t^{DES}$	Stock of building destroyed (in m2)

$BUIL_{h,t}^{DES}$	Stock of building destroyed of household h (in m2)
$BUIL\_VERIF_h$	Stock building verification of household h for the initial period
$BUIL\_VERIF$	Total stock building verification for the initial period
BF_G_VAL	Public deficit (in value)
$C_{e,k}^{PerM2}$	Energy e consumption per m^2 in buildings class k
$C_{e,k}^{PerKM}$	Energy e consumption per Km in automobile class k
CH_c	Households'consumption of commodity c
CHD_c	Households' consumption of domestic commodity c
CHM_c	Households' consumption of imported commodity c
CI_c	Intermediary raw material c
CID_c	Domestically produced intermediary raw material c
$CID_{c,a}$	Domestically produced intermediary raw material c by the activity a
CIM_c	Imported intermediary raw material c by the activity a
$CIM_{c,a}$	Imported intermediary raw material c
CK_a	Capital cost in activity a
CL	Labor cost
CL_a	Labor cost in activity a
CL_S	Labor cost of salary workers
CL_S_a	Labor cost of salary workers in activity a
CL_SE	Labor cost of self-employed workers
CL_SE_a	Labor cost of self-employed workers in activity a
CSE_a	Employeur Social cotisations in activity a
CSE	Aggregated Employeur Social cotisations
CSE_ROW	Total Employeur Social cotisations from the Rest Of the World
CSE_TOT	Total Employeur Social cotisations
CSS	Aggregated Salary Social cotisations

CSS_a	Salary social cotisations in activity a
CSS_SE_a	Self-Employed Social cotisations in the activity a
CSS_TOT	Total Social cotisations
CU_a	Unitary Cost in the activity a
$DEBT_{h,k,t}^{AUTO\_VAL}$	Debt related to housing h for automobile class k
$DEBT_{h,k,t}^{NEWBUIL\_VAL}$	Debt related to housing h for new building k
$DEBT_{h,k,t}^{REHAB\_VAL}$	Debt related to housing h for building rehabilitation$k$
DC_VAL_a	Commercial balance in the activity a
DC_VAL	Aggregated Commercial balance
$DEBT_a$	Debt in the activity a
$DEBT\_G\_VAL$	Public debt
DEP_TCO_VAL	Total amount of carbon tax receipts (in value)
DEP_VAL	Public spendings
$DISPINC\_VAL$	Total net disposable income (in value)
$DISPINC^{AI}\_VAL$	Total disposable income before taxation (in value)
$DISPINC_h\_VAL$	Net Disposable income for household h (in value)
$DISPINC_h^{AI}\_VAL$	Disposable income before taxation for the household h (in value)
DIV^{GOV}_VAL	Government receipts fron the private activity (in value)
DIV^{HH}_VAL	Households dividend (in value)
DP_G_VAL	Public deficit ratio
DS_c	Stock variation in the commodity c
DSD_c	Stock variation in the domestically produced commodity c
DSM_c	Stock variation of the imported commodity c
E_c	Aggregate domestic energy c
$E_{c,a}$	Aggregate domestic energy c produced by the activity a
$E^e{}_c$	Expected aggregate domestic energy c

$E^n{}_c$	Notional aggregate domestic energy c
EBE_a	Gross Operating Profit of the activity a
EBE	Aggregate Gross Operating Profit
ED_c	Domestic energy c
$ED_{ena,e}$	Energy e domestically produced and consumed by the energetic sector ena
ED_{ena}	Total of Energy domestically produced and consumed by the energetic sector ena
EM_c	Imported energy c
$EM_{ena,e}$	Energy e imported and consumed by the energetic sector ena
EM_{ena}	Total of energy imported and consumed by the energetic sector ena
$EMPL_{sex,age}$	Number of worker per sex and age
EMS_a	Amount of emissions of the activity a
EMS_e	Amount of emissions from source e
$EMS_{e,a}$	Amount of emissions from source e of the activity a
$ENER^{BUIL}$	Total energy consumption in Kwh
$ENER_e^{BUIL}$	Energy consumption in Kwh by type of energy e
$ENER_h^{BUIL}$	Energy consumption in Kwh related to housing h
$ENER_{h,e}^{BUIL}$	Energy consumption in Kwh related to housing h by type of energy e
$ENER_{h,k}^{BUIL}$	Energy consumption in Kwh related to housing h per energy class k
$ENER_k^{BUIL}$	Energy consumptionin Kwh per class k building
$ENER_{k,e}^{BUIL}$	Energy consumption in Kwh per building class k by type of energy e
$ENER_{h,k,e}^{BUIL}$	Energy e consumption in Kwh in building class k related to housing h
$ENER_h$	Total energy expenditure of household h (automobile + building)

$ENER_{h,k}$	Total energy expenditure of household h per energy class k (automobile + building)
$ENER^{perM2}_{h,k,e}$	Energy consumption per M2 in Kwh of household h per energy class k by type of energy e
$ENERT_c$	Taxes on the energetic products c (TICE,TICGN, TIPP, TICC)
$ENERTD_c$	Taxes on the domestic energetic products c (TICE,TICGN, TIPP, TICC)
$ENERTM_c$	Taxes on the imported energetic products c (TICE,TICGN, TIPP, TICE)
EXP_c	Total household's expenditure in commodity c
$EXP_{h,c}$	Household's h expenditure in commodity c
$EXP^{OTH\_VAL}_{03,h}$	Household's h other expenditure in commodity 03 (in Value)
$EXP^{OTH\_VAL}_{13,h}$	Household's h other expenditure in commodity 13 (in Value)
EXP^{AUTO}	Household's h total automobile energy expenditure
$EXP^{AUTO}_{k,e}$	Automobile energy expenditure per energy class k by type of energy e
EXP^{AUTO}_{h}	Household's h automobile energy expenditure
$EXP^{AUTO}_{h,k}$	Household's h automobile energy expenditure per energy class k
$EXP^{AUTO}_{h,k,e}$	Household's h automobile energy expenditure per energy class k by type of energy e
$EXP^{BUIL}_{h,k,e}$	Household's h building energy expenditure per energy class k by type of energy e
$EXP^{n}_{h,c}$	Notional Household's h expenditure in commodity c
$EXP^{e}_{h,c}$	Expected Household's h expenditure in commodity c
EXP_h	Household's h expenditure
$EXP^{HOUSING\_VAL}$	Total building expenditure (New building + rehabilitation + energy expenditure)
$EXP^{HOUSING\_VAL}_{h}$	Household's h total building expenditure (New building + rehabilitation + energy expenditure)

$EXP_{h,k}^{HOUSING\_VAL}$	Household's h total building expenditure per energy class k (New building + rehabilitation + energy expenditure)
$EXP^{HOUSINGbis\_VAL}$	Total building expenditure bis
$EXP_{h}^{HOUSINGbis\_VAL}$	Household's h total building expenditure bis
$EXP^{HOUSINGver\_VAL}$	Verification of total building expenditure
$EXP_{h}^{HOUSINGver\_VAL}$	Household's h verification of total building expenditure
$EXP\_MOB_{h}^{OTH\_VAL}$	Household's h other mobility expenditure
$EXP\_MOB_{h}^{VAL}$	Household's h mobility expenditure
$EXP\_MOB^{AUTO\_VAL}$	Total automobile mobility expenditure
$EXP\_MOB_{h}^{AUTO\_VAL}$	Household's h automobile mobility expenditure
$EXP\_MOB_{h,k}^{AUTO\_VAL}$	Household's h automobile mobility expenditure in energy class k
$EXP\_MOB^{AUTObis\_VAL}$	Total automobile mobility expenditure bis
$EXP\_MOB_{h}^{AUTObis\_VAL}$	Household's h automobile mobility expenditure bis
$EXP\_MOB^{AUTOver\_VAL}$	Verification of total automobile mobility expenditure
$EXP\_MOB_{h}^{AUTOver\_VAL}$	Verification of Household's h automobile mobility expenditure
$EXP_{h,c}^{n}$	Notional Household's h expenditure in commodity c
$EXP^{NEWAUTO\_VAL}$	Total new automobile expenditure
$EXP_{h}^{NEWAUTO\_VAL}$	Household's h new automobile expenditure
$EXP_{h,k}^{NEWAUTO\_VAL}$	Household's h new automobile expenditure in energy class k
$EXP^{NEWBUIL\_VAL}$	Total new building expenditure
$EXP_{h}^{NEWBUIL\_VAL}$	Household's h new building expenditure
$EXP_{h,k}^{NEWBUIL\_VAL}$	Household's h new building expenditure in energy class k
EXP^{REHAB_VAL}	Total rehabilitation expenditure in energy class k
$EXP_{h}^{REHAB\_VAL}$	Household's h rehabilitation expenditure

$EXP_{h,k}^{REHAB\_VAL}$	Household's h rehabilitation expenditure
$EXP_{h,03}^{elec}$	Household's h expenditures in an electric car
$EXPG_c$	Public expenditure in commodity c
$EXPH$	Total household's expenditure
$EXPH_c$	Household's expenditure in commodity c
FW_VAL	Households financial wealth (in value)
G_c	Public expenditures of the public good c
GD_c	Public expenditures in the domestic public good c
GDP	Gross domestic product (product definition)
GDP_c	Gross domestic product for commodity c
$GDPbis$	Gross domestic product (product definition check)
$GDPter$	Gross domestic product (value-added definition)
GM_c	Public expenditures of the imported public good c
I_c	Private investment with the commodity c
IA_a	Aggregate Investment in the activity a
$ia_{c,a}$	Commodity c investement in activity a
$IAD_{c,a}$	Aggregate Investment in the activity a in domestic commodity c
$IAM_{c,a}$	Aggregate Investment in the activity a in imported commodity c
IC_c	commodity c
ID_c	Private investment with the domestically produced commodity c
IM_c	Private investment in imported commodity c
IR_VAL	Aggregate tax on income
IR_h_VAL	Tax on income for the houshold h
IS	Aggregate tax on benefits
IS_a	Taxe on benfits in activity a
IY	Aggregate tax on activities

IY_a	Tax on activity a
K_a	Capital stock in the actvity a
Km_h^{AUTO}	Household's h automobile kilometers traveled
$Km_{h,k}^{AUTO}$	Household's h automobile kilometers by energy class k
$Km_{c,h}^{Traveler}$	Household's h kilometers traveled by type of transport c
$Km_h^{Traveler\_AUTO}$	Household's h automobile kilometers traveled
$Km_h^{Traveler}$	Household's h total kilometers traveled
K_a^e	Expected capital stock in activity a
K_a^n	Notional capital stock in activity a
L	Total employment
L_a	Enployment in the activity a
$LD_{h,k}$	Household's h duration loan in class energy k
$LD_{h,k}^{REHAB}$	Household's h duration loan for building rehabilitation in class energy k
L_a^e	Expected employment in activity a
L_a^n	Notional employment in activity a
L_S	Total employment of salary workers
L_S_a	Employment of salary workers in activity a
L_SE	Total employment of self-employed workers
L_SE_a	Employment of self-employed workers in activity a
LF_{age}	Labor force by age
$LF_{sexe,age}$	Labor force by sexe and age
LF_TOT	Total labor force
LF_{sexe}	Labor force by sexe
M	Aggregate importation
M_c	Importation of commodity c
MAT_a	Total raw material in actvity a
$MAT_{c,a}$	Raw material of commodity c in the actvity a

MAT_a^e	Expected total raw material in actvity a
MAT_a^n	Notional total raw material in actvity a
$MATD_{c,a}$	Domestic raw material of commodity c in activity a
$MATM_{c,a}$	Imported raw material of commodity c in activity a
$MBIS_c$	Importation of commodity c (verification)
MC	Aggregate commercial margins on the commodity c
MCD	Agregate ommercial margins on the domestic commodity c
MCD_c	Commercial margins on the domestic commodity c
MCM	Aggregate commercial margins on the imported commodity c
MCM_c	The commercial margins on the imported commodity c
MPS_h	The marginal propension to save of household h
MT	Aggregate transport margins on the domestic commodity
MT_c	Transport margins on the commodity c
MTD	Aggregate transport margins on the domestic commodity
MTD_c	Transport margins on the domestic commodity c
$MTD_{a,c}$	Transport margins of the sector a on the domestic commodity c
MTM	Aggregate transport margins on the imported commodity
MTM_c	Transport margins on the imported commodity c
$MTM_{a,c}$	Transport margins of the sector a on the imported commodity c
NCU_a	Net Unitary Cost in the activity a
$NEWAUTO_h$	Household's h new auto
$NEWAUTO_{h,k}$	Household's h new auto in class energy k
$NEWBUIL_h$	Household's h new building
$NEWBUIL_{h,k}$	Household's h new building in class energy k

$NEXP_h$	Necessary expenditures of household's h
$OTHT$	Aggregate others taxes
$OTHT_c$	Others taxes on the commodity c
$OTHTD_c$	Others taxes on the domestic commodity c
$OTHTM_c$	Others taxes on the imported commodity c
P	Price
$PARTR^n_{sex,age}$	Notional labor force participation by sex and age
$\dot{P}^{Ener\_m2\_e}_{h,k}$	Expected growth rate of energy price per m2 for household h in class k
$\dot{p}^{Ener\_m2}_{h,k}$	Growth rate of energy price per m2 for household h in class k
$P^{Ener\_m2}_{h,k}$	Energy price per m2 for household h in class k
$P^{I\_auto}_k$	Average price of investement in automobile class k
P^{REHAB}_k	Average price of the investement in renovation
$PAUTO_{h,k}$	Price of expenditure related to class k automobile
PCH	Aggregate composite price for the consumed commodity
PCH_c	Composite price for the consumed commodity c
$PCHD$	Aggregate composite price of the domestic consumed commodity
$PCHD_c$	Composite price of the domestic consumed commodity c
$PCHM$	Aggregate composite price of the imported consumed commodity
$PCHM_c$	Composite price of the imported consumed commodity c
PCI	Aggregate composite price for the intermediary raw material
$PCID$	Aggregate composite price for the domestic intermediary raw material c
$PCID_c$	Composite price for the domestic intermediary raw material c

$PCID_{c,a}$	Composite price for the domestic intermediary raw material c in activity a
$PCIM_c$	Aggregate composite price for the imported intermediary raw material
$PCIM_c$	Composite price for the imported intermediary raw material c
$PCIM_{c,a}$	Composite price for the imported intermediary raw material c in activity a
$PCSE$	Aggregate price of employer social contribution paid by domestic producer
$PCSE_a$	Price of employer social contribution paid by domestic producer in activity a
$PCSE^{ROW}$	Price of employer social contribution paid by foreign domestic producer
$PCSE^{SE}$	Price of employer social contribution paid by self-employed worker
$PCSE_a^{TOT}$	Price of the total employer social contribution
$PCSS$	Aggregate price of salary social contribution paid by domestic producers
$PCSS_a$	Price of salary social contribution paid by domestic producer in activity a
$PCSS^{TOT}$	Price of the total salary social contribution paid by domestic producers
$PDEBT_a$	Price of the debt of activity a
$PDEBT$	Aggregate price of the debt of activities
PDS	Aggregate price of changes in inventories for commodities
PDS_c	Price of changes in inventories for commodity c
$PDSD$	Aggregate price of domestically produced changes in inventories for commodities
$PDSD_c$	Price of domestically produced changes in inventories for commodity c
$PDSM$	Aggregate price of imported changes in inventories for commodities

$PDSM_c$	Price of imported changes in inventories for commodity c
$PDIV_a$	Price of dividents paid by activity$a$
PE	Composite Price of the energy
PE_c	Aggregate Price of the energy c
$PE_{c,a}$	Aggregate Price of the energy c in the activity a
PE_e^{TEP}	Unitary energy production in euro per Mtep by type of energy e for productive use
$PEBE$	Aggregate composite price Gross Operating Profit
$PEBE_c$	Composite price of the commodity c Gross Operating Profit
PED_c	Aggregate Price of the domestic energy c
PEM_c	Aggregated price of the imported energy c
$PED_{c,a}$	Price of the domestic energy c in activity a
$PEM_{c,a}$	Aggregated price of the imported energy c
$PENER$	Price of energy consumption
$PENER_h$	Household's h agregate price of energy consumption
$PENER_{h,k}$	Household's h aggregate price of energy consumption in energy class k
$PENER^{BUIL}$	Aggregate price of building energy consumption in energy class k
$PENER_e^{BUIL}$	Aggregate price of building energy consumption by type of energy e
$PENER_h^{BUIL}$	Household's h aggregate price of building energy consumption
$PENER_{h,e}^{BUIL}$	Household's h aggregate price of building energy consumption by type of energy e
$PENER_{h,k}^{BUIL}$	Average energy price paid in class k building
$PENER_{h,k,e}^{BUIL}$	Household's h price of building energy consumption by type of energy e in energy class k
$PENERT$	Aggregate composite price of the taxes on the energetic products (TICE,TICGN, TIPP, TICC)

$PENERT_c$	Composite price of the taxes on the energetic products c (TICE,TICGN, TIPP, TICC)
$PENERTD_c$	Composite price of the taxes on the domestic energetic products c (TICE,TICGN, TIPP, TICC)
$PENERTM_c$	Composite price of the taxes on the imported energetic products c (TICE,TICGN, TIPP, TICC)
$PEXP_{c,h}$	Price of household h's h expenditure in commodity c
$PEXP_h$	Price of household h's h expenditure
$PEXP_e^{TEP}$	Unitary energy production in euro per Mtep by type of energy e for domestic use
$PEXP\_TRSP_e^{TEP}$	Unitary energy production in euro per Mtep by type of energy e for transportation use
$PEXP_{03}^{eff}$	Expenditures Price in an efficient automobile $k = A, B, C$
$PEXPH$	Price of total household expenditure
$PEXPG_c$	Aggregate price of the public expenditures in commodity c
PG	Agregate composite public spending price
PG_c	Composite public spending price for commodity c
PGD	Aggregate domestically produced public spending price
PGD_c	Domestically produced public spending price for commodity c
$PGDP$	Composite price for the gross domestic product
$PGDP_c$	Composite price for the gross domestic product for each product c
$PGDPbis$	Composite price for the gross domestic product (aggregation of $PGDP_c$)
$PGDPter$	Composite price for the gross domestic product (Added Value Method)
PGM	Aggregate import public spending price
PGM_c	Import public spending price for commodity c
$\phi_{c,h}^{EXP}$	Household's h expenditure share in commodiy c
$\phi_{03bis,h}^{EXP}$	Household's h expenditure share in new automobile

$\phi^{EXP}_{13bis,h}$	Household's h expenditure share in new building
ϕ^{NRJ}_{a}	Energy share in activity a
PI	Agregate composite price for the domestic intermediary raw materials
PI_c	Composite price for the domestic intermediary raw material c
PIA	Investment composite price
PIA_a	Investment composite price in activity a
$PIA_{c,a}$	Investment composite price for commodity c in activity a
$PIAD_c$	Domestically produced investment price for commodity c
$PIAM_c$	Imported investment price for commodity c
PID	Composite price of the domestic private investment
PID_c	Composite price of the domestic private investment for commodity c
PIM	Composite price of the private investment in imported
PIM_c	Composite price of the private investment in imported commodity c
PIR	Composite price of the tax on income
PIS	Price of tax on benefits
PIS_c	Price of tax on benefits on commodity c
PIY	Price of tax on activities
PIY_a	Price of tax on activity a
PK_a	Price of capital stock on activity a
PM	Import Price at base cost
PM_a	Import Price at base cost on activity a
$PMAT$	Aggregate price of the material raws
$PMAT_c$	Price of the material raws c
$PMAT_{c,a}$	Price of the material for the imported commodity c in the activity araw in the sector$a$

$PMATD_c$	Aggregated price of the domestic material raws c
$PMATM_c$	Aggregated price of the imported material raws c
PMC_c	Composite price of the the commercial margins on the commodity c
$PMCD$	Composite price of the the commercial margins on the domestic commodities
$PMCD_c$	Composite price of the the commercial margins on the domestic commodity c
$PMCM$	Composite price of the the commercial margins on the imported commodities
$PMCM_c$	Composite price of the the commercial margins on the imported commodity c
PMS_c	Composite selling price of the imported production on the commodity c
PMT_c	Composite price of the transport margins of the sector a on the commodity c
$PMTD$	Composite price of the transport margins on the domestic commodities
$PMTD_c$	Composite price of the transport margins on the domestic commodity c
$PMTD_{c,a}$	Composite price of the transport margins of the sector a on the domestic commodity c
$PMTM$	Composite price of the transport margins on the imported commodities
$PMTM_c$	Composite price of the transport margins of the imported commodity c
$PMTM_{c,a}$	Composite price of the transport margins of the sector a on the imported commodity c
$P_h^{NEWAUTO}$	Price of household's h new auto
$P_{h,k}^{NEWAUTO}$	Price of household's h new auto in class energy k
$P^{NEWBUIL}$	Price of new building
$P_h^{NEWBUIL}$	Price of household's h new building
$P_{h,k}^{NEWBUIL}$	Price of household's h new building in class energy k

$POTHT$	Composite price of others taxes on commodities
$POTHT_c$	Composite price of others taxes on commodity c
$POTHD_c$	Composite price of others taxes on the domestic commodity c
$POTHTM_c$	Composite price of others taxes on the imported commodity c
PQ_c	Composite price for product
PQ_c	Composite price for product on commodity c
PQD	Agregate composite price for the domestic commodities
PQD_c	Composite price for the domestic commodity c
PQM	Agragte composite price for the imported commodities
PQM_c	Composite price for the imported commodity c
$P_{h,k}^{REHAB\_\delta}$	Price of household's h building rehabilitation in class k
$P_{h,k}^{REHAB}$	Price of household's h building rehabilitation in class k
$P_{h,k,k'}^{REHAB}$	Price of household's h building rehabilitation from energy class k' to energy class k
$PRESOC\_DOM^{Oth}\_VAL$	Others domestic social prestations
$PRESOC\_DOM^{U}\_VAL$	unployment social prestations
$PRESOC\_DOM\_VAL$	Agregate domestic social prestations
$PRESOC\_VAL$	Agregate social prestations
$PSUB$	Agregate composite price of the subvention on commodities
$PSUB_c$	Composite price of the subvention on commodity c
PSY	Price of subvention on activities
PSY_a	Price of subvention on activity a
$PTAX$	Composite price of the taxes
$PTAX_c$	Composite price of the taxes on the commodity c
PVA	Composite price for the Added-Value
PVA_c	Composite price for the Added-Value of the commodity c

$PVAT$	Aggregate composite price of the Value Added Tax
$PVAT_c$	Composite price of the Value Added Tax on commodity c
$PVATD_c$	Composite price of the Value Added Tax on domestic commodity c
$PVATM_c$	Composite price of the Value Added Tax on imported commodity c
PX	Aggregate composite price of export
PX_c	Composite price of export on commodity$c$
PXD	Aggregate price of the exports of the commodity c
PXD_c	Price of the exports of the commodity c
PXM	Aggregate price of the exported importations
PXM_c	Price of the exported importations of the commodity c
PY	Aggregate price of the domestically production
PY_a	Price of the domestically production in the activity$a$
PY_a^e	Expected Price of the domestically production in the activity a
PY_a^n	Notional price of the domestically production in the activity a
PYQ	Aggregate composite price of the domestically production
PYQ_c	Composite price of the domestically production on commodity c
$PYQS_c$	Selling price for domestic commodity c
Q	Aggregate produced commodity c
Q_c	Produced commodity c
QD	Domestically produced commodities
QD_c	Domestically produced commodity c
QM	Imported commodities
QM_c	Imported commodity c

Q_a^{MTEP}	Energy production in activity a expressed in physical currency
$Q_{e,h}^{MTEP\_H}$	Consumption of energy e in class of household h expressed in physical currency
$Q_{e,h}^{MTEP\_H\_TRSP}$	Consumption of energy e in class of household h expressed in physical currency linked to a transportation use
$Q_{e,h}^{MTEP\_H\_TRSP}$	Consumption of energy e in class of household h expressed in physical currency linked to a transportation use
$Q_{2301}^{MTEP\_EP}$	Primary energy production of nuclear sector
$Q_{2301}^{MTEP\_EF}$	Final energy production of nuclear sector
R	Interest rate
R_a	Interest rate in activity a
$R_k^{CASh\_auto}$	Share of investement in automobile paid cash
$R_{h,k}^{LOAN}$	Household's h share of investment in building paid with a loan in energy class k
$R_{h,k}^{LOAN\_REHAB}$	Household's h share of investment in building rehabilitation paid with a loan in energy class k
$R_{h,k}^{REHAB\_DEBT}$	Household's h share of debt in building rehabilitation
$REHAB$	Total building rehabilitation (in m2)
$REHAB_h$	Household's h building rehabilitation (in m2)
$REHAB_{h,k}$	Household's h building rehabilitation in energy class k (in m2)
$REHAB_{h,k,k'}$	household's h building rehabilitation from energy class k' to energy class k (in m2)
$R_k^{LOAN\_auto}$	Share of investement in automobile paid with a loan
R_k^I	Interest rate
$R_k^{I\_auto}$	Interest rate of automobile
R_k^{RMBS}	Rate of reimbursement of the debt
$R_k^{RMBS\_auto}$	Rate of reimbursement of the automobile debt

R_k^{SUB}	Rate of subsidies on investement in energy efficiency
$R_k^{SUB\_auto}$	Rate of subsidies on investement in automobile
R_Dir	Interest rate by the taylor rule
R^e	Expected interest rate
R^G	Interest rate
R^N	Notional interest rate
REC_VAL	Public receipts
$RTCO_h$	Carbon tax redistributed to household h
$RTCO_E$	Carbon tax redistributed to the economic activities
S	Aggregate saving
S_h	Saving of household h
SD_c	Domectic stock/inventories for commodity c
SD_c^e	Domestic expected stock/inventories for commodity c
SD_c^n	Domestic notional stock/inventories for commodity c
SM_c	Imported stock/inventories for commodity c
SM_c^e	Imported expected stock/inventories for commodity c
SM_c^n	Imported notional stock/inventories for commodity c
$STANDARD\_BUIL$	buildings norms
SUB	Agregate subvention
SUB_c	Subvention on the commodity c
$SUBST\_CHD_c$	Factor of substitution of domestic household consumption in commodity c
$SUBST\_CHD_c^n$	Factor of substitution of domestic household consumption in commodity c (notional)
$SUBST\_CHM_c$	Factor of substitution of imported household consumption in commodity c
$SUBST\_CHM_c^n$	Factor of substitution of imported household consumption in commodity c (notional)
$SUBST\_E_a^n$	Factor of substitution of energy(notional)

$SUBST\_E_a$	Factor of substitution of energy
$SUBST\_E\_n_{c,a}$	Factor of substitution between energy sources (c=21...24) (notional)
$SUBST\_E_{c,a}$	Factor of substitution between energy sources (c=21...24)
$SUBST\_ED_{c,a}$	Factor of substitution for domestic energy c in activity a (c=21...24)
$SUBST\_ED^n_{c,a}$	Factor of substitution for domestic energy c in activity a (c=21...24) (notional)
$SUBST\_EM_{c,a}$	Factor of substitution for imported energy c in activity a (c=21...24)
$SUBST\_EM^n_{c,a}$	Factor of substitution for imported energy c in activity a (c=21...24) (notional)
$SUBST\_GD^n_c$	Factor of substitution for domestic government consumption in commodity c (notional)
$SUBST\_GD_c$	Factor of substitution for domestic government consumption in commodity c
$SUBST\_GM_c$	Factor of substitution for imported government consumption in commodity c
$SUBST\_IAD_{c,a}$	Factor of substitution for domestic investment in commodity c (c=14...18)
$SUBST\_IAD^n_{c,a}$	Factor of substitution for domestic investment in commodity c (c=14...18) (notional)
$SUBST\_IAM_{c,a}$	Factor of substitution for imported investment in commodity c (c=14...18)
$SUBST\_K^n_a$	Factor of substitution of capital (notional)
$SUBST\_K_a$	Factor of substitution of capital
$SUBST\_L^n_a$	Factor of substitution of labor (notional)
$SUBST\_L_a$	Factor of substitution of labor
$SUBST\_MAT_a$	Factor of substitution of material
$SUBST\_MAT^n_{c,a}$	Factor of substitution between transport of intermediary consumption (c=14...18) (notional)
$SUBST\_MAT_{c,a}$	Factor of substitution between transport of intermediary consumption (c=14...18)

$SUBST\_MAT_a^n$	Factor of substitution of material (notional)
$SUBST\_MATD_{c,a}^n$	Factor of substitution between domestic transport of material raw (c=14...18) (notional)
$SUBST\_MATD_{c,a}$	Factor of substitution between transport of intermediary consumption (c=14...18)
$SUBST\_MATM_{c,a}^n$	Factor of substitution between foreign, transport of intermediary consumption (c=14...18) (notional)
$SUBST\_MATM_{c,a}$	Factor of substitution between transport of intermediary consumption (c=14...18)
$SUBST\_MTD_{c,a}^n$	Factor of substitution between domestic transports (c=14...18) (notional)
$SUBST\_MTD_{c,a}$	Factor of substitution between domestic transports (c=14...18)
$SUBST\_MTM_{c,a}^n$	Factor of substitution between foreign transports (c=14...18) (notional)
$SUBST\_MTM_{c,a}$	Factor of substitution between foreign transports (c=14...18)
$SUBST\_X_c$	Factor of substitution for exportation in commodity c
$SUBST\_X_c^n$	Factor of substitution for exportation in commodity c (notional)
$SUBST\_XD_c$	Factor of substitution for exportation of domestic products in commodity c
$SUBST\_XD_c^n$	Factor of substitution for exportation of domestic products in commodity c (notional)
$SUBST\_XM_c$	Factor of substitution for exportation of imported products in commodity c
$\sum \varphi_{h,k}^{REHAB}$	sum of household's h renovation share of class k building
SY	Agregate subvention on activities
SY_a	Subvention on activity a
$\tau_{h,k}^{REHAB}$	Household's h proportion of buildings rehabilitated in energy class k
$\tau_{h,k}^{REHAB\_n}$	Household's h notional proportion of buildings rehabilitated in energy class k
TAX	Aggregate Tax on domestic commodity c
TAX_c	Tax on domestic commodity c

TCO_c_VAL	Carbon tax on commodity c
$TCOD_c\_VAL$	Carbon tax on domestic commodity c
TMD_a	Mark-up in activity a
TS	saving rate
TS_h	Household's h saving rate
$UC^E_{h,k}$	Household's h user cost of energy building in energy class k
$UC^{E\_REHAB}_{h,k}$	Household's h user cost of energy building in energy class k
$UC_{h,k}$	Household's h user cost of building in energy class k
$UC^K_{h,k}$	Household's h user cost of capital building in energy class k
$UC^{K\_REHAB}_{h,k}$	Household's h user cost of capital building rehabilitation in energy class k
$UC^{REHAB}_{h,k}$	Household's h user cost building rehabilitation in energy class k
UN_{age}	Unemployment level by age
$UN_{sex,age}$	Unemployment level by sex and age
UN_{sex}	Unemployment level by sex
UNR_{age}	Unemployment rate by age
UNR_FR	Unemployment rate in France
UNR_HFR	Unemployment rate in France
$UNR_{sex,age}$	Unemployment rate by sex and age
UNR_{sex}	Unemployment rate by sex
UNR_TOT	Total unemployment rate
UNR_ZE	European unemployment rate
VA	Agregate value-added
VA_a	Value-added in activity a
VAT	Value Added Tax on domestic commodities
VAT_c	Value Added Tax on domestic commodity c

$VATD_c$	Value Added T)ax on domestic commodity c
$VATM_c$	Value Added Tax on imported commodity c
$VER\_P_{h,k}^{REHAB\_\delta}$	Verification of price household's h building rehabilitation in class k
VER_BUIL	Verification of building stock (in m2)
$VER\_\varphi_{h,k}^{REHAB}$	Verification of household's h renovation share of class k building
W	Agregate wage
W_S	Agregate wage of salaries
W_S_a	Wage of salaries in activity a
$W\_S_a^e$	Expected wage of salaries in activity a
$W\_S_a^n$	Notional wage of salaries in activity a
W_SE	Agregate wage of self employment
W_SE_a	Wage of self employment in activity a
X	Exportations of the commodities
X_c	Exportations of the commodity c
XD	Aggregate exportations of the domestically produced commodities
XD_c	Exportations of the domestically produced commodity c
XM	Aggregate re-exported importations of the commodities
XM_c	Re-exported importations of the commodity c
Y	Aggregate production
Y_a	Production in activity a
$Y_{c,a}$	Production of the commodity c in activity a
$YOPT_a$	Potential production in activity a
YQ	Aggregate production
YQ_c	Production in commodity c
$YQbis_c$	Production in commodity c (verification)
YQS_c	The volume of the production in commodity c expressed at market price before VAT

Exogenous variables

$BF\_G\_VAL\_ajust$	Public deficit adjustment(in value)
CSS_ROW	Social salary cotisations paid by the Rest Of the World
CSS_SE	Social salary cotisations paid by the Self-employed workers
$DEBT_{20}$	Debt in the activity 20
$DIV_a^{BK}\_VAL$	Dividends paid to the Bank by the sector a (in value)
$DIV_a^{GOV}\_VAL$	Dividends paid to the governement by the sector a (in value)
$DIV_a^{HH}\_VAL$	Dividends paid to the household by the sector a (in value)
$DIV_a^{ROW}\_VAL$	Dividends paid to the rest of the world by the sector a (in value)
$DNAIRU$	Non-Accelerating Inflation Rate of Unemployment
$DP\_G^n\_VAL$	Notional public deficit expressed in percentage of GDP
DSD_c	Stock variation of the domestic commodity c
DSM_c	Stock variation of the imported commodity c
$EXPG\_TREND$	Total public spendings
$GR\_PROG_a^E$	Growth rate of technical Progress for energy in activity a
$GR\_PROG_a^K$	Growth rate of technical Progress for energy in activity a
$GR\_PROG_a^L$	Growth rate of technical Progress for energy in activity a
$INFL\_ZE\_TARGET$	Target inflation of europe zone
INT_VAL	Total interest for household (in value)
LD_k	Duration of the loan
LD_k^{auto}	Duration of the automobile loan
$POP_{sex,age}$	Population by sex and age
POP^{TOT}	Total population

$PRESOC\_ROW\_VAL$ Social prestation to the benefit of the Rest Of the World (in value)

$PROG_a^j$ Index of Autonomous Technical Progress coefficient for input j = {K,L,E,M} in activity a

PWD_c World price for commodity c

SB_ROW foreign salary base

T^{AIC} Rate of tax capital hold by the households

TC euro currency change rate

T^{BONUS_elec} Rate of bonus granting for the buying of an electric car

T^{TCO} Rate of carbon tax

T_a^{CSS} Employe social contribution rate by activity a

T^{CSS_ROW} Employe social contribution rate paid by the rest of the world

T^{CSS_SE} Employe social contribution rate paid by self-employed

T_c^{ENERTD} Energy tax rate on domestic produced commodity c

T_c^{ENERTM} Energy tax rate on imported commodity c

T^{gth_elec} Penetration rate of the electric automobile

T^{IR} Rate of tax on household's income

T_a^{IS} Rate of tax on benefits

T_a^{IYN} Rate of tax on activity a

T_c^{OTHD} Rate of other tax on domestically produced commodity c

T_c^{OTHM} Rate of other tax on imported commodity c

TR_ROW_VAL Transferts toward the rest of the world (in value)

T_c^{SUB} Subvention rate on domestically produced commodity c

T_a^{SYN} Subvention rate for activities a

T_c^{VATD} VAT rate on domestic produced households consumption c

T_c^{VATM} VAT rate on imported households consumption c

$T_c^{VATDOTH}$	VAT rate on domestic produced commodity c (applied on intermediary consumption, investments and government consumption)
$T_c^{VATMOTH}$	VAT rate on domestic produced commodity c (applied on intermediary consumption, investments and government consumption)
WD_c	World demand for the product c

Greek symbols (parameters)

α^{AUTO}	
α_a^S	Share of the annual production this stocked by activity a
α^{TCO}	Share of the carbon tax receipts redistributed toward the households
$\beta_{sex,age}^{EMP}$	Participation rate to the labor market for each population of age age and sex sex
$\varphi_{h,k}^{NewBUIL}$	Share of the new building contructed with a class k label
$\delta_{h,k}^{BUIL}$	Depreciation rate from class k to k'
δ_a	Depreciation rate of the capital in sector a
$\tau_{h,k}^{REHAB}$	Proportion of the building of categoriy k is rehabilitated
$\varphi_{h,k',k}^{REHAB}$	share of the renovation of class k' building that are rehabilitated toward class k
$\varphi_{h,k}^{NewAUTO}$	Share of the new automobile contructed with a class k label
$\delta_{h,k}^{AUTO}$	Automobile depreciation rate
φ_a^K	Share (in value) of capital into the production of activity a
φ_a^L	Share (in value) of labor into the production of activity a
φ_a^E	Share (in value) of energy into the production of activity a
φ_a^M	Share (in value) of material into the production of activity a

φ_h^{TCO}	Share of the household carbon tax receipt redistributed toward the household h
$\varphi_{c,a}^{Y}$	Share of the commodity c produced by the activity a
φ^{AUTO}	Share of the auto in the transports
$\eta_a^{j,j'}$	Elasticity of substitution in activity a between the production factors j = {K,L,E,M} and j' = {K,L,E,M} for $j \neq j'$
$\eta_{h,k,e}^{BUIL\_i,i'}$	Inter-energy Elasticity of substitution for each household h and by type of energy e
η^{BONUS_elec}	Elasticity between the demand in electric car and the level of the electric bonus
η^{AUTO_elec}	Elasticity between the demand in electric car and the relative price of fuel energy
η^{prest}	Elasticity of the other social prestations to the level of unemployment
$\eta^{cd,cm}$	Armington's elasticity between the domestic good cd and the imported one cm
η^{LES_CES}	Elasticity of the L.E.S consumption function
$\eta^{MOB\_TRSP\_COL}$	Elasticity of substitution between the automobile and the collective transports
$\phi_{c,h}^{EXP}$	Share of the expenditure c on the comsumption
α_a^{TMD}	Elasticity of mark-up with production in activity a
ζ_e^{ENE}	conversion factor between primary and final energy production by type of energy e
λ_i^X	Ajustement parameter i = {1,..,5} for variable X (see Equations 8.1, 8.2, 8.3)