1 Introduction

This appendix provides all the equations of the model. The names of variables are defined in the Glossary in the last section of the document and ranked in alphabetical order. The glossary provides also the number of the equation defining a given variable and the page where this equation is located. Because there are several versions of ThreeME, an endogenous variable may be defined more than once in the document. In such a case, it appears several time in the Glossary.

For instance, there are three versions of the household block: (1) the basic version where a LES utility function is assumed for all commodities; (2) the nested version where transport, car, housing and energy consumption are modeled using a nested utility function; (3) the hybrid version where transport, car, housing and energy consumption are modeled using a bottom-up model.

There are also several versions regarding the specification of prices and taxes on commodities: (1) the basic version where taxes are not differentiated between uses (e.g. intermediary, final consumption, export, etc.) and type (e.g. VAT, subsidies, etc.); (2) the advanced version where this differentiation is made.

In this appendix, t is the time operator that may be omitted when no confusion arises, *e.g.* $Z = Z_t$. Variables in first difference are referred as: $\Delta(Z_t) = Z_t - Z_{t-1}$. Therefore the logarithm difference of a variable is approximately its growth rate: $\Delta(\log Z_t) \approx Z_t/Z_{t-1} - 1$. All parameters written in Greek letter are positive. n as an exponent refers to the notional value of a given variable that is the optimal value desired by the maximization agent: *e.g.* Z^n is the notional value of variable Z. Because of adjustment constraint, effective values adjust slowly to their notional value.

1.1 Sets and indexes

This section provides the different sets for each index used in the equation description.

Production factors f

$$f \in \{K, L, E, M\} \tag{1.1}$$

Greenhouse Gases ghg

$$ghg \in \{CO2, CH4, N2O, SF6, HFC, PFC\} \tag{1.2}$$

Car energy labels ecl

$$ecl \in \{CA, CB, CC, CD, CE, CF, CG\} \tag{1.3}$$

Building energy labels bcl

$$bcl \in \{CA, CB, CC, CD, CE, CF, CG, DES\} \tag{1.4}$$

Sectors (or activities) s

$$s \in S \tag{1.5}$$

Commodities c**,** cc

$$c, cc \in C \tag{1.6}$$

Margins m**,** mm

$$m, mm \in CMARG \subset C \tag{1.7}$$

Commodities used as material input cm

$$cm \in CMAT \subset C \tag{1.8}$$

commodities used as transportation input ct

$$ct \in CTRSP \subset C \tag{1.9}$$

commodities used as energy input ce

$$ce \in CE \subset C \tag{1.10}$$

2 Supply-Use equilibrium

This section provides the equations defining the supply use - equilibrium for the domestic and imported products and at the aggregate level. It also derives the GDP according to various definitions. All equations are therefore accounting identity.

Each identity is expressed in value and in volume. The value equation defines therefore a price index. By convention, the variable Z is always expressed in volume. PZ is its price. Therefore the quantity expressed in value is $Z^{VAL} = PZ * Z$. In most case, values are expressed as $PZ * Z$. When there is a risk that a variable in volume is equal to zero in simulation, we shall defined value as Z^{VAL} to avoid a division by zero issue. A typical example would be the value-added of sector s: $VA_s^{VAL} = PY_s\, Y_s - PCI_s\, CI_s$.

2.1 Use side

2.1.1 Domestic and foreign equilibrium for commodities c (value & volume):

Market price for the domestically produced commodity c

$$\begin{aligned} PQD_c\, QD_c = {} & PMGSD_c\, MGSD_c + PCID_c\, CID_c + PCHD_c\, CHD_c \\ & + PGD_c\, GD_c + PID_c\, ID_c + PXD_c\, XD_c + PDSD_c\, DSD_c \end{aligned} \tag{2.1}$$

Quantity of domestically produced commodity c expressed at market price

$$QD_c = MGSD_c + CID_c + CHD_c + GD_c + ID_c + XD_c + DSD_c \tag{2.2}$$

Market price for imported commodity c

$$\begin{aligned} PQM_c\, QM_c = {} & PMGSM_c\, MGSM_c + PCIM_c\, CIM_c + PCHM_c\, CHM_c \\ & + PGM_c\, GM_c + PIM_c\, IM_c + PXM_c\, XM_c + PDSM_c\, DSM_c \end{aligned} \tag{2.3}$$

Quantity of imported commodity c expressed at market price

$$QM_c = MGSM_c + CIM_c + CHM_c + GM_c + IM_c + XM_c + DSM_c \tag{2.4}$$

2.1.2 Margins supplied (value & volume):

The margins supplied by commodity m corresponds to the margins supplied by this commodity. By definition, the margins supplied is the sum of the margins paid (or used) on the commodities c.

The margins paid on domestic and imported products ($MGPD_{m,c}$ and $MGPM_{m,c}$) are defined with behavioral equations in the producer block. They follow the domestic and imported production of commodity c (YQ_c and M_c) more or less proportionally depending on the possibility of substitutions between margins. The margins paid are then aggregated to define the margins supplied, MGS_m. The latter is then disaggregated between the domestic and imported margins supplied ($MGSD_c$ and $MGSM_c$). See specification in the producer block.

Market price of the margins supplied by commodity m

$$PMGS_m \; MGS_m = \sum_c PMGP_{m,c} \; MGP_{m,c} \tag{2.5}$$

Margins supplied by commodity m, expressed at market price

$$MGS_m = \sum_c MGP_{m,c} \tag{2.6}$$

The margins supplied correspond to the sum of the margins paid to commodity m over all the commodities c

Market price of the margins supplied by commodity m (for verification)

$$PMGS_m^{bis} \; MGS_m^{bis} = PMGSD_m \; MGSD_m + PMGSM_m \; MGSM_m \tag{2.7}$$

Same variable as $PMGS_m$ above to check the accounting consistency.

Margins supplied by commodity m, expressed at market price (for verification)

$$MGS_m^{bis} = MGSD_m + MGSM_m \tag{2.8}$$

Same variable as MGS_m above to check the accounting consistency.

2.1.3 Aggregation of imports and domestic production for commodity c per use, expressed at market price (value & volume)

This subsection aggregates imports and domestic production for commodity c for various uses. It does not do it for Exports, Households and Government final consumption (X, CH and G) because these aggregates are already

defined in behaviour equations (see Trade international, Consumer and Government blocks). Expressed in value, this subsection also defines the prices indexes at market price for commodity c per use as a weighted average of imported and domestic production per uses: *i.e.* for Q (production of commodities), CI (intermediary consumption), I (private investment) and DS (change in inventories).

Market price of the production of commodity c

$$PQ_c\, Q_c = PQD_c\, QD_c + PQM_c\, QM_c \tag{2.9}$$

Production of commodity c**, expressed at market price**

$$Q_c = QD_c + QM_c \tag{2.10}$$

Market price of the intermediate consumption of commodity c

$$PCI_c\, CI_c = PCID_c\, CID_c + PCIM_c\, CIM_c \tag{2.11}$$

Intermediate consumption of commodity c**, expressed at market price**

$$CI_c = CID_c + CIM_c \tag{2.12}$$

Market price of the investment in commodity c

$$PI_c\, I_c = PID_c\, ID_c + PIM_c\, IM_c \tag{2.13}$$

Investment in commodity c**, expressed at market price**

$$I_c = ID_c + IM_c \tag{2.14}$$

Market price of the change in inventories of commodity c

$$PDS_c\, DS_c = PDSD_c\, DSD_c + PDSM_c\, DSM_c \tag{2.15}$$

Change in inventories of commodity c**, expressed at market price**

$$DS_c = DSD_c + DSM_c \tag{2.16}$$

2.1.4 Aggregation on sectors: production of commodity c per use for domestic and imported products, expressed at market price (value & volume)

This subsection provides the aggregates for commodity c for various uses, for domestic and imported products. They are calculated through the aggregation of the corresponding sectorial data on the sector index.

Market price for the domestically produced commodity c used as intermediary consumption

$$PCID_c \, CID_c = \sum_s PCID_{c,s} \, CID_{c,s} \tag{2.17}$$

Quantity of domestically produced commodity c used as intermediary consumption, expressed at market price

$$CID_c = \sum_s CID_{c,s} \tag{2.18}$$

Market price for imported commodity c used as intermediary consumption

$$PCIM_c \, CIM_c = \sum_s PCIM_{c,s} \, CIM_{c,s} \tag{2.19}$$

Quantity of imported commodity c used as intermediary consumption, expressed at market price

$$CIM_c = \sum_s CIM_{c,s} \tag{2.20}$$

Market price for domestically produced commodity c used as investment

$$PID_c \, ID_c = \sum_s PID_{c,s} \, ID_{c,s} \tag{2.21}$$

Quantity of imported commodity c used as investment, expressed at market price

$$ID_c = \sum_s ID_{c,s} \tag{2.22}$$

Market price for imported commodity c used as investment

$$PIM_c \, IM_c = \sum_s PIM_{c,s} \, IM_{c,s} \tag{2.23}$$

Quantity of imported commodity c used as investment, expressed at market price

$$IM_c = \sum_s IM_{c,s} \tag{2.24}$$

2.1.5 Aggregation on commodities: imported, domestic and aggregate intermediate consumption and investment of sector s, expressed at market price (value & volume)

This subsection provides the intermediate consumption and investment of sector s (imported, domestically produced and aggregated). They are calculated through the aggregation of the corresponding sectorial data on the commodity index.

Market price of domestically produced intermediate consumption of sector s

$$PCID_s\, CID_s = \sum_c PCID_{c,s}\, CID_{c,s} \tag{2.25}$$

Domestically produced intermediate consumption of sector s, expressed at market price

$$CID_s = \sum_c CID_{c,s} \tag{2.26}$$

Market price of imported intermediate consumption of sector s

$$PCIM_s\, CIM_s = \sum_c PCIM_{c,s}\, CIM_{c,s} \tag{2.27}$$

Imported intermediate consumption of sector s, expressed at market price

$$CIM_s = \sum_c CIM_{c,s} \tag{2.28}$$

Market price of intermediate consumption of sector s

$$PCI_s\, CI_s = PCID_s\, CID_s + PCIM_s\, CIM_s \tag{2.29}$$

Intermediate consumption of sector s, expressed at market price

$$CI_s = CID_s + CIM_s \tag{2.30}$$

Market price of intermediate consumption of sector s (for verification)

$$PCI^{bis}.CI^{bis} = \sum_{s} PCI_s \; CI_s \tag{2.31}$$

Intermediate consumption of sector s, expressed at market price (for verification)

$$CI^{bis} = \sum_{s} CI_s \tag{2.32}$$

Market price of domestically produced investment of sector s

$$PID_s \; ID_s = \sum_{c} PID_{c,s} \; ID_{c,s} \tag{2.33}$$

Domestically produced investment of sector s, expressed at market price

$$ID_s = \sum_{c} ID_{c,s} \tag{2.34}$$

Market price of imported investment of sector s

$$PIM_s \; IM_s = \sum_{c} PIM_{c,s} \; IM_{c,s} \tag{2.35}$$

Imported investment of sector s, expressed at market price

$$IM_s = \sum_{c} IM_{c,s} \tag{2.36}$$

Market price of investment of sector s

$$PI_s \; I_s = PID_s \; ID_s + PIM_s \; IM_s \tag{2.37}$$

Investment of sector s, expressed at market price

$$I_s = ID_s + IM_s \tag{2.38}$$

Market price of investment of sector s (for verification)

$$PI^{bis}.I^{bis} = \sum_{s} PI_s \; I_s \tag{2.39}$$

Investment of sector s, expressed at market price (for verification)

$$I^{bis} = \sum_{s} I_s \tag{2.40}$$

2.1.6 Aggregation on commodities: imports and domestic aggregate production per use, expressed at market price (value & volume)

This subsection provides the aggregate production for various uses, for domestic and imported products. They are calculated through the aggregation of commodity c production per use on the commodity index.

Aggregate market price for domestically produced commodities

$$PQD.QD = \sum_c PQD_c \, QD_c \tag{2.41}$$

Aggregate domestically produced commodities, expressed at market price

$$QD = \sum_c QD_c \tag{2.42}$$

Aggregate market price for imported commodities

$$PQM.QM = \sum_c PQM_c \, QM_c \tag{2.43}$$

Aggregate imported commodities, expressed at market price

$$QM = \sum_c QM_c \tag{2.44}$$

Aggregate market price for the margins supplied on domestically produced commodities

$$PMGSD.MGSD = \sum_c PMGSD_c \, MGSD_c \tag{2.45}$$

Aggregate margins supplied on domestically produced commodities, expressed at market price

$$MGSD = \sum_c MGSD_c \tag{2.46}$$

Aggregate market price for the margins supplied on imported commodities

$$PMGSM.MGSM = \sum_c PMGSM_c \, MGSM_c \tag{2.47}$$

Aggregate margins supplied on imported commodities, expressed at market price

$$MGSM = \sum_{c} MGSM_c \tag{2.48}$$

Aggregate market price for domestically produced intermediate consumption

$$PCID.CID = \sum_{c} PCID_c \, CID_c \tag{2.49}$$

Aggregate domestically produced intermediate consumption, expressed at market price

$$CID = \sum_{c} CID_c \tag{2.50}$$

Aggregate market price for imported intermediate consumption

$$PCIM.CIM = \sum_{c} PCIM_c \, CIM_c \tag{2.51}$$

Aggregate imported intermediate consumption, expressed at market price

$$CIM = \sum_{c} CIM_c \tag{2.52}$$

Aggregate market price for domestically produced households final consumption

$$PCHD.CHD = \sum_{c} PCHD_c \, CHD_c \tag{2.53}$$

Aggregate domestically produced final consumption, expressed at market price

$$CHD = \sum_{c} CHD_c \tag{2.54}$$

Aggregate market price for imported households final consumption

$$PCHM.CHM = \sum_{c} PCHM_c \, CHM_c \tag{2.55}$$

Aggregate imported households final consumption, expressed at market price

$$CHM = \sum_{c} CHM_c \tag{2.56}$$

Aggregate market price for domestically produced Government final consumption

$$PGD.GD = \sum_{c} PGD_c \, GD_c \tag{2.57}$$

Aggregate domestically produced Government final consumption, expressed at market price

$$GD = \sum_{c} GD_c \tag{2.58}$$

Aggregate market price for imported Government final consumption

$$PGM.GM = \sum_{c} PGM_c \, GM_c \tag{2.59}$$

Aggregate imported Government final consumption, expressed at market price

$$GM = \sum_{c} GM_c \tag{2.60}$$

Aggregate market price for domestically produced investment

$$PID.ID = \sum_{c} PID_c \, ID_c \tag{2.61}$$

Aggregate domestically produced investment, expressed at market price

$$ID = \sum_{c} ID_c \tag{2.62}$$

Aggregate market price for imported investment

$$PIM.IM = \sum_{c} PIM_c \, IM_c \tag{2.63}$$

Aggregate imported investment, expressed at market price

$$IM = \sum_{c} IM_c \tag{2.64}$$

Aggregate market price for domestically produced exports

$$PXD.XD = \sum_{c} PXD_c \, XD_c \tag{2.65}$$

Aggregate domestically produced exports, expressed at market price

$$XD = \sum_c XD_c \tag{2.66}$$

Aggregate market price for imported exports (re-exports)

$$PXM.XM = \sum_c PXM_c \, XM_c \tag{2.67}$$

Aggregate imported exports (re-exports), expressed at market price

$$XM = \sum_c XM_c \tag{2.68}$$

Aggregate market price for domestically produced change in inventories

$$PDSD.DSD = \sum_c PDSD_c \, DSD_c \tag{2.69}$$

Aggregate domestically produced change in inventories, expressed at market price

$$DSD = \sum_c DSD_c \tag{2.70}$$

Aggregate market price for imported change in inventories

$$PDSM.DSM = \sum_c PDSM_c \, DSM_c \tag{2.71}$$

Aggregate imported change in inventories, expressed at market price

$$DSM = \sum_c DSM_c \tag{2.72}$$

2.1.7 Aggregation of domestic and imported production per use, expressed at market price (value & volume)

This subsection provides the aggregate production for various uses by summing the corresponding domestic and imported aggregates.

Aggregate market price for production

$$PQ.Q = PQD.QD + PQM.QM \tag{2.73}$$

Aggregate production, expressed at market price

$$Q = QD + QM \tag{2.74}$$

Aggregate market price for supplied margins

$$PMGS.MGS = PMGSD.MGSD + PMGSM.MGSM \tag{2.75}$$

Aggregate supplied margins

$$MGS = MGSD + MGSM \tag{2.76}$$

Aggregate market price for intermediate consumption

$$PCI.CI = PCID.CID + PCIM.CIM \tag{2.77}$$

Aggregate intermediate consumption, expressed at market price

$$CI = CID + CIM \tag{2.78}$$

Aggregate market price for household final (consumer price index)

$$PCH.CH = PCHD.CHD + PCHM.CHM \tag{2.79}$$

Aggregate household final consumption, expressed at market price

$$CH = CHD + CHM \tag{2.80}$$

Aggregate market price for Government final consumption

$$PG.G = PGD.GD + PGM.GM \tag{2.81}$$

Aggregate Government final consumption, expressed at market price

$$G = GD + GM \tag{2.82}$$

Aggregate market price for investment

$$PI.I = PID.ID + PIM.IM \tag{2.83}$$

Aggregate investment, expressed at market price

$$I = ID + IM \tag{2.84}$$

Aggregate market price for exports

$$PX.X = PXD.XD + PXM.XM \tag{2.85}$$

Aggregate exports, expressed at market price

$$X = XD + XM \tag{2.86}$$

Aggregate market price for change in inventories

$$PDS.DS = PDSD.DSD + PDSM.DSM \tag{2.87}$$

Aggregate change in inventories, expressed at market price

$$DS = DSD + DSM \tag{2.88}$$

2.2 Supply side

2.2.1 Domestic and foreign equilibrium for commodities c (value & volume):

Production of commodity c, expressed at basic price

$$YQ_c\ PYQ_c + NTAXCD_c^{VAL} + PMGPD_c\ MGPD_c = PQD_c\ QD_c \quad (2.89)$$

Basic price of the production of commodity c (for verification)

$$PYQ_c^{bis}\ YQ_c + NTAXCD_c^{VAL} + PMGPD_c\ MGPD_c = PQD_c\ QD_c \quad (2.90)$$

This price is already defined as a weighted average of the production price of the sectors producing commodity c in the price block: $PYQ.YQ = \sum_c PYQ_c\ YQ_c$. To verify the accounting consistency, we define it here under an alias name.

Production of commodity c, expressed at basic price (for verification)

$$YQ_c^{bis} + NTAXCD_c + MGPD_c = QD_c \quad (2.91)$$

Same variable as YQ_c above to check the accounting consistency.

Imports of commodity c, expressed at basic price

$$M_c\ PM_c + NTAXCM_c^{VAL} + PMGPM_c\ MGPM_c = PQM_c\ QM_c \quad (2.92)$$

Basic price of imports of commodity c (for verification)

$$PM_c^{bis}\ M_c + NTAXCM_c^{VAL} + PMGPM_c\ MGPM_c = PQM_c\ QM_c \quad (2.93)$$

This price is already defined in the price block as $PM_c = EXR.PWD_c$. To verify the accounting consistency, we define it here under an alias name.

Imports of commodity c, expressed at basic price (for verification)

$$M_c^{bis} + NTAXCM_c + MGPM_c = QM_c \quad (2.94)$$

Same variable as M_c above to check the accounting consistency.

2.2.2 Margins paid (value & volume)

Price of the margins paid on domestically produced commodity c

$$PMGPD_c \; MGPD_c = \sum_m PMGPD_{m,c} \; MGPD_{m,c} \tag{2.95}$$

Margins paid on the domestically produced commodity c

$$MGPD_c = \sum_m MGPD_{m,c} \tag{2.96}$$

Price of the margins paid on imported commodity c

$$PMGPM_c \; MGPM_c = \sum_m PMGPM_{m,c} \; MGPM_{m,c} \tag{2.97}$$

Margins paid on imported commodity c

$$MGPM_c = \sum_m MGPM_{m,c} \tag{2.98}$$

Price of the margins paid to commodity m on commodity c

$$PMGP_{m,c} \; MGP_{m,c} = PMGPD_{m,c} \; MGPD_{m,c} + PMGPM_{m,c} \; MGPM_{m,c} \tag{2.99}$$

Margins paid to commodity m on commodity c

$$MGP_{m,c} = MGPD_{m,c} + MGPM_{m,c} \tag{2.100}$$

2.2.3 Aggregation on commodities: supply side aggregates (value & volume)

Aggregate price of the margins paid on domestically produced commodity

$$PMGPD.MGPD = \sum_c PMGPD_c \; MGPD_c \tag{2.101}$$

Margins paid on domestically produced commodities

$$MGPD = \sum_c MGPD_c \tag{2.102}$$

Aggregate price of the margins paid on imported commodities

$$PMGPM.MGPM = \sum_c PMGPM_c \, MGPM_c \tag{2.103}$$

Margins paid on imported commodities

$$MGPM = \sum_c MGPM_c \tag{2.104}$$

Aggregate basic price of domestic production

$$PYQ.YQ = \sum_c PYQ_c \, YQ_c \tag{2.105}$$

Domestic production, expressed at basic price

$$YQ = \sum_c YQ_c \tag{2.106}$$

Aggregate basic price of imports

$$PM.M = \sum_c PM_c \, M_c \tag{2.107}$$

Imports, expressed at basic price

$$M = \sum_c M_c \tag{2.108}$$

2.2.4 Supply indicators of sector s (value & volume):

Production of sector s, expressed at basic price

$$Y_s = \sum_c Y_{c,s} \tag{2.109}$$

The production price of sector s is defined in the producer block as a behavior equation. It can not therefore be defined here as an index.

Value-added of sector s expressed in value

$$VA_s^{VAL} = PY_s \, Y_s - PCI_s \, CI_s \tag{2.110}$$

Value-added of sector s

$$VA_s = Y_s - CI_s \tag{2.111}$$

Gross operating surplus of sector s expressed in value

$$GOS_s^{VAL} = VA_s^{VAL} - PWAGES_s\, WAGES_s - PRSC_s\, RSC_s - NTAXS_s^{VAL} \tag{2.112}$$

The standard definition of the Gross Operating Surplus (GOS) generally include tax on profits. For simplicity, we assume that $NTAXS_s$ includes all net taxes on capital (i.e. tax on production and profits). In our definition, the tax on profit is therefore excluded from the GOS. This should be taken into account if one wants to use the GOS as a basis for the tax on profits.

Gross operating surplus of sector s

$$GOS_s = VA_s - WAGES_s - RSC_s - NTAXS_s \tag{2.113}$$

Net operating surplus of sector s expressed in value

$$NOS_s^{VAL} = GOS_s^{VAL} - PK_{s,t-1}\, \delta_s\, F_{K,s,t-1} \tag{2.114}$$

Net operating surplus of sector s

$$NOS_s = GOS_s - PK_{s,t_0-1}\, \delta_s\, F_{K,s,t-1} \tag{2.115}$$

2.2.5 Aggregation on sectors: supply indicators of all sectors (value & volume)

Basic price of aggregate production

$$PY.Y = \sum_s PY_s\, Y_s \tag{2.116}$$

Aggregate production, expressed at basic price

$$Y = \sum_s Y_s \tag{2.117}$$

Value-added price

$$PVA.VA = \sum_s VA_s^{VAL} \tag{2.118}$$

Aggregate value-added

$$VA = \sum_s VA_s \tag{2.119}$$

Gross wage index paid by sectors

$$PWAGES.WAGES = \sum_s PWAGES_s \, WAGES_s \tag{2.120}$$

The gross wage includes employees (but not employers)' social contribution

Aggregate gross wages paid by sectors

$$WAGES = \sum_s WAGES_s \tag{2.121}$$

Price of the aggregate gross operating surplus

$$PGOS.GOS = \sum_s GOS_s^{VAL} \tag{2.122}$$

Aggregate gross operating surplus

$$GOS = \sum_s GOS_s \tag{2.123}$$

Price of the aggregate net operating surplus

$$PNOS.NOS = \sum_s NOS_s^{VAL} \tag{2.124}$$

Aggregate net operating surplus

$$NOS = \sum_s NOS_s \tag{2.125}$$

2.3 Gross Domestic Product (GDP)

In this subsection, GDP is calculated according to different approaches. All approaches lead to same result.

2.3.1 Expenditure approach

Price of GDP (expenditure definition)

$$PGDP.GDP = PCH.CH + PG.G + PI.I + PX.X + PDS.DS - PM.M \tag{2.126}$$

According to the expenditure approach, GDP is calculated as the sum of the different components in the final uses of goods and services.

GDP (expenditure definition)

$$GDP = CH + G + I + X + DS - M \tag{2.127}$$

Price of GDP of commodity c (expenditure definition)

$$\begin{aligned} PGDP_c\, GDP_c = {} & PCH_c\, CH_c + PG_c\, G_c + PI_c\, I_c \\ & + PX_c\, X_c + PDS_c\, DS_c - PM_c\, M_c \end{aligned} \tag{2.128}$$

GDP of commodity c (expenditure definition)

$$GDP_c = CH_c + G_c + I_c + X_c + DS_c - M_c \tag{2.129}$$

Price of GDP (expenditure definition, for verification)

$$PGDP^{bis}.GDP^{bis} = \sum_c PGDP_c\, GDP_c \tag{2.130}$$

GDP (expenditure definition, for verification)

$$GDP^{bis} = \sum_c GDP_c \tag{2.131}$$

2.3.2 Production approach

Price of GDP (production definition)

$$PGDP^{ter}.GDP^{ter} = PVA.VA + PNTAXC.NTAXC \tag{2.132}$$

According to the production approach, GDP is calculated as the sum of the value added plus the total net taxes on commodities.

GDP (production definition)

$$GDP^{ter} = VA + NTAXC \tag{2.133}$$

2.3.3 Income approach

Price of GDP (income definition)

$$PGDP4.GDP4 = PGOS.GOS + PWAGES.WAGES + PRSC.RSC + NTAXS^{VAL} + PNTAXC.NTAXC \tag{2.134}$$

According to the income approach, GDP is calculated as the sum of all the economic incomes (from labor and capital) corrected by the social and taxes transfers.

GDP (income definition)

$$GDP4 = GOS + WAGES + RSC + NTAXS + NTAXC \tag{2.135}$$

3 Prices

This file provides the equations defining the prices, wages and the interest rates.

3.1 Behavioral equations

3.1.1 Price setting

Notional production price of sector s

$$PY_s^n = CU_s^n \ (1 + \mu_s) \tag{3.1}$$

Notional mark-up of the sector s (specification 1)

$$\Delta\left(\log\left(1 + \mu_s^n\right)\right) = \rho^{\mu,Y}.\Delta\left(\log CUR_s\right) \tag{3.2}$$

The notional mark-up is a positive function of the capacity utilization ratio. One can notice that this specification is strictly equivalent to: $\Delta\left(\log 1 + \mu_s^n\right) = \rho^{\mu,Y}.\left(\Delta\left(\log Y_s\right) - \Delta\left(\log YCAP_s\right)\right)$ which is quite close to the specification 2 below where the production capacity $YCAP_s$ is replaced by the past production $Y_{s,t-1}$.

Notional mark-up of the sector s (specification 2)

$$\Delta\left(\log\left(1+\mu_s^{n2}\right)\right) = \rho^{\mu,Y}.\left(\Delta\left(\log Y_s\right) - \Delta\left(\log Y_{s,t-1}\right)\right) \tag{3.3}$$

This specification can be used instead of the default specification 1 above.

Production capacity of the sector s

$$\begin{aligned}\Delta\left(\log YCAP_s\right) = &\sum_f \varphi_{f,s,t-1}\ \Delta\left(\log\left(F_{f,s}\ PROG_{f,s}\right)\right)\\ &+ \alpha_s^{YCAP,Y}\ \left(\log Y_{s,t-1} - \log\left(YCAP_{s,t-1}\ CUR_{s,t_0}\right)\right)\end{aligned} \tag{3.4}$$

The production capacity is defined by the production function and the effective quantities of inputs.

Capacity utilization ratio of the sector s

$$CUR_s = \frac{Y_s}{YCAP_s} \tag{3.5}$$

Average mark-up on commodity c

$$\left(1+\mu_c\right) = \frac{PYQ_c\ YQ_c}{\sum_s CU_s\ Y_{c,s}} \tag{3.6}$$

3.1.2 Wage setting

Notional wage in sector s

$$\begin{aligned}\Delta\left(\log W_s^n\right) = &\rho_s^{W,Cons} + \rho_s^{W,P}\ \Delta\left(\log P\right) + \rho_s^{W,Pe}\ \Delta\left(\log P^e\right)\\ &+ \rho_s^{W,PROG}\ \Delta\left(\log PROG_s^L\right) - \rho_s^{W,U}\ \left(UnR - DNAIRU\right)\\ &- \rho_s^{W,DU}\ \Delta\left(UnR\right) + \rho_s^{W,L}\ \Delta\left(\log F_{L,s} - \log F_L\right)\end{aligned} \tag{3.7}$$

This general specification combines various wage equations found in the literature: the Phillips curve and the WS curve. The WS curve à la Layard et al. (2005) requires the following constraints:

$$\rho_s^{W,P} + \rho_s^{W,Pe} = \rho_s^{W,PROG} = 1, \rho_s^{W,U} = \rho_s^{W,Cons} = 0$$

In the case of a Phillips curve, the $NAIRU$ is predetermined in the long run when wages are fully indexed on price and productivity. To have a long run "Time-Varying" $NAIRU$ under these hypotheses, we have to assume that the constant is a function of the unemployment rate (see Heyer et al. 2007):

$$d(\rho_s^{W,Cons}) = \rho_s^{Cons,U} * \rho_s^{W,U} * d(UnR)$$

Average wage

$$W.F_L = \left(\sum_s W_s \; F_{L,s} \right) \tag{3.8}$$

Consumer Price Index

$$P = PCH \tag{3.9}$$

Gross wages paid by sector s including employees (but not employers)' social contribution

$$WAGES_s \; PWAGES_s = W_s \; F_{L,s} \tag{3.10}$$

To derive the volume, we assume that the price of wages is the consumer price.

Price index for gross wages in sector s

$$PWAGES_s = P \tag{3.11}$$

3.1.3 Interest rate setting

Notional key interest rate of the Central Bank (Taylor rule)

$$\Delta\left(R^n\right) = \rho^{Rn,Cons} + \rho^{Rn,P}.\Delta\left(\frac{\Delta\left(P\right)}{P_{t-1}}\right) - \rho^{Rn,UnR}.\Delta\left(UnR\right) \tag{3.12}$$

Interest rate paid on capital by sector s

$$\Delta\left(R_s\right) = \Delta\left(R\right) \tag{3.13}$$

We assume a constant premium on the key interest rate of the Central Bank.

Interest rate paid by the Government on its debt

$$\Delta\left(r^{DEBT,G}\right) = \Delta\left(r\right) \tag{3.14}$$

3.2 Costs

Notional unit cost of production in sector s

$$CU_s^n \; Y_s = \sum_f C_{f,s} \; F_{f,s}^n + NTAXS_s^{VAL} \tag{3.15}$$

The notional price is based on the notional unit cost of production instead of the effective one. This leads to a more stable dynamic and gives a better representation of expectations.

Unit cost of production in sector s

$$CU_s \; Y_s = \sum_f C_{f,s} \; F_{f,s} + NTAXS_s^{VAL} \tag{3.16}$$

Labor cost in sector s

$$C_{L,s} = W_s \; (1 + RRSC_s) \tag{3.17}$$

Capital cost in sector s

$$C_{K,s} = PK_s \; (\delta_s + r_s) \tag{3.18}$$

It is preferable to calculate the user cost of capital based on the price of capital rather than on the price of investment. Indeed the price of the average capital installed is lower than the one of investment because of inflation. Using the price of investment tends to overestimate the cost of capital because it assumes that the debt contracted to finance past investments is indexed on inflation which is not the case in reality. Moreover using the price of investment often lead to unstable dynamics because it overestimate the impact of inflationary shocks on the cost of capital.

Price of capital in sector s

$$PK_s \; F_{K,s} = (1 - \delta_s) \; PK_{s,t-1} \; F_{K,s,t-1} + PI_s \; I_s \tag{3.19}$$

The price of capital is calibrated by rewriting the above equation in the long run. Its baseyear value is always smaller than 1 because it is calibrated as follows:

$$PK_s = \frac{PI_s * (\delta_s + GR^{REAL}) * (1 + GR^{PRICES})}{(Rdep_s - 1 + (1 + GR^{REAL}) * (1 + GR^{PRICES}))}$$

Energy costs in sector s

$$C_{E,s} = PE_s \tag{3.20}$$

In first approximation the cost of energy correspond to the energy price. However if the producer is forward-looking, she will integrate the anticipation of price increase in it definition of the user cost of energy. In this case the specification becomes:

Price of energy in sector s

$$PE_s \; F_{E,s} = \sum_{ce} PCI_{ce,s} \; CI_{ce,s} \tag{3.21}$$

Materials costs in sector s

$$C_{MAT,s} = PMAT_s \tag{3.22}$$

Price of materials in sector s

$$PMAT_s \; F_{MAT,s} = \sum_{cm} PCI_{cm,s} \; CI_{cm,s} \tag{3.23}$$

Aggregate cost of capital

$$C_K \; F_K = \sum_{s} C_{K,s} \; F_{K,s} \tag{3.24}$$

Aggregate cost of labor

$$C_L \; F_L = \sum_{s} C_{L,s} \; F_{L,s} \tag{3.25}$$

Aggregate cost of energy

$$C_E \; F_E = \sum_{s} C_{E,s} \; F_{E,s} \tag{3.26}$$

Aggregate cost of materials

$$C_{MAT} \; F_{MAT} = \sum_{s} C_{MAT,s} \; F_{MAT,s} \tag{3.27}$$

3.3 From basic to market prices for various uses

In the basic version of the model presented in this sub-section, we do not differentiate the market prices for various uses. For instance, the market price of household's final consumption is the same as the ones of intermediary consumption and exports. This hypotheses is often made in CGE models because it is easier to calibrate. But it is not very realistic for two reasons. First, the import content of household consumption is generally higher than the one of exports. Second, household consumption, intermediary consumption and exports are not subject to the same taxes. For instance, there is generally no VAT on exports and intermediary consumption. These hypotheses are changed in the tax block.

Price of domestically produced commodity c, expressed at basic price

$$PYQ_c \, YQ_c = \sum_s PY_s \, Y_{c,s} \tag{3.28}$$

Price of imported commodity c, expressed at basic price

$$PM_c = EXR.PWD_c \tag{3.29}$$

Price of domestically produced commodity c, expressed at market price

$$PYQS_c \, YQS_c = PYQ_c \, YQ_c + PMGPD_c \, MGPD_c + NTAXCD_c^{VAL} \tag{3.30}$$

YQS_c is the volume of the production expressed at market price. It should not be seen as a composite of several "goods": production at base price, margins and taxes. Its does not increase when the volume of the margins and taxes increase. The price does instead. This is equivalent to assuming that YQS_c is always proportional to and YQ_c since the volume of margins and taxes depends on the latter. Writing it following the specification composite of several goods, $YQS_c = YQ_c + MGPD_c + NTAXCD_c$, would lead to inaccurate results since a decrease in the quantity of margins used per unit of production would not lead to a decrease of the selling price.

Production of commodity c, expressed at market price

$$\Delta \left(\log YQS_c \right) = \Delta \left(\log YQ_c \right) \tag{3.31}$$

Price of imported commodity c, expressed at market price

$$PMS_c\, MS_c = PM_c\, M_c + NTAXCM_c^{VAL} + PMGPM_c\, MGPM_c \quad (3.32)$$

Imports of commodity c, expressed at market price

$$\Delta\left(\log MS_c\right) = \Delta\left(\log M_c\right) \quad (3.33)$$

Market price of the margins paid to commodity m on domestically produced commodity c

$$PMGPD_{m,c}\, MGS_m = PMGSD_m\, MGSD_m + PMGSM_m\, MGSM_m \quad (3.34)$$

We assume that the margins paid on domestic and imported commodities can be produced by domestic and foreign (using the import share of the margin supplied). The price of the margins paid to commodity m is assumed common to all commodity c.

Market price of the margins paid to commodity m on imported commodity c

$$PMGPM_{m,c} = PMGPD_{m,c} \quad (3.35)$$

This price is the same as the one paid on domestic commodity because of the assumption given in the previous equation.

Market price of margins supplied by domestically produced commodity c

$$PMGSD_c = PYQS_c \quad (3.36)$$

Market price of margins supplied by imported commodity c

$$PMGSM_c = PMS_c \quad (3.37)$$

Market price of domestically produced intermediate consumption c purchased by sector s

$$PCID_{c,s} = PYQS_c \quad (3.38)$$

Market price of imported intermediate consumption c purchased by sector s

$$PCIM_{c,s} = PMS_c \quad (3.39)$$

Market price of domestically produced households final consumption c

$$PCHD_c = PYQS_c \tag{3.40}$$

Market price of imported households final consumption c

$$PCHM_c = PMS_c \tag{3.41}$$

Market price of domestically produced Government final consumption c

$$PGD_c = PYQS_c \tag{3.42}$$

Market price of imported Government final consumption c

$$PGM_c = PMS_c \tag{3.43}$$

Market price of domestically produced investment c **purchased by sector** s

$$PID_{c,s} = PYQS_c \tag{3.44}$$

Market price of imported investment c **purchased by sector** s

$$PIM_{c,s} = PMS_c \tag{3.45}$$

Market price of domestically produced exports c

$$PXD_c = PYQS_c \tag{3.46}$$

Market price of imported exports (re-exports) c

$$PXM_c = PMS_c \tag{3.47}$$

Market price of domestically produced change in inventories c

$$PDSD_c = PYQS_c \tag{3.48}$$

Market price of imported change in inventories c

$$PDSM_c = PMS_c \tag{3.49}$$

3.4 Average market prices for various uses (aggregation of domestic and imported uses)

Market price of intermediate consumption c purchased by sector s

$$PCI_{c,s}\, CI_{c,s} = PCID_{c,s}\, CID_{c,s} + PCIM_{c,s}\, CIM_{c,s} \tag{3.50}$$

Market price of households final consumption c

$$PCH_c\, CH_c = PCHD_c\, CHD_c + PCHM_c\, CHM_c \tag{3.51}$$

Market price of Government final consumption c

$$PG_c\, G_c = PGD_c\, GD_c + PGM_c\, GM_c \tag{3.52}$$

Market price of exports c

$$PX_c\, X_c = PXD_c\, XD_c + PXM_c\, XM_c \tag{3.53}$$

4 Producer

This file provides the equations defining the producer behaviour.

4.1 Margins

Margins paid to commodity m on the domestic commodity c

$$\Delta\left(\log MGPD_{m,c}\right) = \Delta\left(\log YQ_c\right) + \Delta\left(SUBST_{m,c}^{MGPD}\right) \tag{4.1}$$

The demand for margins m paid on commodity c depends on the demand for the commodity c and on the substitution between margins type.

Notional substitution between margin m and the other margin types mm paid on domestic commodity c

$$SUBST_{m,c}^{MGPD,n} = \sum_{mm} -\sigma_{m,mm,c}^{MGPD}\, \varphi_{mm,c,t-1}^{MGPD}\, \Delta\left(\log PMGPD_{m,c} - \log PMGPD_{mm,c}\right) \tag{4.2}$$

Share of margin type m into the total margins paid on domestic commodity c

$$\varphi_{m,c}^{MGPD} = \frac{PMGPD_{m,c}\, MGPD_{m,c}}{\sum_{mm} PMGPD_{mm,c}\, MGPD_{mm,c}} \tag{4.3}$$

Margins paid to commodity m on the imported commodity c

$$\Delta\left(\log MGPM_{m,c}\right) = \Delta\left(\log M_c\right) + \Delta\left(SUBST_{m,c}^{MGPM}\right) \tag{4.4}$$

Notional substitution between margin m and the other margin types mm paid on imported commodity c

$$SUBST_{m,c}^{MGPM,n} = \sum_{mm} -\sigma_{m,mm,c}^{MGPM}\, \varphi_{mm,c,t-1}^{MGPM}\, \Delta\left(\log PMGPM_{m,c} - \log PMGPM_{mm,c}\right) \tag{4.5}$$

Share of margin type m into the total margins paid on imported commodity c

$$\varphi_{m,c}^{MGPM} = \frac{PMGPM_{m,c}\, MGPM_{m,c}}{\sum_{mm} PMGPM_{mm,c}\, MGPM_{mm,c}} \tag{4.6}$$

4.2 Production factors

Production of commodity c by sector s

$$Y_{c,s} = PhiY_{c,s}\, YQ_c \tag{4.7}$$

We assume that each sector s may produce more than one commodity c. Therefore the production Y of commodity c by sector s depends on the parameter $\varphi_{c,s}^{Y}$ which represents the share of sector s in the total production of commodity c.

Demand for production factor f by sector s

$$\Delta\left(\log F_{f,s}^{n}\right) = \Delta\left(\log Y_s\right) - \Delta\left(\log PROG_{f,s}\right) + \Delta\left(SUBST_{f,s}^{F}\right) \tag{4.8}$$

Notional substitution between input f and the other inputs ff

$$\Delta\left(SUBST_{f,s}^{F,n}\right) = \sum_{ff} -ES_{f,ff,s}\, \varphi_{ff,s,t-1}\, \Delta\left(\log \frac{C_{f,s}}{PROG_{f,s}} - \log \frac{C_{ff,s}}{PROG_{ff,s}}\right) \tag{4.9}$$

Cost share of input f for sector s

$$\varphi_{f,s} = \frac{C_{f,s}\ F^n_{f,s}}{\sum_{ff} C_{ff,s}\ F^n_{ff,s}} \tag{4.10}$$

Aggregate production factors f

$$F_f = \sum_s F_{f,s} \tag{4.11}$$

Investment in commodity c by sector s

$$\Delta\left(\log I_{c,s}\right) = \Delta\left(\log IA_s\right) \tag{4.12}$$

For a given sector, we assume that the investment structure is fixed over time. In other words, the investment good is a composite of several commodities in fixed proportion.

Energy consumption ce of sector s

$$\Delta\left(\log CI_{ce,s}\right) = \Delta\left(\log F_{E,s}\right) + \Delta\left(SUBST^{CI}_{ce,s}\right) \tag{4.13}$$

Notional substitution between energy commodity ce and the other energy commodities cee in the sector s

$$\Delta\left(SUBST^{CI,n}_{ce,s}\right) = \sum_{cee} -\sigma^{NRJ}_{ce,cee,s}\ \varphi_{E,cee,s,t-1}\ \Delta\left(\log PCI_{ce,s} - \log PCI_{cee,s}\right) \tag{4.14}$$

Share of energy ce into the total energy use of sector s

$$\varphi_{E,ce,s} = \frac{PCI_{ce,s}\ CI_{ce,s}}{\sum_{cee} PCI_{cee,s}\ CI_{cee,s}} \tag{4.15}$$

Material consumption cmo of sector s

$$\Delta\left(\log CI_{cmo,s}\right) = \Delta\left(\log F_{MAT,s}\right) \tag{4.16}$$

We assume that intermediary consumption that are not transport or energy commodities are not substitutables (Leontief technology).

Transport demand of sector s

$$\Delta\left(\log TRSP_s\right) = \Delta\left(\log F_{MAT,s}\right) \tag{4.17}$$

Demand for transport commodity ct by sector s

$$\Delta\left(\log CI_{ct,s}\right) = \Delta\left(\log TRSP_s\right) + \Delta\left(SUBST^{CI}_{ct,s}\right) \tag{4.18}$$

Notional substitution between the transport ct and the other transports mt in the sector s

$$\Delta\left(SUBST^{CI,n}_{ct,s}\right) = \sum_{ctt} -\sigma^{TRSP}_{ct,ctt,s}\ \varphi^{TRSP}_{ctt,s,t-1}\ \Delta\left(\log PCI_{ct,s} - \log PCI_{ctt,s}\right) \tag{4.19}$$

Share for transport ct into the total transport use of sector s

$$\varphi^{TRSP}_{ct,s} = \frac{PCI_{ct,s}\ CI_{ct,s}}{\sum_{ctt} PCI_{ctt,s}\ CI_{ctt,s}} \tag{4.20}$$

Technical progress of the production factor f in sector s

$$PROG_{f,s} = PROG_{f,s,t-1}\ \left(1 + GR^{PROG}_{f,s}\right) \tag{4.21}$$

Energy efficiency gains in sector s

$$\begin{aligned} GR^{PROG}_{E,s} = {} & GR^{PROG}_{E,s,t_0} + \rho^{PROG,E,PE}.\left(\log PE_s - \log P\right. \\ & \left.> 0\right)\ \Delta\left(\log PE_s - \log P\right) \end{aligned} \tag{4.22}$$

This specification states that the productivity gain of the energy input in sector s depends on an exogenous trend and an endogenous price-induced component. Energy efficiency gains increase when the real energy price increases. This effect is assumed as irreversible: a decrease in the real energy price does not lead to a decrease in energy efficiency gains.

5 Consumer

5.1 Households' income

Disposable income before tax expressed in value

$$\begin{aligned} DISPINC^{BT,VAL} = {} & PWAGES.WAGES + PROP^{INC,H,VAL} \\ & + SOC^{BENF,VAL} + TRSF^{HH,VAL} \end{aligned} \tag{5.1}$$

The disposable income before tax is used as base for the income tax.

Disposable income after tax expressed in value

$$DISPINC^{AT,VAL} = DISPINC^{BT,VAL} - INC^{SOC,TAX,VAL} \quad (5.2)$$

The definition of the disposable income after tax corresponds to the definition of "gross disposable income" defined in the annual account by institutional sector of Eurostat (b.6.g).

Income and social taxes expressed in value

$$INC^{SOC,TAX,VAL} = RINC^{SOC,TAX}.DISPINC^{BT,VAL} \quad (5.3)$$

Property incomes expressed in value

$$PROP^{INC,H,VAL,n} = \varphi^{PROP^{INC,H}}.PNOS.NOS \quad (5.4)$$

Social benefits expressed in value

$$SOC^{BENF,VAL} = RR^{POP}.W_{t_0}\ PROG^{L}.P.POP + RR^{Un}.W.Un \quad (5.5)$$

5.2 Households' expenditures

Aggregate notional households final consumption expressed in value

$$CH^{n,VAL} = DISPINC^{AT,VAL}.(1 - MPS^{n}) \quad (5.6)$$

Notional marginal propensity to save

$$\Delta(MPS^{n}) = \rho^{MPS,R}.\Delta\left(R - \frac{\Delta(P)}{P_{t-1}}\right) + \rho^{MPS,UnR}.\Delta(UnR) \quad (5.7)$$

Households' final consumption c

$$(CH_c^n - NCH_c)\ PCH_c = \varphi_c^{MCH}\ \left(CH^{n,VAL} - PNCH.NCH\right) \quad (5.8)$$

We assume a Linear Expenditure System (LES) utility function to model consumption decisions between the commodity types. A LES specification assumes that a share of the base year consumption (NCH_c) is incompressible and therefore the relation between income and consumption is not linear.

This specification allows for the distinction between the consumption of necessity and luxurious goods.

Price of necessary households consumption c

$$PNCH_c = PCH_c \tag{5.9}$$

Price of aggregate necessary households consumption

$$PNCH.NCH = \sum_c PNCH_c \, NCH_c \tag{5.10}$$

Aggregate necessary households final consumption

$$NCH = \sum_c NCH_c \tag{5.11}$$

Share of commodity c **into the total marginal household consumption**

$$\Delta \left(\log \varphi_c^{MCH} \right) = \left(1 - \sigma^{LESCES} \right) . \Delta \left(\log \frac{PCH_c}{PCH^{CES}} \right) \tag{5.12}$$

The household marginal propensity to spend in commodity c, φ_c^{MCH}, is generally constant in a LES setting assuming implicitly an elasticity of substitution of one between commodities. We assume here a more general case where the elasticity of substitution can vary from zero to infinity.

Share of commodity c **into the total household consumption**

$$\varphi_c^{CH} = \frac{CH_c}{CH} \tag{5.13}$$

Notice that if $NCH_c = 0$, $\varphi_c^{CH} = \varphi_c^{MCH}$.

CES consumption price index

$$PCH^{CES} = \left(\sum_c \varphi_{c,t_0}^{MCH} \, PCH_c^{\left(1-\sigma^{LESCES}\right)} \right)^{\left(\frac{1}{(1-\sigma^{LESCES})} \right)} \tag{5.14}$$

Households savings expressed in value

$$SAV^{H,VAL} = DISPINC^{AT,VAL} - PCH.CH \tag{5.15}$$

Households savings rate

$$RSAV^{H,VAL} = \frac{SAV^{H,VAL}}{DISPINC^{AT,VAL}} \tag{5.16}$$

Households savings stock

$$Stock^{SAV,H,VAL} = Stock_{t-1}^{SAV,H,VAL} + SAV^{H,VAL} \tag{5.17}$$

6 Government

6.1 Incomes

6.1.1 Taxes and social contributions

We assume that the volume of the tax varies only when the volume of the tax bases (e.g. production, consumption) varies. Hence an increase in the tax rate does not increase the volume of the tax but increases its price. This is consistent with the specification of the production price: increasing the tax rate on production increases the production price but not production.

Net taxes on domestically produced commodity c expressed in value

$$NTAXCD_c^{VAL} = RNTAXCD_c\, PYQ_c\, YQ_c \tag{6.1}$$

Net taxes on domestically produced commodity c

$$NTAXCD_c = RNTAXCD_{c,t_0}\, YQ_c \tag{6.2}$$

Net taxes on imported commodity c expressed in value

$$NTAXCM_c^{VAL} = RNTAXCM_c\, PM_c\, M_c \tag{6.3}$$

Net taxes on imported commodity c

$$NTAXCM_c = RNTAXCM_{c,t_0}\, M_c \tag{6.4}$$

Net taxes on commodity c expressed in value

$$NTAXC_c^{VAL} = NTAXCD_c^{VAL} + NTAXCM_c^{VAL} \tag{6.5}$$

Net taxes on commodity c

$$NTAXC_c = NTAXCD_c + NTAXCM_c \tag{6.6}$$

Net taxes on the production of sector s expressed in value

$$NTAXS_s^{VAL} = RNTAXS_s \; PY_s \; Y_s + T2VAL_s^{MAT} + T2VAL_s^{Y} \quad (6.7)$$

Net taxes on the production of sector s

$$NTAXS_s = RNTAXS_{s,t_0} \; Y_s + T2_s^{MAT} + T2_s^{Y} \quad (6.8)$$

Employers' social security contribution paid by sector s

$$RSC_s \; PRSC_s = W_s \; F_{L,s} \; RRSC_s \quad (6.9)$$

Price of the employers' social security contribution paid by sector s

$$PRSC_s = P \quad (6.10)$$

6.1.2 Aggregate taxes and social contributions

Aggregate net taxes on commodity c expressed in value

$$PNTAXC.NTAXC = \sum_c NTAXC_c^{VAL} \quad (6.11)$$

Aggregate net taxes on commodity c

$$NTAXC = \sum_c NTAXC_c \quad (6.12)$$

Aggregate net taxes on the production of sectors expressed in value

$$NTAXS^{VAL} = \sum_s NTAXS_s^{VAL} \quad (6.13)$$

Aggregate net taxes on the production of sectors

$$NTAXS = \sum_s NTAXS_s \quad (6.14)$$

Price of the aggregate employers' social security contribution paid by sector s

$$PRSC.RSC = \sum_s PRSC_s \; RSC_s \quad (6.15)$$

Aggregate employers' social security contribution paid by sectors

$$RSC = \sum_s RSC_s \quad (6.16)$$

Average employers' social security contribution rate

$$RRSC = \frac{PRSC.RSC}{W.F_L} \quad (6.17)$$

6.1.3 Other and aggregate incomes

Notional property incomes of the Government expressed in value

$$PROP^{INC,G,VAL,n} = \varphi^{PROP^{INC,G}}.PNOS.NOS \tag{6.18}$$

Aggregate incomes of the Government expressed in value

$$\begin{aligned} INC^{G,VAL} = {} & PNTAXC.NTAXC + NTAXS^{VAL} \\ & + INC^{SOC,TAX,VAL} + PRSC.RSC + PROP^{INC,G,VAL} \end{aligned} \tag{6.19}$$

6.2 spending

Government final consumption of commodity c

$$\Delta\left(\log G_c\right) = \Delta\left(\log EXPG\right) \tag{6.20}$$

Aggregate spending of the Government expressed in value

$$SPEND^{G,VAL} = PG.G + SOC^{BENF,VAL} + DEBT_{t-1}^{G,VAL}\ \left(\varphi_{t-1}^{RD^G} + r_{t-1}^{DEBT,G}\right) \tag{6.21}$$

6.3 Deficit and debt

Savings of the Government expressed in value

$$SAV^{G,VAL} = INC^{G,VAL} - SPEND^{G,VAL} \tag{6.22}$$

It corresponds to the net lending/borrowing, which is the published deficit/savings of the Government.

Primary balance of the Government expressed in value (deficit)

$$Bal^{G,Prim,VAL} = SAV^{G,VAL} + DEBT_{t-1}^{G,VAL}\ \left(\varphi_{t-1}^{RD^G} + r_{t-1}^{DEBT,G}\right) \tag{6.23}$$

It corresponds to the savings excluding the reimbursement and the interest on the debt.

Primary balance of the Government expressed in value (deficit) (for verification)

$$Bal^{G,Prim,VAL,bis} = INC^{G,VAL} - \left(PG.G + SOC^{BENF,VAL}\right) \quad (6.24)$$

Total balance of the Government expressed in value (deficit)

$$Bal^{G,Tot,VAL} = Bal^{G,Prim,VAL} - DEBT_{t-1}^{G,VAL}\, r_{t-1}^{DEBT,G} \quad (6.25)$$

Government's debt expressed in value

$$DEBT^{G,VAL} = DEBT_{t-1}^{G,VAL}\, \left(1 - \varphi_{t-1}^{RD^G}\right) - SAV^{G,VAL} \quad (6.26)$$

It corresponds to the previous year debt minus the reimbursement of the debt and the government savings.

Government's savings rate expressed in value (in percent of GDP)

$$RSAV^{G,VAL} = \frac{SAV^{G,VAL}}{(PGDP.GDP)} \quad (6.27)$$

Primary balance of the Government expressed in value (in percent of GDP)

$$RBal^{G,Prim,VAL} = \frac{Bal^{G,Prim,VAL}}{(PGDP.GDP)} \quad (6.28)$$

Total balance of the Government expressed in value (in percent of GDP)

$$RBal^{G,Tot,VAL} = \frac{Bal^{G,Tot,VAL}}{(PGDP.GDP)} \quad (6.29)$$

Ratio of the Government's debt expressed in value (in percent of GDP)

$$RDEBT^{G,VAL} = \frac{DEBT^{G,VAL}}{(PGDP.GDP)} \quad (6.30)$$

7 International Trade

This file provides the equations defining the allocation between domestic and imported goods per use.The differentiation per use allows for distinguishing import share per use and therefore a more realistic representation of the economy than model that assume a common import share. Indeed, the import share of export is generally smaller than for consumption.

7.1 Domestic demand

Received margins on domestically produced commodity m

$$MGSD_m = \left(1 - \varphi_m^{MGSM}\right)\ MGS_m \tag{7.1}$$

Private final consumption of domestically produced commodity c

$$CHD_c = \left(1 - \varphi_c^{CHM}\right)\ CH_c \tag{7.2}$$

Public final consumption of domestically produced commodity c

$$GD_c = \left(1 - \varphi_c^{GM}\right)\ G_c \tag{7.3}$$

Margins supplied from imported commodity m

$$MGSM_m = \varphi_m^{MGSM}\ MGS_m \tag{7.4}$$

Private final consumption of imported commodity c

$$CHM_c = \varphi_c^{CHM}\ CH_c \tag{7.5}$$

Public final consumption of imported commodity c

$$GM_c = \varphi_c^{GM}\ G_c \tag{7.6}$$

Import share of commodity c on supplied margins

$$\varphi_m^{MGSM} = \frac{1}{\left(1 + \frac{MGSD_m}{MGSM_{m,t_0}}\ e^{SUBST_m^{MGSM}}\right)} \tag{7.7}$$

Import share of commodity c for household final consumption

$$\varphi_c^{CHM} = \frac{1}{\left(1 + \frac{CHD_c}{CHM_{c,t_0}}\ e^{SUBST_c^{CHM}}\right)} \tag{7.8}$$

Import share φ_c of commodity c on the government final consumption

$$\varphi_c^{GM} = \frac{1}{\left(1 + \frac{GD_c}{GM_{c,t_0}}\ e^{SUBST_c^{GM}}\right)} \tag{7.9}$$

Notional substitution effect induced by a change in the relative price between imported and domestically produced commodity c for margins supplied

$$\Delta\left(SUBST_c^{MGSM,n}\right) = -\sigma_c^{MGSM}\ \Delta\left(\log PMGSD_c - \log PMGSM_c\right) \quad (7.10)$$

Notional substitution effect induced by a change in the relative price between imported and domestically produced commodity c for households final consumption

$$\Delta\left(SUBST_c^{CHM,n}\right) = -\sigma_c^{CHM}\ \Delta\left(\log PCHD_c - \log PCHM_c\right) \quad (7.11)$$

Notional substitution effect induced by a change in the relative price between imported and domestically produced commodity c for government final consumption

$$\Delta\left(SUBST_c^{GM,n}\right) = -\sigma_c^{GM}\ \Delta\left(\log PGD_c - \log PGM_c\right) \quad (7.12)$$

Intermediary consumption from sector s in domestically produced commodity c

$$CID_{c,s} = \left(1 - \varphi_{c,s}^{CIM}\right)\ CI_{c,s} \quad (7.13)$$

Investment from sector s in domestically produced commodity c

$$ID_{c,s} = \left(1 - \varphi_{c,s}^{IM}\right)\ I_{c,s} \quad (7.14)$$

Intermediary consumption from sector s in imported commodity c

$$CIM_{c,s} = \varphi_{c,s}^{CIM}\ CI_{c,s} \quad (7.15)$$

Investment from sector s in imported commodity c

$$IM_{c,s} = \varphi_{c,s}^{IM}\ I_{c,s} \quad (7.16)$$

Import share of intermediary consumption from sector s in domestically produced commodity c

$$\varphi_{c,s}^{CIM} = \frac{1}{\left(1 + \frac{CID_{c,s}}{CIM_{c,s},t_0}\ e^{SUBST_{c,s}^{CIM}}\right)} \quad (7.17)$$

Import share of intermediary consumption from sector s in imported commodity c

$$\varphi_{c,s}^{IM} = \frac{1}{\left(1 + \frac{ID_{c,s}}{IM_{c,s},t_0}\ e^{SUBST_{c,s}^{IM}}\right)} \tag{7.18}$$

Notional substitution effect induced by a change in the relative price between imported and domestic intermediary consumption in commodity c from the sector s

$$\Delta\left(SUBST_{c,s}^{CIM,n}\right) = -\sigma_{c,s}^{CIM}\ \Delta\left(\log PCID_{c,s} - \log PCIM_{c,s}\right) \tag{7.19}$$

Notional substitution effect induced by a change in the relative price between imported and domestic investment in commodity c from the sector s

$$\Delta\left(SUBST_{c,s}^{IM,n}\right) = -\sigma_{c,s}^{IM}\ \Delta\left(\log PID_{c,s} - \log PIM_{c,s}\right) \tag{7.20}$$

7.2 Exports

Exports of domestically produced commodity c

$$XD_c = \left(1 - \varphi_c^{XM}\right)\ X_c \tag{7.21}$$

Exports of imported commodity c

$$XM_c = \varphi_c^{XM}\ X_c \tag{7.22}$$

Import share of commodity c exports

$$\varphi_c^{XM} = \frac{1}{\left(1 + \frac{XD_c}{XM_c,t_0}\ e^{SUBST_c^{XM}}\right)} \tag{7.23}$$

Notional substitution effect induced by a change in the relative price between imported and domestic products c for exports

$$\Delta\left(SUBST_c^{XM,n}\right) = -\sigma_c^{XM}\ \Delta\left(\log PXD_c - \log PXM_c\right) \tag{7.24}$$

Foreign demand for exports of commodity c

$$\Delta\left(\log X_c\right) = \Delta\left(\log WD_c\right) + \Delta\left(SUBST_c^{X}\right) \tag{7.25}$$

Notional substitution effect induced by a change in the relative price between export prices and (converted in domestic currency) international prices for the commodity c

$$\Delta\left(SUBST_c^{X,n}\right) = -\sigma_c^X \ \Delta\left(\log PX_c - \log\left(EXR.PWD_c\right)\right) \tag{7.26}$$

Balance of trade of commodity c

$$Bal_c^{Trade,VAL} = PX_c \ X_c - PM_c \ M_c \tag{7.27}$$

Aggregate balance of trade

$$Bal^{Trade,VAL} = \sum_c Bal_c^{Trade,VAL} \tag{7.28}$$

Balance of trade (in percent of GDP)

$$RBal^{Trade,VAL} = \frac{Bal^{Trade,VAL}}{(PGDP.GDP)} \tag{7.29}$$

8 Demography

Working-age population

$$\Delta\left(\log WAPop\right) = \Delta\left(\log POP\right) \tag{8.1}$$

The working age population linearly grows with the total population.

Labor force

$$LF = PARTR.WAPop \tag{8.2}$$

The Labor force depends on a participation rate of the working-age population.

Labor force participation ratio

$$\Delta\left(PARTR^n\right) = \Delta\left(PARTR^{trend}\right) - \rho^{PART,UnR}.\Delta\left(UnR\right) \tag{8.3}$$

Because of discouraged worker effect, the participation ratio depends generally negatively on the unemployment rate.

Employment (ILO definition)

$$\Delta\left(\log empl\right) = \Delta\left(\log F_L\right) \tag{8.4}$$

In general, labor according to the national account differs from the employment according to the ILO definition. One reason is that labor is expressed in FTE (full time equivalent). To calculate the unemployment rate, one needs to use the employment according to the ILO definition. We assume that the average work duration is constant over time, implying stability of the employment to labor ratio.

Unemployment

$$Un = LF - Empl \tag{8.5}$$

Unemployment is determined as the difference between the total active population with the one which is employed.

Unemployment rate

$$UnR = \frac{Un}{LF} \tag{8.6}$$

The Unemployment rate is defined as the ratio between the total unemployment and the active population.

9 Greenhouse gases emissions

This file provides the equations defining the path of GreenHouse Gases (GHG) emissions. All emission types are expressed in CO2-equivalent to facilitate aggregation. For the same emission type (e.g. CO2), several equation are defined depending on the emission basis: intermediary consumption, household consumption or production.

Emissions of the greenhouse gas ghg related to the intermediary consumption of commodity c by sector s

$$\Delta\left(\log EMS^{CI}_{ghg,c,s}\right) = \Delta\left(\log\left(CI_{c,s}\ IEMS^{CI}_{ghg,c,s}\right)\right) \tag{9.1}$$

In practice only a few intermediaries generate emissions (e.g. coal, gas, petrol). IEMS˙CI[ghg,c,s] is the corresponding emission intensity calibrated

to 1 in the baseyear. It may change over time because of the increase of the share of biofuels.

Emissions of the greenhouse gas ghg related to the materials consumption of sector s

$$\Delta\left(\log EMS^{MAT}_{ghg,s}\right) = \Delta\left(\log\left(F_{MAT,s}\ IEMS^{MAT}_{ghg,s}\right)\right) \tag{9.2}$$

This mainly corresponds to the CO2 emissions from decarbonation.

Emissions of the greenhouse gas ghg related to the final production of sector s

$$\Delta\left(\log EMS^{Y}_{ghg,s}\right) = \Delta\left(\log\left(Y_s\ IEMS^{Y}_{ghg,s}\right)\right) \tag{9.3}$$

This mainly correspond to the emissions from agriculture.

Emissions of the greenhouse gas ghg related to the household consumption c

$$\Delta\left(\log EMS^{CH}_{ghg,c}\right) = \Delta\left(\log\left(CH_c\ IEMS^{CH}_{ghg,c}\right)\right) \tag{9.4}$$

Emissions of the greenhouse gas ghg related to the intermediary consumption of commodity c

$$EMS^{CI}_{ghg,c} = \sum_{s} EMS^{CI}_{ghg,c,s} \tag{9.5}$$

Emissions of the greenhouse gas ghg related to the intermediary consumption by sector s

$$EMS^{CI}_{ghg,s} = \sum_{c} EMS^{CI}_{ghg,c,s} \tag{9.6}$$

Emissions of the greenhouse gas ghg related to the intermediary consumption

$$EMS^{CI}_{ghg} = \sum_{s} EMS^{CI}_{ghg,s} \tag{9.7}$$

Aggregation by sector s.

Emissions of the greenhouse gas ghg related to the intermediary consumption (for verification)

$$EMS^{CI,bis}_{ghg} = \sum_{c} EMS^{CI}_{ghg,c} \tag{9.8}$$

Aggregation by commodity c.

Emissions of the greenhouse gas ghg related to the total material consumption

$$EMS^{MAT}_{ghg} = \sum_{s} EMS^{MAT}_{ghg,s} \tag{9.9}$$

Emissions of the greenhouse gas ghg related to the final production

$$EMS^{Y}_{ghg} = \sum_{s} EMS^{Y}_{ghg,s} \tag{9.10}$$

Emissions of the greenhouse gas ghg related to the household final consumption

$$EMS^{CH}_{ghg} = \sum_{c} EMS^{CH}_{ghg,c} \tag{9.11}$$

Aggregate emissions of the greenhouse gas ghg

$$EMS_{ghg} = EMS^{CI}_{ghg} + EMS^{MAT}_{ghg} + EMS^{Y}_{ghg} + EMS^{CH}_{ghg} \tag{9.12}$$

Aggregate emissions related to the intermediary consumption

$$EMS^{CI} = \sum_{ghg} EMS^{CI}_{ghg} \tag{9.13}$$

Aggregate emissions related to the material consumption

$$EMS^{MAT} = \sum_{ghg} EMS^{MAT}_{ghg} \tag{9.14}$$

Aggregate emissions related to the final production

$$EMS^{Y} = \sum_{ghg} EMS^{Y}_{ghg} \tag{9.15}$$

Aggregate emissions related to the households final consumption

$$EMS^{CH} = \sum_{ghg} EMS^{CH}_{ghg} \tag{9.16}$$

Aggregate emissions

$$EMS = EMS^{CI} + EMS^{MAT} + EMS^{Y} + EMS^{CH} \tag{9.17}$$

Aggregate emissions by type of gas ghg

$$EMS^{bis} = \sum_{ghg} EMS_{ghg} \tag{9.18}$$

9.1 Final production and demand

Demand for energy ce **of sector** s**, expressed in toe**

$$\Delta\left(\log CI^{toe}_{ce,s}\right) = \Delta\left(\log CI_{ce,s}\right) \tag{9.19}$$

Demand for energy ce **of households, expressed in toe**

$$\Delta\left(\log CH^{toe}_{ce}\right) = \Delta\left(\log CH_{ce}\right) \tag{9.20}$$

External demand for energy ce**, expressed in toe**

$$\Delta\left(\log X^{toe}_{ce}\right) = \Delta\left(\log X_{ce}\right) \tag{9.21}$$

Final production of energy of ce **by sector** s**, expressed in toe**

$$\Delta\left(\log Y^{toe}_{ce,s}\right) = \Delta\left(\log Y_{ce,s}\right) \tag{9.22}$$

Imported energy ce**, expressed in toe**

$$M^{toe}_{ce} = CI^{toe}_{ce} + CH^{toe}_{ce} + X_{ce} - Y^{toe}_{ce} \tag{9.23}$$

Demand for energy ce **of sectors, expressed in toe**

$$CI^{toe}_{ce} = \sum_{s} CI^{toe}_{ce,s} \tag{9.24}$$

Final production of energy of ce **by sectors, expressed in toe**

$$Y^{toe}_{ce} = \sum_{s} Y^{toe}_{ce,s} \tag{9.25}$$

9.2 Primary production and demand

10 Other equations

10.1 Adjustment equations and anticipation

Mark-up in the sector s

$$\mu_s = \alpha_s^{\mu}\ \mu_s^n + (1 - \alpha_s^{\mu})\ \mu_{s,t-1} \tag{10.1}$$

Expected inflation.

$$\Delta\left(\log P^e\right) = \alpha^{Pe,P1}.\Delta\left(\log P_{t-1}\right) + \left(1 - \alpha^{Pe,P1}\right).\Delta\left(\log P_{t-1}^e\right) \tag{10.2}$$

This equation defines the expected inflation and not the expected price. P^e does not necessary converge to P. If the wage equation is a WS curve, even in the very long term it may not converge.

Expected production

$$\Delta\left(\log Y_s^e\right) = \alpha_s^{Ye,Y}\ \Delta\left(\log Y_s\right) + \left(1 - \alpha_s^{Ye,Y}\right)\ \Delta\left(\log Y_{s,t-1}^e\right) \tag{10.3}$$

Quantity of Labor, Energy and Material inputs in sector s

$$\log F_{f,s} = \alpha_{f,s}^{0,F}\ \log F_{f,s}^n + \left(1 - \alpha_{f,s}^{0,F}\right)\ \left(\log F_{f,s,t-1} + \Delta\left(\log F_{f,s}^e\right)\right) \tag{10.4}$$

Expected quantity of Labor, Energy and Material inputs in sector s

$$\Delta\left(\log F_{f,s}^e\right) = \alpha_{f,s}^{1,F}\ \Delta\left(\log F_{f,s,t-1}^e\right) + \alpha_{f,s}^{2,F}\ \Delta\left(\log F_{f,s,t-1}\right) + \alpha_{f,s}^{3,F}\ \Delta\left(\log F_{f,s}^n\right) \tag{10.5}$$

Capital stock of sector s

$$F_{K,s} = (1 - \delta_s)\ F_{K,s,t-1} + IA_s \tag{10.6}$$

Investment in sector s

$$\begin{aligned}\Delta\left(\log IA_s\right) = {} & \alpha_s^{IA,Ye}\ \Delta\left(\log Y_s^e\right) + \alpha_s^{IA,IA1}\ \Delta\left(\log IA_{s,t-1}\right) \\ & + \alpha_s^{IA,SUBST}\ \Delta\left(SUBST_{K,s}^F\right) \\ & + \alpha_s^{IA,Kn}\ \left(\log F_{K,s,t-1}^n - \log F_{K,s,t-1}\right)\end{aligned} \tag{10.7}$$

Households final consumption of commodity c

$$\log CH_c = \alpha_c^{0,CH}\ \log CH_c^n + \left(1-\alpha_c^{0,CH}\right)\ \left(\log CH_{c,t-1} + \Delta\left(\log CH_c^e\right)\right) \quad (10.8)$$

Expected households final consumption of commodity c

$$\begin{aligned}\Delta\left(\log CH_c^e\right) = \alpha_c^{1,CH}\ \Delta\left(\log CH_{c,t-1}^e\right) + \alpha_c^{2,CH}\ \Delta\left(\log CH_{c,t-1}\right) \\ + \alpha_c^{3,CH}\ \Delta\left(\log CH_c^n\right)\end{aligned} \quad (10.9)$$

Production price of sector s

$$\log PY_s = \alpha_s^{0,PY}\ \log PY_s^n + \left(1-\alpha_s^{0,PY}\right)\ \left(\log PY_{s,t-1} + \Delta\left(\log PY_s^e\right)\right) \quad (10.10)$$

Expected production price of sector s

$$\begin{aligned}\Delta\left(\log PY_s^e\right) = \alpha_s^{1,PY}\ \Delta\left(\log PY_{s,t-1}^e\right) + \alpha_s^{2,PY}\ \Delta\left(\log PY_{s,t-1}\right) \\ + \alpha_s^{3,PY}\ \Delta\left(\log PY_s^n\right)\end{aligned} \quad (10.11)$$

Wages of the sector s

$$\Delta\left(\log W_s\right) = \alpha_s^{W,Wn}\ \Delta\left(\log W_s^n\right) + \alpha_s^{W,W1}\ \Delta\left(\log W_{s,t-1}\right) - \alpha_s^{W,W1Wn1}\ \log\frac{W_{s,t-1}}{W_{s,t-1}^n} \quad (10.12)$$

Labor participation ratio

$$PARTR = \alpha^{0,PARTR}.PARTR^n + \left(1-\alpha^{0,PARTR}\right).PARTR_{t-1} \quad (10.13)$$

Interest rate

$$R = \alpha^{0,R}.R^n + \left(1-\alpha^{0,R}\right).R_{t-1} \quad (10.14)$$

Households property income in value

$$\begin{aligned}\log PROP^{INC,H,VAL} = \alpha^{0,PROP,INC,H,VAL}.\log PROP^{INC,H,VAL,n} \\ + \left(1-\alpha^{0,PROP,INC,H,VAL}\right).\Big(\log PROP_{t-1}^{INC,H,VAL} \\ + \Delta\left(\log PROP^{INC,H,VAL,e}\right)\Big)\end{aligned} \quad (10.15)$$

Expected Households property income in value

$$\begin{aligned}\Delta\left(\log PROP^{INC,H,VAL,e}\right) = \alpha^{1,PROP,INC,H,VAL}.\Delta\left(\log PROP_{t-1}^{INC,H,VAL,e}\right) \\ + \alpha^{2,PROP,INC,H,VAL}.\Delta\left(\log PROP_{t-1}^{INC,H,VAL}\right) \\ + \alpha^{3,PROP,INC,H,VAL}.\Delta\left(\log PROP^{INC,H,VAL,n}\right)\end{aligned} \tag{10.16}$$

Government property incomes in value

$$\begin{aligned}\log PROP^{INC,G,VAL} = \alpha^{0,PROP,INC,G,VAL}.\log PROP^{INC,G,VAL,n} \\ + \left(1-\alpha^{0,PROP,INC,G,VAL}\right).\Big(\log PROP_{t-1}^{INC,G,VAL} \\ + \Delta\left(\log PROP^{INC,G,VAL,e}\right)\Big)\end{aligned} \tag{10.17}$$

Expected Government property incomes in value

$$\begin{aligned}\Delta\left(\log PROP^{INC,G,VAL,e}\right) = \alpha^{1,PROP,INC,G,VAL}.\Delta\left(\log PROP_{t-1}^{INC,G,VAL,e}\right) \\ + \alpha^{2,PROP,INC,G,VAL}.\Delta\left(\log PROP_{t-1}^{INC,G,VAL}\right) \\ + \alpha^{3,PROP,INC,G,VAL}.\Delta\left(\log PROP^{INC,G,VAL,n}\right)\end{aligned} \tag{10.18}$$

10.2 Substitutions

Substitution effect of the production factor f in the sector s

$$SUBST_{f,s}^{F} = \alpha_{f,s}^{6,F}\ SUBST_{f,s}^{F,n} + \left(1-\alpha_{f,s}^{6,F}\right)\ SUBST_{f,s,t-1}^{F} \tag{10.19}$$

Substitution effect of the domestic margin paid m for the commodity c

$$SUBST_{m,c}^{MGPD} = \alpha_{m,c}^{6,MGPD}\ SUBST_{m,c}^{MGPD,n} + \left(1-\alpha_{m,c}^{6,MGPD}\right)\ SUBST_{m,c,t-1}^{MGPD} \tag{10.20}$$

Substitution effect on the imported margin paid m for the commodity c

$$SUBST_{m,c}^{MGPM} = \alpha_{m,c}^{6,MGPM}\ SUBST_{m,c}^{MGPM,n} + \left(1-\alpha_{m,c}^{6,MGPM}\right)\ SUBST_{m,c,t-1}^{MGPM} \tag{10.21}$$

Substitution effect on the energy intermediate consumption ce in the sector s

$$SUBST_{ce,s}^{CI} = \alpha_{ce,s}^{6,CI}\ SUBST_{ce,s}^{CI,n} + \left(1 - \alpha_{ce,s}^{6,CI}\right)\ SUBST_{ce,s,t-1}^{CI} \quad (10.22)$$

Substitution effect on the transportation intermediate consumption ce in the sector s

$$SUBST_{ct,s}^{CI} = \alpha_{ct,s}^{6,CI}\ SUBST_{ct,s}^{CI,n} + \left(1 - \alpha_{ct,s}^{6,CI}\right)\ SUBST_{ct,s,t-1}^{CI} \quad (10.23)$$

Substitution effect on the imported margin supplied for the commodity m

$$SUBST_{m}^{MGSM} = \alpha_{m}^{6,MGSM}\ SUBST_{m}^{MGSM,n} + \left(1 - \alpha_{m}^{6,MGSM}\right)\ SUBST_{m,t-1}^{MGSM} \quad (10.24)$$

Substitution effect on the imported households final consumption for the commodity c

$$SUBST_{c}^{CHM} = \alpha_{c}^{6,CHM}\ SUBST_{c}^{CHM,n} + \left(1 - \alpha_{c}^{6,CHM}\right)\ SUBST_{c,t-1}^{CHM} \quad (10.25)$$

Substitution effect on the imported government final consumption for the commodity c

$$SUBST_{c}^{GM} = \alpha_{c}^{6,GM}\ SUBST_{c}^{GM,n} + \left(1 - \alpha_{c}^{6,GM}\right)\ SUBST_{c,t-1}^{GM} \quad (10.26)$$

Substitution effect on the exports for the imported commodity c

$$SUBST_{c}^{XM} = \alpha_{c}^{6,XM}\ SUBST_{c}^{XM,n} + \left(1 - \alpha_{c}^{6,XM}\right)\ SUBST_{c,t-1}^{XM} \quad (10.27)$$

Substitution effect on the intermediate consumption for the imported commodity c in the sector s

$$SUBST_{c,s}^{CIM} = \alpha_{c,s}^{6,CIM}\ SUBST_{c,s}^{CIM,n} + \left(1 - \alpha_{c,s}^{6,CIM}\right)\ SUBST_{c,s,t-1}^{CIM} \quad (10.28)$$

Substitution effect on the investment for the imported commodity c in the sector s

$$SUBST_{c,s}^{IM} = \alpha_{c,s}^{6,IM}\ SUBST_{c,s}^{IM,n} + \left(1 - \alpha_{c,s}^{6,IM}\right)\ SUBST_{c,s,t-1}^{IM} \quad (10.29)$$

Substitution effect on the exports of the commodity c

$$SUBST_{c}^{X} = \alpha_{c}^{6,X}\ SUBST_{c}^{X,n} + \left(1 - \alpha_{c}^{6,X}\right)\ SUBST_{c,t-1}^{X} \quad (10.30)$$

11 Carbon tax

11.1 Incomes generated by the carbon tax by type of emissions, sector and commodity

11.1.1 Incomes generated by intermediary consumption emissions

Carbon tax in value on intermediary consumption emissions depending on ghg emission types, commodity c in sector s

$$T2VAL^{CI}_{ghg,c,s} = R2^{CI}_{ghg,c,s}\ EMS^{CI}_{ghg,c,s} \tag{11.1}$$

Carbon tax in volume on intermediary consumption emissions depending on ghg emission types, commodity c in sector s

$$T2^{CI}_{ghg,c,s} = R2^{CI}_{ghg,c,s,t_0}\ EMS^{CI}_{ghg,c,s} \tag{11.2}$$

Carbon tax in value on intermediary consumption emissions depending on ghg emission types and commodity c

$$T2VAL^{CI}_{ghg,c} = \sum_{s} T2VAL^{CI}_{ghg,c,s} \tag{11.3}$$

Carbon tax in value on intermediary consumption emissions depending on ghg emission types and domestic commodity c

$$T2VAL^{CID}_{ghg,c} = \sum_{s} T2VAL^{CI}_{ghg,c,s}\ \frac{CID_{c,s}}{CI_{c,s}} \tag{11.4}$$

Carbon tax in volume on intermediary consumption emissions depending on ghg emission types and domestic commodity c

$$T2^{CID}_{ghg,c} = \sum_{s} T2^{CI}_{ghg,c,s}\ \frac{CID_{c,s}}{CI_{c,s}} \tag{11.5}$$

Carbon tax in value on intermediary consumption emissions depending on ghg emission types and imported commodity c

$$T2VAL^{CIM}_{ghg,c} = \sum_{s} T2VAL^{CI}_{ghg,c,s}\ \frac{CIM_{c,s}}{CI_{c,s}} \tag{11.6}$$

Carbon tax in volume on intermediary consumption emissions depending on ghg emission types and imported commodity c

$$T2^{CIM}_{ghg,c} = \sum_{s} T2^{CI}_{ghg,c,s} \frac{CIM_{c,s}}{CI_{c,s}} \tag{11.7}$$

Carbon tax in value on intermediary consumption emissions depending on ghg emission types and sector s

$$T2VAL^{CI}_{ghg,s} = \sum_{c} T2VAL^{CI}_{ghg,c,s} \tag{11.8}$$

Carbon tax in value on intermediary consumption emissions depending on commodity c and sector s

$$T2VAL^{CI}_{c,s} = \sum_{ghg} T2VAL^{CI}_{ghg,c,s} \tag{11.9}$$

Carbon tax in value on intermediary consumption emissions depending on ghg emission types

$$T2VAL^{CI}_{ghg} = \sum_{c} T2VAL^{CI}_{ghg,c} \tag{11.10}$$

Carbon tax in value on intermediary consumption emissions depending on commodity c

$$T2VAL^{CI}_{c} = \sum_{ghg} T2VAL^{CI}_{ghg,c} \tag{11.11}$$

Carbon tax in value on intermediary consumption emissions depending on domestic commodity c

$$T2VAL^{CID}_{c} = \sum_{ghg} T2VAL^{CID}_{ghg,c} \tag{11.12}$$

Carbon tax in volume on intermediary consumption emissions depending on domestic commodity c

$$T2^{CID}_{c} = \sum_{ghg} T2^{CID}_{ghg,c} \tag{11.13}$$

Carbon tax in value on intermediary consumption emissions depending on imported commodity c

$$T2VAL_{c}^{CIM} = \sum_{ghg} T2VAL_{ghg,c}^{CIM} \tag{11.14}$$

Carbon tax in volume on intermediary consumption emissions depending on imported commodity c

$$T2_{c}^{CIM} = \sum_{ghg} T2_{ghg,c}^{CIM} \tag{11.15}$$

Carbon tax in value on intermediary consumption emissions depending on sector s

$$T2VAL_{s}^{CI} = \sum_{ghg} T2VAL_{ghg,s}^{CI} \tag{11.16}$$

Carbon tax in value on intermediary consumption emissions

$$T2VAL^{CI} = \sum_{s} T2VAL_{s}^{CI} \tag{11.17}$$

11.1.2 Incomes generated by material emissions

Carbon tax in value on material emissions depending on ghg emission types, commodity c in sector s

$$T2VAL_{ghg,s}^{MAT} = R2_{ghg,s}^{MAT}\ EMS_{ghg,s}^{MAT} \tag{11.18}$$

Carbon tax in volume on material emissions depending on ghg emission types, commodity c in sector s

$$T2_{ghg,s}^{MAT} = R2_{ghg,s,t_0}^{MAT}\ EMS_{ghg,s}^{MAT} \tag{11.19}$$

Carbon tax in value on material emissions depending on ghg emission types

$$T2VAL_{ghg}^{MAT} = \sum_{s} T2VAL_{ghg,s}^{MAT} \tag{11.20}$$

Carbon tax in volume on material emissions depending on ghg emission types

$$T2_{ghg}^{MAT} = \sum_{s} T2_{ghg,s}^{MAT} \tag{11.21}$$

Carbon tax in value on material emissions depending on commodity c

$$T2VAL_{s}^{MAT} = \sum_{ghg} T2VAL_{ghg,s}^{MAT} \tag{11.22}$$

Carbon tax in volume on material emissions depending on commodity c

$$T2_{s}^{MAT} = \sum_{ghg} T2_{ghg,s}^{MAT} \tag{11.23}$$

Carbon tax in value on material emissions

$$T2VAL^{MAT} = \sum_{s} T2VAL_{s}^{MAT} \tag{11.24}$$

11.1.3 Incomes generated by production emissions

Carbon tax in value on production emissions depending on ghg emission types, commodity c in sector s

$$T2VAL_{ghg,s}^{Y} = R2_{ghg,s}^{Y}\ EMS_{ghg,s}^{Y} \tag{11.25}$$

Carbon tax in volume on production emissions depending on ghg emission types, commodity c in sector s

$$T2_{ghg,s}^{Y} = R2_{ghg,s,t_0}^{Y}\ EMS_{ghg,s}^{Y} \tag{11.26}$$

Carbon tax in value on production emissions depending on ghg emission types

$$T2VAL_{ghg}^{Y} = \sum_{s} T2VAL_{ghg,s}^{Y} \tag{11.27}$$

Carbon tax in volume on production emissions depending on ghg emission types

$$T2_{ghg}^{Y} = \sum_{s} T2_{ghg,s}^{Y} \tag{11.28}$$

Carbon tax in value on production emissions depending on sector s

$$T2VAL_{s}^{Y} = \sum_{ghg} T2VAL_{ghg,s}^{Y} \tag{11.29}$$

Carbon tax in volume on production emissions depending on sector s

$$T2^{Y}_{s} = \sum_{ghg} T2^{Y}_{ghg,s} \tag{11.30}$$

Carbon tax in value on production emissions

$$T2VAL^{Y} = \sum_{s} T2VAL^{Y}_{s} \tag{11.31}$$

11.1.4 Incomes generated by households' emissions

Carbon tax in value on households' consumption depending on ghg emission types and commodity c

$$T2VAL^{CH}_{ghg,c} = R2^{CH}_{ghg,c}\ EMS^{CH}_{ghg,c} \tag{11.32}$$

Carbon tax in volume on households' consumption depending on ghg emission types and commodity c

$$T2^{CH}_{ghg,c} = R2^{CH}_{ghg,c,t_0}\ EMS^{CH}_{ghg,c} \tag{11.33}$$

Carbon tax in value on households' consumption depending on ghg emission types

$$T2VAL^{CH}_{ghg} = \sum_{c} T2VAL^{CH}_{ghg,c} \tag{11.34}$$

Carbon tax in value on households' consumption depending on commodity c

$$T2VAL^{CH}_{c} = \sum_{ghg} T2VAL^{CH}_{ghg,c} \tag{11.35}$$

Carbon tax in volume on households' consumption depending on commodity c

$$T2^{CH}_{c} = \sum_{ghg} T2^{CH}_{ghg,c} \tag{11.36}$$

Carbon tax in value on households' consumption depending on ghg emission types and commodity c

$$T2VAL^{CH} = \sum_{c} T2VAL^{CH}_{c} \tag{11.37}$$

12 Taxes on commodities & Prices per uses

There are two versions regarding the specification of prices and taxes on commodities: (1) the basic version where taxes are not differentiated between uses (e.g. intermediary, final consumption, export, etc.) and type (e.g. VAT, subsidies, etc.); (2) the advanced version where this differentiation is made.

This file provides the equations defining with more detail taxes and prices. In the basic version, taxes on commodities are not differentiated between uses. A constant average tax rate on each commodity is assumed. This has the advantage to require less data for the calibration. But this assumption is often unrealistic since taxes on commodities are generally differentiated per uses. For instance, VAT applies on final consumption but not on intermediary consumption or exports. Subsidies are generally higher for domestic than imported products. When the equations of this section are activated in ThreeME, the heterogeneity regarding the tax rates is taken into account. Additional data are required to disaggregate taxes. The average tax rate is not constant anymore and becomes an endogenous variable that depends on the evolution of structure of taxes and subsidies. To preserve the accountancy consistency of the model, prices have also to be amended compared to the basic version.

12.1 Taxes on commodities

12.1.1 Average tax rates on commodities

Net taxes on domestically produced commodity c expressed in value

$$NTAXCD_c^{VAL} = PVATD_c\, VATD_c + POTHCTD_c\, OTHCTD_c + PSUBCD_c\, SUBCD_c + T2VAL_c^{CH}\, \frac{CHD_c}{CH_c + T2VAL_c^{CID}} \tag{12.1}$$

Net taxes on domestically produced commodity c

$$NTAXCD_c = VATD_c + OTHCTD_c + SUBCD_c + T2_c^{CH}\, \frac{CHD_c}{CH_c + T2_c^{CID}} \tag{12.2}$$

This is not defined anymore by simply assuming a constant rate over the production value: $NTAXCD_c^{VAL} = RNTAXCD_c * PYQ_c * YQ_c$. Different taxes are now defined depending on their basis (see below).

Average tax rate on domestically produced commodity c

$$RNTAXCD_c = \frac{NTAXCD_c^{VAL}}{(PYQ_c\, YQ_c)} \tag{12.3}$$

This rate become now endogenous by inverting the equation of $NTAXCD_c^{VAL}$. This specification ensures the accounting equality between the various GDP definition.

Net taxes on imported commodity c **expressed in value**

$$\begin{aligned} NTAXCM_c^{VAL} = {} & PVATM_c\, VATM_c + POTHCTM_c\, OTHCTM_c \\ & + PSUBCM_c\, SUBCM_c + T2VAL_c^{CH}\, \frac{CHM_c}{CH_c + T2VAL_c^{CIM}} \end{aligned} \tag{12.4}$$

Net taxes on imported commodity c

$$NTAXCM_c = VATM_c + OTHCTM_c + SUBCM_c + T2_c^{CH}\, \frac{CHM_c}{CH_c + T2_c^{CIM}} \tag{12.5}$$

Average tax rate on imported commodity c

$$RNTAXCM_c = \frac{NTAXCM_c^{VAL}}{(PM_c\, M_c)} \tag{12.6}$$

12.1.2 Value-added tax (value & volume)

Price of value-added tax on domestically produced commodity c

$$PVATD_c\, VATD_c = RVATD_c\, PYQSBVAT_c\, \frac{CHD_c}{(1 + RVATD_{c,t_0})} \tag{12.7}$$

Value-added tax on domestically produced commodity c

$$VATD_c = RVATD_{c,t_0}\, \frac{CHD_c}{(1 + RVATD_{c,t_0})} \tag{12.8}$$

Price of value-added tax on imported commodity c

$$PVATM_c\, VATM_c = RVATM_c\, PMSBVAT_c\, \frac{CHM_c}{(1 + RVATM_{c,t_0})} \quad (12.9)$$

Value-added tax on imported commodity c

$$VATM_c = RVATM_{c,t_0}\, \frac{CHM_c}{(1 + RVATM_{c,t_0})} \quad (12.10)$$

12.1.3 Other taxes on commodities (value & volume)

Price of other taxes on domestically produced commodity c

$$POTHCTD_c\, OTHCTD_c = ROTHCTD_c\, PYQ_c\, YQ_c \quad (12.11)$$

Other taxes on domestically produced commodity c

$$OTHCTD_c = ROTHCTD_{c,t_0}\, YQ_c \quad (12.12)$$

Price other taxes on imported commodity c

$$POTHCTM_c\, OTHCTM_c = ROTHCTM_c\, PM_c\, M_c \quad (12.13)$$

Other taxes on imported commodity c

$$OTHCTM_c = ROTHCTM_{c,t_0}\, M_c \quad (12.14)$$

12.1.4 Subsidies on commodities (value & volume)

$$PSUBCD_c\, SUBCD_c = RSUBCD_c\, YQ_c \quad (12.15)$$

Subsidies on domestically produced commodity c

$$SUBCD_c = RSUBCD_{c,t_0}\, YQ_c \quad (12.16)$$

We assume that subsidies are proportional to on the volume of production which is often the cases (in particular for agriculture). Consequently the price of the subvention grows like the subvention rate. For simplicity, we assume that at the steady state, the subvention rate grows at the rate of inflation.

Price of subsidies on imported commodity c

$$PSUBCM_c\, SUBCM_c = RSUBCM_c\, M_c \quad (12.17)$$

Subsidies on imported commodity c

$$SUBCM_c = RSUBCM_{c,t_0}\, M_c \quad (12.18)$$

12.2 Prices of commodities

Prices are amended to be consistent with the above specification of taxes.

Selling price before VAT for domestically produced commodity c

$$\begin{aligned} PYQSBVAT_c\, YQSBVAT_c = {} & PYQ_c\, YQ_c + POTHCTD_c\, OTHCTD_c \\ & + PSUBCD_c\, SUBCD_c \\ & + PMGPD_c\, MGPD_c \end{aligned} \tag{12.19}$$

Production of commodity c **expressed at market price before VAT**

$$\Delta\left(\log YQSBVAT_c\right) = \Delta\left(\log YQ_c\right) \tag{12.20}$$

$YQSBVAT_c$ 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 basic price, margins and taxes. Indeed, it does not increase when the volume of the commercial and transport margins increase. The price does instead. Consequently, $YQSBVAT_c$ is always proportional to YQ_c. Notice the consistency with the specification of the volume of a tax or a subvention: 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 tax base (e.g. consumption, production) increases.

Selling price before VAT for imported commodity c

$$\begin{aligned} PMSBVAT_c\, MSBVAT_c = {} & PM_c\, M_c + POTHCTM_c\, OTHCTM_c \\ & + PSUBCM_c\, SUBCM_c + PMGPM_c\, MGPM_c \end{aligned} \tag{12.21}$$

Imports of commodity c **expressed at market price before VAT**

$$\Delta\left(\log MSBVAT_c\right) = \Delta\left(\log M_c\right) \tag{12.22}$$

Market price of margins supplied by domestically produced commodity c

$$PMGSD_c = PYQSBVAT_c \tag{12.23}$$

Market price of margins supplied by imported commodity c

$$PMGSM_c = PMSBVAT_c \tag{12.24}$$

Market price of domestically produced intermediate consumption c purchased by sector s

$$PCID_{c,s} = PYQSBVAT_c + \frac{T2VAL^{CI}_{c,s}}{CI_{c,s}} \tag{12.25}$$

Market price of imported intermediate consumption c purchased by sector s

$$PCIM_{c,s} = PMSBVAT_c + \frac{T2VAL^{CI}_{c,s}}{CI_{c,s}} \tag{12.26}$$

Market price of domestically produced households final consumption c

$$PCHD_c = PYQSBVAT_c \frac{1 + RVATD_c}{1 + RVATD_{c,t_0}} \tag{12.27}$$

Market price of imported households final consumption c

$$PCHM_c = PMSBVAT_c \frac{1 + RVATM_c}{1 + RVATM_{c,t_0}} \tag{12.28}$$

Market price of domestically produced Government final consumption c

$$PGD_c = PYQSBVAT_c \tag{12.29}$$

Market price of imported Government final consumption c

$$PGM_c = PMSBVAT_c \tag{12.30}$$

Market price of domestically produced investment c purchased by sector s

$$PID_{c,s} = PYQSBVAT_c \tag{12.31}$$

Market price of imported investment c purchased by sector s

$$PIM_{c,s} = PMSBVAT_c \tag{12.32}$$

Market price of domestically produced exports c

$$PXD_c = PYQSBVAT_c \tag{12.33}$$

Market price of imported exports (re-exports) c

$$PXM_c = PMSBVAT_c \tag{12.34}$$

Market price of domestically produced change in inventories c

$$PDSD_c = PYQSBVAT_c \tag{12.35}$$

Market price of imported change in inventories c

$$PDSM_c = PMSBVAT_c \tag{12.36}$$

12.2.1 Aggregation of taxes

Aggregate market price for value-added tax paid on domestically produced comodities

$$PVATD.VATD = \sum_{c} PVATD_c \, VATD_c \tag{12.37}$$

Aggregate value-added tax paid on domestically produced comodities

$$VATD = \sum_{c} VATD_c \tag{12.38}$$

Aggregate market price for other product tax paid on domestically produced comodities

$$POTHCTD.OTHCTD = \sum_{c} POTHCTD_c \, OTHCTD_c \tag{12.39}$$

Aggregate other product tax paid on domestically produced comodities

$$OTHCTD = \sum_{c} OTHCTD_c \tag{12.40}$$

Aggregate market price for subsidies on domestically produced commodities

$$PSUBCD.SUBCD = \sum_{c} PSUBCD_c \, SUBCD_c \tag{12.41}$$

Aggregate subsidies on domestically produced commodities

$$SUBCD = \sum_{c} SUBCD_c \tag{12.42}$$

Aggregate market price for value-added tax paid on imported comodities

$$PVATM.VATM = \sum_{c} PVATM_c \, VATM_c \tag{12.43}$$

Aggregate value-added tax paid on imported comodities

$$VATM = \sum_{c} VATM_c \tag{12.44}$$

Aggregate market price for Other product Tax on imported commododities

$$POTHCTM.OTHCTM = \sum_{c} POTHCTM_c \, OTHCTM_c \quad (12.45)$$

Aggregate Other product Tax on imported commododities

$$OTHCTM = \sum_{c} OTHCTM_c \quad (12.46)$$

Aggregate market price for subsidies on imported commododities

$$PSUBCM.SUBCM = \sum_{c} PSUBCM_c \, SUBCM_c \quad (12.47)$$

Aggregate subsidies on imported commodities

$$SUBCM = \sum_{c} SUBCM_c \quad (12.48)$$

Aggregate market price for Value-added Tax on total households final consumption

$$PVAT.VAT = PVATD.VATD + PVATM.VATM \quad (12.49)$$

Aggregate Value-added Tax on total households final consumption

$$VAT = VATD + VATM \quad (12.50)$$

Aggregate market price for other product Tax

$$POTHCT.OTHCT = POTHCTD.OTHCTD + POTHCTM.OTHCTM \quad (12.51)$$

Aggregate Other product Tax

$$OTHCT = OTHCTD + OTHCTM \quad (12.52)$$

Aggregate market price for subsidies on commodities

$$PSUBC.SUBC = PSUBCD.SUBCD + PSUBCM.SUBCM \quad (12.53)$$

Aggregate subsidies on commodities

$$SUBC = SUBCD + SUBCM \quad (12.54)$$

12.2.2 Average tax rates

Average VAT rate on domestically produced commodity

$$RVATD = \frac{PVATD.VATD}{PCHD.CHD - PVATD.VATD} \tag{12.55}$$

Average rate of other taxes on domestically produced commodity

$$ROTHCTD = POTHCTD.\frac{OTHCTD}{(PYQ.YQ)} \tag{12.56}$$

Average rate of subsidies on domestically produced commodity

$$RSUBCD = PSUBCD.\frac{SUBCD}{YQ} \tag{12.57}$$

Average VAT rate on imported commodity

$$RVATM = \frac{PVATM.VATM}{PCHM.CHM - PVATM.VATM} \tag{12.58}$$

Average rate of other taxes on imported commodity

$$ROTHCTM = POTHCTM.\frac{OTHCTM}{(PM.M)} \tag{12.59}$$

Average rate of subsidies on imported commodity

$$RSUBCM = PSUBCM.\frac{SUBCM}{M} \tag{12.60}$$

Average VAT rate

$$RVAT = \frac{PVAT.VAT}{PCH.CH - PVAT.VAT} \tag{12.61}$$

Average rate of other taxes on commodity

$$ROTHCT = POTHCT.\frac{OTHCT}{(PYQ.YQ + PM.M)} \tag{12.62}$$

Average rate of subsidies on commodity

$$RSUBC = PSUBC.\frac{SUBC}{(YQ + M)} \tag{12.63}$$

13 Integration of an Emission Trading Scheme

Nominal price of emissions permits

$$P^{ETS,nominal} = \left(\frac{P^{ETS}}{1000000}\right).PGDP \tag{13.1}$$

Quantity of freely allocated permits to sector s For each sector, the quantity of free permits is defined as a share of emissions that are eligible to the emission trading scheme.

$$Q_s^{ETS,free} = share_s^{free}\ share_s^{ETS}\ EMS_s \tag{13.2}$$

Quantity of emissions permits required for sector s **relative to its** $ce2$ **energy consumption**

$$Q_{ce2,s}^{ETS} = \left(share_s^{ETS}\ EMS_{ce2,s}\right) - Q_s^{ETS,free}\ \frac{EMS_{ce2,s}}{EMS_s} \tag{13.3}$$

Nominal value of emissions permits bought by sector s **due to** $ce2$ **consumption**

$$ETS_{ce2,s}^{VAL} = \left(P^{ETS,nominal}.Q_{ce2,s}^{ETS}\right) \tag{13.4}$$

Nominal value of emissions permits required for sector s

$$ETS_s^{VAL} = \sum_{ce2} ETS_{ce2,s}^{VAL} \tag{13.5}$$

Total nominal value of emissions permits on the trading market

$$ETS^{VAL,TOT} = \sum_{s} ETS_s^{VAL} \tag{13.6}$$

13.1 Scenario 1 : price signal

We overwrite the equation of the price block in order to add the ETS cost (energy $ce2$ used in activity s). We only consider energy goods $ce2$ - and not ce - since intermediary consumption of electricity does not induce dioxyde emissions.

Price of $ce2$ **energy consumption in sector** s

$$PE_{ce2,s}\ E_{ce2,s} = PED_{ce2}\ ED_{ce2,s} + PEM_{ce2}\ EM_{ce2,s} + ETS_{ce2,s}^{VAL,SEC} \tag{13.7}$$

13.2 Scenario 2 : implicit production subvention

We overwrite the production cost equation of the price block in order to consider the freely allocated permits as an implicit subvention on production.

Nominal production prices of covered sectors

$$PY_s^n\, Y_s = \big(CK_s\, K_s + CL_s\, L_s\, PROG_s^L + PE_s\, E_s + PMAT_s\, MAT_s + PIY_s\, IY_s + PSY_s\, SY_s + PIS_s\, IS_s - P^{ETS,nominal}.Q_s^{ETS,free}\big)\ (1 + TMD_s) \tag{13.8}$$

13.3 Government budget

We overwrite the equation in order to add the aggregated value of bought permits to the revenue of the government.

Government revenues

$$INC^{G,VAL} = PNTAXC.NTAXC + NTAXS^{VAL} + INC^{SOC,TAX,VAL} + PRSC.RSC + PROP^{INC,G,VAL} + ETS^{VAL,TOT} \tag{13.9}$$

Employers' social security contribution paid by sector s

$$RSC_s\, PRSC_s = W_s\, F_{L,s}\, RRSC_s - ETS_s^{VAL} \tag{13.10}$$

Necessary (minimum) households' final consumption for construction commodity *ccon*

$$NCH_{ccon} = PNewBUIL_{t_0}\, NewBUIL + PREHAB_{t_0}\, REHAB + CH_{CCON}^{OTH} \tag{13.11}$$

14 Nested CES Production function

This file provides the equations defining a nested CES production function. The nested structure is a follows: K (capital), L (labor), E (energy), M (material).

The specification of the Elasticity of Substitution (ES) used between two inputs is the one presented in Reynès (2018, Appendix B), From the ES in the different levels of the nest, it is possible to determine the actual elasticity

between two inputs. Since the ES between two inputs is symmetric, we have:

ES between material and capital

$$ES_{MAT,K,s} = \sigma_s^{NEST^{MAT,KEL}} \tag{14.1}$$

ES between capital and material

$$ES_{K,MAT,s} = ES_{MAT,K,s} \tag{14.2}$$

ES between material and energy

$$ES_{MAT,E,s} = \sigma_s^{NEST^{MAT,KEL}} \tag{14.3}$$

ES between energy and material

$$ES_{E,MAT,s} = ES_{MAT,E,s} \tag{14.4}$$

ES between material and labor

$$ES_{MAT,L,s} = \sigma_s^{NEST^{MAT,KEL}} \tag{14.5}$$

ES between labor and material

$$ES_{L,MAT,s} = ES_{MAT,L,s} \tag{14.6}$$

ES between capital and energy

$$ES_{K,E,s} = \frac{\sigma_s^{NEST^{K,E}}}{(1-\varphi_{MAT,s}-\varphi_{L,s}) - \frac{\sigma_s^{NEST^{MAT,KEL}}}{\left(1-\varphi_{MAT,s}\right)-\sigma_s^{NEST^{KE,L}} \frac{\varphi_{L,s}}{1-\varphi_{MAT,s}-\varphi_{L,s}}}} \tag{14.7}$$

ES between energy and capital

$$ES_{E,K,s} = ES_{K,E,s} \tag{14.8}$$

ES between capital and labor

$$ES_{K,L,s} = \frac{\sigma_s^{NEST^{KE,L}} - \sigma_s^{NEST^{MAT,KEL}} \varphi_{MAT,s}}{1-\varphi_{MAT,s}} \tag{14.9}$$

ES between labor and capital

$$ES_{L,K,s} = ES_{K,L,s} \tag{14.10}$$

ES between energy and labor

$$ES_{E,L,s} = ES_{K,L,s} \tag{14.11}$$

ES between labor and energy

$$ES_{L,E,s} = ES_{E,L,s} \tag{14.12}$$

15 Exogenous variables

15.1 From prices section

15.1. $\rho_s^{W,X}$ – **Constant in the wage equation for sector** s

15.2. $\rho_s^{W,P}$ – **Elasticity of the notional wage inflation to prices inflation for sector** s

15.3. $\rho_s^{W,Pe}$ – **Elasticity of the notional wage inflation to expected price inflation for sector** s

15.4. $\rho_s^{W,PROG}$ – **Elasticity of the notional wage inflation to labor productivity growth for sector** s

15.5. $\rho_s^{W,U}$ – **Elasticity of the notional wage inflation to the unemployment rate for sector** s

15.6. $DNAIRU$ – **Change in the long term NAIRU**

15.7. $\rho_s^{W,DU}$ – **Elasticity of the notional wage inflation to the variation of the unemployment rate for sector** s

15.8. $\rho_s^{W,L}$ – **Elasticity of the notional wage inflation to the growth rate of share of labor in sector** s

15.9. $\rho^{Rn,Cons}$ – **Constant of the notional interest rate equation (Taylor rule).**

The constant is equal to zero in the baseline scenario. It can be used to simulate monetary shocks.

15.10. $\rho^{Rn,P}$ – **Elasticity of the notional interest rate to inflation**

15.11. $\rho^{Rn,UnR}$ – **Elasticity of the notional interest rate to the unemployment rate**

15.2 From producer section

15.12. $\varphi_{f,s}$ – **Share of the production input f by sector s**

15.3 From Consumer section

15.13. σ^{lesces} – **Elasticity of the linear elasticity system**

15.14. gr^{nomi} – **Nominal growth rate of the economy**

15.15. $riskprem$ – **Risk premium**

15.16. $Pwages$ – **Nominal price index**

15.17. $\rho^{MPS,R}$ – **Elasticity of the marginal propensity to share to the growth rate of the interest rate**

15.18. $\rho^{MPS,UnR}$ – **Elasticity of the marginal propensity to share to the growth rate of unemployment**

15.19. $RINC^{SOC,TAX}$ – **Rate of social taxes to the disposable income**

15.20. RR^{POP} – **Population growth rate**

15.21. RR^{Un} – **unemployment growth rate**

15.22. $TRSF^{HH,VAL}$ – **Transfers to households**

(should be endogenous)
15.23. $prog_s^L$ – **Labor productivity in the sector** s

15.4 From government section

15.24. $RNTAXS_s$ – **tax rate on the production of sector** s

15.25. $RRSC_s$ – **Employers' social security contribution rate of the sector** s

15.26. $EXPG^{trend}$ – **Public expenditures trend from the government**

15.27. $\varphi^{PROPINC,G}$ – **Propriety income of the government expressed in value**

15.28. φ^{RDG} – **Share of debt reimbursed every year**

15.5 From International Trade section

15.29. σ_c^{MGSM} – **Elasticity of substitution between imported and domestically produced commodity** c **for margins supplied**

15.30. σ_c^{CHM} – **Elasticity of substitution between imported and domestically produced commodity** c **for households final consumption**

15.31. σ_c^{GM} – **Elasticity of substitution between imported and domestically produced commodity** c **for government final consumption**

15.32. $\sigma_{c,s}^{CIM}$ – **Elasticity of substitution between imported and domestic intermediary consumption in commodity** c **from the sector** s

15.33. $\sigma^{IM}_{c,s}$ – **Elasticity of substitution between imported and domestic investment in commodity c from the sector s**

15.34. σ^{XM}_{c} – **Elasticity of substitution between domestic and imported commodity c for exports**

15.35. σ^{X}_{c} – **Elasticity of substitution between french exports and rest of the world exports**

15.36. EXR – **Exchange rate of the euro with the rest of world's currency**

15.6 From Demography section

15.37. POP – **Total population**

15.38. $\rho^{PATR,UnR}$ – **Elasticity of unemployed population with the labor force participation**

15.39. $PARTR^{TREND}$ – **Participation rate to the labor force trend**

15.7 From Emissions section

15.40. $IEMS^{CI}_{ghg,c,s}$ – **Emissions intensity of the greenhouse gas ghg related to the intermediary consumption of commodity c by sector s**

15.41. $IEMS^{MAT}_{ghg,s}$ – **Emissions intensity of the greenhouse gas ghg related to the material consumption of sector s**

15.42. $IEMS^{Y}_{ghg,s}$ – **Emissions intensity of the greenhouse gas ghg related to the final production of sector s**

15.43. $IEMS^{CH}_{ghg,c}$ – **Emissions intensity of the greenhouse gas ghg related to the household final consumption of commodity c**

15.8 From Adjustment section

15.44. α^{μ}_{s} – **Adjustment parameter between the notional and the previous period value of the mark-up in the sector s**

15.45. $\alpha^{Pe,P1}$ – **Adjustment parameter on the formation of inflation expectation**

15.46. $\alpha^{Ye,Y}_{s}$ – **Adjustment parameter on the formation of production of the sector s expectation**

15.47. $\alpha^{0}_{f,s}$ – **Adjustment parameter between the notional and the expected value of the variable Ff, s, t**

15.48. $\alpha^{1}_{f,s}$ – **Adjustment parameter between the expected and the real value of a variable $F^{e}_{f,s,t-1}$**

15.49. $\alpha^{2}_{f,s}$ – **Adjustment parameter between the previous period real value and the current value of a variable $F_{f,s,t-1}$**

15.50. $\alpha^{3}_{f,s}$ – **Adjustment parameter between the notional and the real value of the variable $F^{n}_{f,s,t-1}$**

15.51. $\alpha^{0,IA}_{s}$ – **Adjustment parameter between the notional and the expected value of investment in the sector s**

15.52. $\alpha_s^{1,IA}$ – **Adjustment parameter on the previous period expected value of investment in the sector** s

15.53. $\alpha_s^{2,IA}$ – **Adjustment parameter on the previous period real value of investment in the sector** s

15.54. $\alpha_s^{3,IA}$ – **Adjustment parameter on the notional value of investment in the sector** s

15.55. $\alpha_c^{0,CH}$ – **Adjustment parameter between the notional and the expected value of household consumption of commodity** c

15.56. $\alpha_c^{1,CH}$ – **Adjustment parameter on the previous period expected value of household consumption of commodity** c

15.57. $\alpha_c^{2,CH}$ – **Adjustment parameter on the previous period real value of household consumption of commodity** c

15.58. $\alpha_c^{3,CH}$ – **Adjustment parameter on the notional value of household consumption of commodity** c

15.59. $\alpha_s^{0,PY}$ – **Adjustment parameter on the notional value of production price in the sector** s

15.60. $\alpha_s^{1,PY}$ – **Adjustment parameter on the previous period expected value of production price in the sector** s

15.61. $\alpha_s^{2,PY}$ – **Adjustment parameter on the previous period value of production price in the sector** s

15.62. $\alpha_s^{3,PY}$ – **Adjustment parameter on the notional value of production price in the sector** s

15.63. $\alpha_s^{W,Wn}$ – **Adjustment parameter on the notional value of the wages in the sector** s

15.64. $\alpha_s^{W,W1}$ – **Adjustment parameter on the previous period value of the wages in the sector** s

15.65. $\alpha_s^{W,W1Wn1}$ – **Adjustment parameter on the ratio between the previous period value of the wages and the previous period notional value in the sector** s

15.66. $\alpha^{0,PARTR}$ – **Adjustment parameter on the notional value of the labor participation ratio**

15.67. $\alpha^{0,R}$ – **Adjustment parameter on the notional value of the interest rate**

15.68. $\alpha^{0,PROP,INC,H,VAL}$ – **Adjustment parameter on the notional value of the Households property income**

15.69. $\alpha^{1,PROP,INC,H,VAL}$ – **Adjustment parameter on the expected value of the Households property income**

15.70. $\alpha^{0,PROP,INC,G,VAL}$ – **Adjustment parameter on the notional value of the government property income**

15.71. $\alpha^{1,PROP,INC,G,VAL}$ – **Adjustment parameter on the expected value of the government property income**

15.72. $\alpha_{f,s}^{6}$ – **Adjustment parameter between the notional and the real value for the substitution effect on the production factor** f **in the sector** s

15.73. $\alpha_{m,c}^{6,MGPD}$ – **Adjustment parameter between the notional and**

the real value for the substitution effect on the domestic margin paid m for the commodity c

15.74. $\alpha_{m,c}^{6,MGPM}$ – **Adjustment parameter between the notional and the real value for the substitution effect on the imported margin paid m for the commodity c**

15.75. $\alpha_{ce,s}^{6,CI}$ – **Adjustment parameter between the notional and the real value for the substitution effect on the energy intermediate consumption ce in the sector s**

15.76. $\alpha_{ct,s}^{6,CI}$ – **Adjustment parameter between the notional and the real value for the substitution effect on the transportation intermediate consumption ce in the sector s**

15.77. $\alpha_{m}^{6,MGSM}$ – **Adjustment parameter between the notional and the real value for the substitution effect on the imported margin supplied for the commodity m**

15.78. $\alpha_{c}^{6,CHM}$ – **Adjustment parameter between the notional and the real value for the substitution effect on the imported households final consumption for the commodity c**

15.79. $\alpha_{c}^{6,GM}$ – **Adjustment parameter between the notional and the real value for the substitution effect on the imported government final consumption for the commodity c**

15.80. $\alpha_{c}^{6,XM}$ – **Adjustment parameter between the notional and the real value for the substitution effect on the exports for the imported commodity c**

15.81. $\alpha_{c,s}^{6,CIM}$ – **Adjustment parameter between the notional and the real value for the substitution effect on the intermediate consumption for the imported commodity c in the sector s**

15.82. $\alpha_{c,s}^{6,IM}$ – **Adjustment parameter between the notional and the real value for the substitution effect on the investment for the imported commodity c in the sector s**

15.83. $\alpha_{c}^{6,X}$ – **Adjustment parameter between the notional and the real value for the substitution effect on the exports of the commodity c**

15.9 From Taxes and Price exception

15.84. $R2_{ghg,c,s}^{CI}$ – **Carbon tax rate on the greenhouse gas ghg associated to the intermediary consumption of commodity c by the sector s**

15.85. $R2_{ghg,s}^{MAT}$ – **Carbon tax rate on the greenhouse gas ghg associated to the material consumption of the sector s**

15.86. $R2_{ghg,s}^{Y}$ – **Carbon tax rate on the greenhouse gas ghg associated to the final production of the sector s**

15.87. $R2_{ghg,c}^{CH}$ – **Carbon tax rate on the greenhouse gas ghg associated to the household final consumption of the sector s**

15.10 From ETS section

15.88. $share_{s}^{ETS}$ – **Percentage of emissions covered by an ETS scheme for the sector s**

15.89. $share_{s}^{free}$ – **Percentage of freely allocated permits to sector s**

16 Glossary

α_s^{μ}	Adjustment parameter between the notional and the previous period value of the mark-up in the sector s	15.44, 71
$\alpha^{Pe,P1}$	Adjustment parameter on the formation of inflation expectation	15.45, 71
$\alpha_s^{W,W1}$	Adjustment parameter on the previous period value of the wages in the sector s	15.64, 73
$\alpha_s^{W,W1Wn1}$	Adjustment parameter on the ratio between the previous period value of the wages and the previous period notional value in the sector s	15.65, 73
$\alpha_s^{W,Wn}$	Adjustment parameter on the notional value of the wages in the sector s	15.63, 73
$\alpha_s^{Ye,Y}$	Adjustment parameter on the formation of production of the sector s expectation	15.46, 71
$\alpha_{f,s}^{0}$	Adjustment parameter between the notional and the expected value of the variable Ff, s, t	15.47, 71
$\alpha_c^{0,CH}$	Adjustment parameter between the notional and the expected value of household consumption of commodity c	15.55, 72
$\alpha_s^{0,IA}$	Adjustment parameter between the notional and the expected value of investment in the sector s	15.51, 71
$\alpha^{0,PARTR}$	Adjustment parameter on the notional value of the labor participation ratio	15.66, 73
$\alpha^{0,PROP,INC,G,VAL}$	Adjustment parameter on the notional value of the government property income	15.70, 73
$\alpha^{0,PROP,INC,H,VAL}$	Adjustment parameter on the notional value of the Households property income	15.68, 73
$\alpha_s^{0,PY}$	Adjustment parameter on the notional value of production price in the sector s	15.59, 72
$\alpha^{0,R}$	Adjustment parameter on the notional value of the interest rate	15.67, 73

$\alpha^{1}_{f,s}$	Adjustment parameter between the expected and the real value of a variable $F^{e}_{f,s,t-1}$	15.48, 71
$\alpha^{1,CH}_{c}$	Adjustment parameter on the previous period expected value of household consumption of commodity c	15.56, 72
$\alpha^{1,IA}_{s}$	Adjustment parameter on the previous period expected value of investment in the sector s	15.52, 72
$\alpha^{1,PROP,INC,G,VAL}$	Adjustment parameter on the expected value of the government property income	15.71, 73
$\alpha^{1,PROP,INC,H,VAL}$	Adjustment parameter on the expected value of the Households property income	15.69, 73
$\alpha^{1,PY}_{s}$	Adjustment parameter on the previous period expected value of production price in the sector s	15.60, 72
$\alpha^{2}_{f,s}$	Adjustment parameter between the previous period real value and the current value of a variable $F_{f,s,t-1}$	15.49, 71
$\alpha^{2,CH}_{c}$	Adjustment parameter on the previous period real value of household consumption of commodity c	15.57, 72
$\alpha^{2,IA}_{s}$	Adjustment parameter on the previous period real value of investment in the sector s	15.53, 72
$\alpha^{2,PY}_{s}$	Adjustment parameter on the previous period value of production price in the sector s	15.61, 72
$\alpha^{3}_{f,s}$	Adjustment parameter between the notional and the real value of the variable $F^{n}_{f,s,t-1}$	15.50, 71
$\alpha^{3,CH}_{c}$	Adjustment parameter on the notional value of household consumption of commodity c	15.58, 72
$\alpha^{3,IA}_{s}$	Adjustment parameter on the notional value of investment in the sector s	15.54, 72
$\alpha^{3,PY}_{s}$	Adjustment parameter on the notional value of production price in the sector s	15.62, 72
$\alpha^{6}_{f,s}$	Adjustment parameter between the notional and the real value for the substitution effect on the production factor f in the sector s	15.72, 73

$\alpha_c^{6,CHM}$	Adjustment parameter between the notional and the real value for the substitution effect on the imported households final consumption for the commodity c	15.78, 74
$\alpha_{ce,s}^{6,CI}$	Adjustment parameter between the notional and the real value for the substitution effect on the energy intermediate consumption ce in the sector s	15.75, 74
$\alpha_{ct,s}^{6,CI}$	Adjustment parameter between the notional and the real value for the substitution effect on the transportation intermediate consumption ce in the sector s	15.76, 74
$\alpha_{c,s}^{6,CIM}$	Adjustment parameter between the notional and the real value for the substitution effect on the intermediate consumption for the imported commodity c in the sector s	15.81, 74
$\alpha_c^{6,GM}$	Adjustment parameter between the notional and the real value for the substitution effect on the imported government final consumption for the commodity c	15.79, 74
$\alpha_{c,s}^{6,IM}$	Adjustment parameter between the notional and the real value for the substitution effect on the investment for the imported commodity c in the sector s	15.82, 75
$\alpha_{m,c}^{6,MGPD}$	Adjustment parameter between the notional and the real value for the substitution effect on the domestic margin paid m for the commodity c	15.73, 73
$\alpha_{m,c}^{6,MGPM}$	Adjustment parameter between the notional and the real value for the substitution effect on the imported margin paid m for the commodity c	15.74, 74
$\alpha_m^{6,MGSM}$	Adjustment parameter between the notional and the real value for the substitution effect on the imported margin supplied for the commodity m	15.77, 74

$\alpha_c^{6,X}$	Adjustment parameter between the notional and the real value for the substitution effect on the exports of the commodity c	15.83, 75
$\alpha_c^{6,XM}$	Adjustment parameter between the notional and the real value for the substitution effect on the exports for the imported commodity c	15.80, 74
$Bal^{G,Prim,VAL}$	Primary balance of the Government expressed in value (deficit)	6.23, 37
$Bal^{G,Prim,VAL,bis}$	Primary balance of the Government expressed in value (deficit) (for verification)	6.24, 38
$Bal^{G,Tot,VAL}$	Total balance of the Government expressed in value (deficit)	6.25, 38
$Bal^{Trae,VAL}$	Aggregate balance of trade	7.28, 42
$Bal_c^{Trae,VAL}$	Balance of trade of commodity c	7.27, 42
$C_{E,s}$	Energy costs in sector s	3.20, 25
C_E	Aggregate cost of energy	3.26, 25
$C_{K,s}$	Capital cost in sector s	3.18, 24
C_K	Aggregate cost of capital	3.24, 25
$C_{L,s}$	Labor cost in sector s	3.17, 24
C_L	Aggregate cost of labor	3.25, 25
$C_{MAT,s}$	Materials costs in sector s	3.22, 25
C_{MAT}	Aggregate cost of materials	3.27, 25
CH	Aggregate household final consumption, expressed at market price	2.80, 13
CH_c	Households final consumption of commodity c	10.8, 48
CH_c^e	Expected households final consumption of commodity c	10.9, 48
CH_c^n	Households' final consumption c	5.8, 33
$CH^{n,VAL}$	Aggregate notional households final consumption expressed in value	5.6, 33

CH^{toe}_{ce}	Demand for energy *ce* of households, expressed in toe	9.20, 46
CHD	Aggregate domestically produced final consumption, expressed at market price	2.54, 10
CHD_c	Private final consumption of domestically produced commodity c	7.2, 39
CHM	Aggregate imported households final consumption, expressed at market price	2.56, 10
CHM_c	Private final consumption of imported commodity c	7.5, 39
CI	Aggregate intermediate consumption, expressed at market price	2.78, 13
CI_c	Intermediate consumption of commodity c, expressed at market price	2.12, 5
$CI_{ce,s}$	Energy consumption *ce* of sector s	4.13, 31
$CI_{cmo,s}$	Material consumption *cmo* of sector s	4.16, 31
$CI_{ct,s}$	Demand for transport commodity *ct* by sector s	4.18, 32
CI_s	Intermediate consumption of sector s, expressed at market price	2.30, 7
$CI^{toe}_{ce,s}$	Demand for energy *ce* of sector s, expressed in toe	9.19, 46
CI^{toe}_{ce}	Demand for energy *ce* of sectors, expressed in toe	9.24, 46
CI^{bis}	Intermediate consumption of sector s, expressed at market price (for verification)	2.32, 8
CID	Aggregate domestically produced intermediate consumption, expressed at market price	2.50, 10
$CID_{c,s}$	Intermediary consumption from sector s in domestically produced commodity c	7.13, 40
CID_c	Quantity of domestically produced commodity c used as intermediary consumption, expressed at market price	2.18, 6
CID_s	Domestically produced intermediate consumption of sector s, expressed at market price	2.26, 7

CIM	Aggregate imported intermediate consumption, expressed at market price	2.52,	10
$CIM_{c,s}$	Intermediary consumption from sector s in imported commodity c	7.15,	40
CIM_c	Quantity of imported commodity c used as intermediary consumption, expressed at market price	2.20,	6
CIM_s	Imported intermediate consumption of sector s, expressed at market price	2.28,	7
CU_s	Unit cost of production in sector s	3.16,	24
CU_s^n	Notional unit cost of production in sector s	3.15,	24
CUR_s	Capacity utilization ratio of the sector s	3.5,	22
$DEBT^{G,VAL}$	Government's debt expressed in value	6.26,	38
$DISPINC^{AT,VAL}$	Disposable income after tax expressed in value	5.2,	33
$DISPINC^{BT,VAL}$	Disposable income before tax expressed in value	5.1,	32
$DNAIRU$	Change in the long term NAIRU	15.6,	67
DS	Aggregate change in inventories, expressed at market price	2.88,	14
DS_c	Change in inventories of commodity c, expressed at market price	2.16,	5
DSD	Aggregate domestically produced change in inventories, expressed at market price	2.70,	12
DSM	Aggregate imported change in inventories, expressed at market price	2.72,	12
$empl$	Employment (ILO definition)	8.4,	43
EMS	Aggregate emissions	9.17,	46
EMS_{ghg}	Aggregate emissions of the greenhouse gas ghg	9.12,	45
EMS^{CH}	Aggregate emissions related to the households final consumption	9.16,	46
$EMS^{CH}_{ghg,c}$	Emissions of the greenhouse gas ghg related to the household consumption c	9.4,	44

EMS^{CH}_{ghg}	Emissions of the greenhouse gas ghg related to the household final consumption	9.11, 45
EMS^{CI}	Aggregate emissions related to the intermediary consumption	9.13, 45
$EMS^{CI}_{ghg,c,s}$	Emissions of the greenhouse gas ghg related to the intermediary consumption of commodity c by sector s	9.1, 43
$EMS^{CI}_{ghg,c}$	Emissions of the greenhouse gas ghg related to the intermediary consumption of commodity c	9.5, 44
$EMS^{CI}_{ghg,s}$	Emissions of the greenhouse gas ghg related to the intermediary consumption by sector s	9.6, 44
EMS^{CI}_{ghg}	Emissions of the greenhouse gas ghg related to the intermediary consumption	9.7, 44
$EMS^{CI,bis}_{ghg}$	Emissions of the greenhouse gas ghg related to the intermediary consumption (for verification)	9.8, 45
EMS^{MAT}	Aggregate emissions related to the material consumption	9.14, 45
$EMS^{MAT}_{ghg,s}$	Emissions of the greenhouse gas ghg related to the materials consumption of sector s	9.2, 44
EMS^{MAT}_{ghg}	Emissions of the greenhouse gas ghg related to the total material consumption	9.9, 45
EMS^{Y}	Aggregate emissions related to the final production	9.15, 45
$EMS^{Y}_{ghg,s}$	Emissions of the greenhouse gas ghg related to the final production of sector s	9.3, 44
EMS^{Y}_{ghg}	Emissions of the greenhouse gas ghg related to the final production	9.10, 45
EMS^{bis}	Aggregate emissions by type of gas ghg	9.18, 46
$ES_{E,K,s}$	ES between energy and capital	14.8, 66
$ES_{E,L,s}$	ES between energy and labor	14.11, 66
$ES_{E,MAT,s}$	ES between energy and material	14.4, 66
$ES_{K,E,s}$	ES between capital and energy	14.7, 66
$ES_{K,L,s}$	ES between capital and labor	14.9, 66

$ES_{K,MAT,s}$	ES between capital and material	14.2, 66
$ES_{L,E,s}$	ES between labor and energy	14.12, 66
$ES_{L,K,s}$	ES between labor and capital	14.10, 66
$ES_{L,MAT,s}$	ES between labor and material	14.6, 66
$ES_{MAT,E,s}$	ES between material and energy	14.3, 66
$ES_{MAT,K,s}$	ES between material and capital	14.1, 66
$ES_{MAT,L,s}$	ES between material and labor	14.5, 66
σ_c^{CHM}	Elasticity of substitution between imported and domestically produced commodity c for households final consumption	15.30, 69
$\sigma_{c,s}^{CIM}$	Elasticity of substitution between imported and domestic intermediary consumption in commodity c from the sector s	15.32, 69
σ_c^{GM}	Elasticity of substitution between imported and domestically produced commodity c for government final consumption	15.31, 69
$\sigma_{c,s}^{IM}$	Elasticity of substitution between imported and domestic investment in commodity c from the sector s	15.33, 70
σ^{lesces}	Elasticity of the linear elasticity system	15.13, 68
σ_c^{MGSM}	Elasticity of substitution between imported and domestically produced commodity c for margins supplied	15.29, 69
σ_c^{X}	Elasticity of substitution between french exports and rest of the world exports	15.35, 70
σ_c^{XM}	Elasticity of substitution between domestic and imported commodity c for exports	15.34, 70
$ETS_{ce2,s}^{VAL}$	Nominal value of emissions permits bought by sector s due to $ce2$ consumption	13.4, 64
ETS_{s}^{VAL}	Nominal value of emissions permits required for sector s	13.5, 64

$ETS^{VAL,TOT}$	Total nominal value of emissions permits on the trading market	13.6, 64
$EXPG^{tren}$	Public expenditures trend from the government	15.26, 69
EXR	Exchange rate of the euro with the rest of world's currency	15.36, 70
$F_{f,s}$	Quantity of Labor, Energy and Material inputs in sector s	10.4, 47
F_f	Aggregate production factors f	4.11, 31
$F_{K,s}$	Capital stock of sector s	10.6, 47
$F^e_{f,s}$	Expected quantity of Labor, Energy and Material inputs in sector s	10.5, 47
$F^n_{f,s}$	Demand for production factor f by sector s	4.8, 30
G	Aggregate Government final consumption, expressed at market price	2.82, 13
G_c	Government final consumption of commodity c	6.20, 37
GD	Aggregate domestically produced Government final consumption, expressed at market price	2.58, 11
GD_c	Public final consumption of domestically produced commodity c	7.3, 39
GDP	GDP (expenditure definition)	2.127, 20
GDP_c	GDP of commodity c (expenditure definition)	2.129, 20
$GDP4$	GDP (income definition)	2.135, 21
GDP^{bis}	GDP (expenditure definition, for verification)	2.131, 20
GDP^{ter}	GDP (production definition)	2.133, 20
GM	Aggregate imported Government final consumption, expressed at market price	2.60, 11
GM_c	Public final consumption of imported commodity c	7.6, 39
GOS	Aggregate gross operating surplus	2.123, 19
GOS_s	Gross operating surplus of sector s	2.113, 18
GOS^{VAL}_s	Gross operating surplus of sector s expressed in value	2.112, 18

gr^{nomi}	Nominal growth rate of the economy	15.14, 68
$GR^{PROG}_{E,s}$	Energy efficiency gains in sector s	4.22, 32
I	Aggregate investment, expressed at market price	2.84, 14
$I_{c,s}$	Investment in commodity c by sector s	4.12, 31
I_c	Investment in commodity c, expressed at market price	2.14, 5
I_s	Investment of sector s, expressed at market price	2.38, 8
IA_s	Investment in sector s	10.7, 47
I^{bis}	Investment of sector s, expressed at market price (for verification)	2.40, 8
ID	Aggregate domestically produced investment, expressed at market price	2.62, 11
$ID_{c,s}$	Investment from sector s in domestically produced commodity c	7.14, 40
ID_c	Quantity of imported commodity c used as investment, expressed at market price	2.22, 6
ID_s	Domestically produced investment of sector s, expressed at market price	2.34, 8
$IEMS^{CH}_{ghg,c}$	Emissions intensity of the greenhouse gas ghg related to the household final consumption of commodity c	15.43, 71
$IEMS^{CI}_{ghg,c,s}$	Emissions intensity of the greenhouse gas ghg related to the intermediary consumption of commodity c by sector s	15.40, 70
$IEMS^{MAT}_{ghg,s}$	Emissions intensity of the greenhouse gas ghg related to the material consumption of sector s	15.41, 70
$IEMS^{Y}_{ghg,s}$	Emissions intensity of the greenhouse gas ghg related to the final production of sector s	15.42, 71
IM	Aggregate imported investment, expressed at market price	2.64, 11
$IM_{c,s}$	Investment from sector s in imported commodity c	7.16, 40

IM_c	Quantity of imported commodity c used as investment, expressed at market price	2.24, 7
IM_s	Imported investment of sector s, expressed at market price	2.36, 8
$INC^{G,VAL}$	Aggregate incomes of the Government expressed in value	6.19, 37
$INC^{G,VAL}$ (2)	Government revenues	13.9, 65
$INC^{SOC,TAX,VAL}$	Income and social taxes expressed in value	5.3, 33
LF	Labor force	8.2, 42
M	Imports, expressed at basic price	2.108, 17
M_c	Imports of commodity c, expressed at basic price	2.92, 15
M_{ce}^{toe}	Imported energy ce, expressed in toe	9.23, 46
μ_c	Average mark-up on commodity c	3.6, 22
μ_s	Mark-up in the sector s	10.1, 47
μ_s^n	Notional mark-up of the sector s (specification 1)	3.2, 21
μ_s^{n2}	Notional mark-up of the sector s (specification 2)	3.3, 22
M_c^{bis}	Imports of commodity c, expressed at basic price (for verification)	2.94, 15
$MGP_{m,c}$	Margins paid to commodity m on commodity c	2.100, 16
$MGPD$	Margins paid on domestically produced commodities	2.102, 16
$MGPD_c$	Margins paid on the domestically produced commodity c	2.96, 16
$MGPD_{m,c}$	Margins paid to commodity m on the domestic commodity c	4.1, 29
$MGPM$	Margins paid on imported commodities	2.104, 17
$MGPM_c$	Margins paid on imported commodity c	2.98, 16
$MGPM_{m,c}$	Margins paid to commodity m on the imported commodity c	4.4, 30
MGS	Aggregate supplied margins	2.76, 13

MGS_m	Margins supplied by commodity m, expressed at market price	2.6, 4
MGS_m^{bis}	Margins supplied by commodity m, expressed at market price (for verification)	2.8, 4
$MGSD$	Aggregate margins supplied on domestically produced commodities, expressed at market price	2.46, 9
$MGSD_m$	Received margins on domestically produced commodity m	7.1, 39
$MGSM$	Aggregate margins supplied on imported commodities, expressed at market price	2.48, 10
$MGSM_m$	Margins supplied from imported commodity m	7.4, 39
MPS^n	Notional marginal propensity to save	5.7, 33
MS_c	Imports of commodity c, expressed at market price	3.33, 27
$MSBVAT_c$	Imports of commodity c expressed at market price before VAT	12.22, 59
NCH	Aggregate necessary households final consumption	5.11, 34
NCH_{ccon}	Necessary (minimum) households' final consumption for construction commodity *ccon*	13.11, 65
NOS	Aggregate net operating surplus	2.125, 19
NOS_s	Net operating surplus of sector s	2.115, 18
NOS_s^{VAL}	Net operating surplus of sector s expressed in value	2.114, 18
$NTAXC$	Aggregate net taxes on commodity c	6.12, 36
$NTAXC_c$	Net taxes on commodity c	6.6, 35
$NTAXC_c^{VAL}$	Net taxes on commodity c expressed in value	6.5, 35
$NTAXCD_c$	Net taxes on domestically produced commodity c	6.2, 35
$NTAXCD_c$ (2)	Net taxes on domestically produced commodity c	12.2, 56
$NTAXCD_c^{VAL}$	Net taxes on domestically produced commodity c expressed in value	6.1, 35
$NTAXCD_c^{VAL}$ (2)	Net taxes on domestically produced commodity c expressed in value	12.1, 56
$NTAXCM_c$	Net taxes on imported commodity c	6.4, 35

$NTAXCM_c$ (2)	Net taxes on imported commodity c	12.5, 57
$NTAXCM_c^{VAL}$	Net taxes on imported commodity c expressed in value	6.3, 35
$NTAXCM_c^{VAL}$ (2)	Net taxes on imported commodity c expressed in value	12.4, 57
$NTAXS$	Aggregate net taxes on the production of sectors	6.14, 36
$NTAXS_s$	Net taxes on the production of sector s	6.8, 36
$NTAXS^{VAL}$	Aggregate net taxes on the production of sectors expressed in value	6.13, 36
$NTAXS_s^{VAL}$	Net taxes on the production of sector s expressed in value	6.7, 36
$OTHCT$	Aggregate Other product Tax	12.52, 62
$OTHCTD$	Aggregate other product tax paid on domestically produced comodities	12.40, 61
$OTHCTD_c$	Other taxes on domestically produced commodity c	12.12, 58
$OTHCTM$	Aggregate Other product Tax on imported commododities	12.46, 62
$OTHCTM_c$	Other taxes on imported commodity c	12.14, 58
P	Consumer Price Index	3.9, 23
P^e	Expected inflation.	10.2, 47
$P^{ETS,nominal}$	Nominal price of emissions permits	13.1, 64
$PARTR$	Labor participation ratio	10.13, 48
$PARTR^n$	Labor force participation ratio	8.3, 42
$PARTR^{TREND}$	Participation rate to the labor force trend	15.39, 70
PCH	Aggregate market price for household final (consumer price index)	2.79, 13
PCH_c	Market price of households final consumption c	3.51, 29
PCH^{CES}	CES consumption price index	5.14, 34

$PCHD$	Aggregate market price for domestically produced households final consumption	2.53, 10
$PCHD_c$	Market price of domestically produced households final consumption c	3.40, 28
$PCHD_c$ (2)	Market price of domestically produced households final consumption c	12.27, 60
$PCHM$	Aggregate market price for imported households final consumption	2.55, 10
$PCHM_c$	Market price of imported households final consumption c	3.41, 28
$PCHM_c$ (2)	Market price of imported households final consumption c	12.28, 60
PCI	Aggregate market price for intermediate consumption	2.77, 13
$PCI_{c,s}$	Market price of intermediate consumption c purchased by sector s	3.50, 29
PCI_c	Market price of the intermediate consumption of commodity c	2.11, 5
PCI_s	Market price of intermediate consumption of sector s	2.29, 7
PCI^{bis}	Market price of intermediate consumption of sector s (for verification)	2.31, 8
$PCID$	Aggregate market price for domestically produced intermediate consumption	2.49, 10
$PCID_{c,s}$	Market price of domestically produced intermediate consumption c purchased by sector s	3.38, 27
$PCID_{c,s}$ (2)	Market price of domestically produced intermediate consumption c purchased by sector s	12.25, 60
$PCID_c$	Market price for the domestically produced commodity c used as intermediary consumption	2.17, 6
$PCID_s$	Market price of domestically produced intermediate consumption of sector s	2.25, 7

$PCIM$	Aggregate market price for imported intermediate consumption	2.51, 10
$PCIM_{c,s}$	Market price of imported intermediate consumption c purchased by sector s	3.39, 27
$PCIM_{c,s}$ (2)	Market price of imported intermediate consumption c purchased by sector s	12.26, 60
$PCIM_c$	Market price for imported commodity c used as intermediary consumption	2.19, 6
$PCIM_s$	Market price of imported intermediate consumption of sector s	2.27, 7
PDS	Aggregate market price for change in inventories	2.87, 14
PDS_c	Market price of the change in inventories of commodity c	2.15, 5
$PDSD$	Aggregate market price for domestically produced change in inventories	2.69, 12
$PDSD_c$	Market price of domestically produced change in inventories c	3.48, 28
$PDSD_c$ (2)	Market price of domestically produced change in inventories c	12.35, 60
$PDSM$	Aggregate market price for imported change in inventories	2.71, 12
$PDSM_c$	Market price of imported change in inventories c	3.49, 28
$PDSM_c$ (2)	Market price of imported change in inventories c	12.36, 60
$PE_{ce2,s}$	Price of $ce2$ energy consumption in sector s	13.7, 64
PE_s	Price of energy in sector s	3.21, 25
PG	Aggregate market price for Government final consumption	2.81, 13
PG_c	Market price of Government final consumption c	3.52, 29
PGD	Aggregate market price for domestically produced Government final consumption	2.57, 11
PGD_c	Market price of domestically produced Government final consumption c	3.42, 28

PGD_c (2)	Market price of domestically produced Government final consumption c	12.29, 60
$PGDP$	Price of GDP (expenditure definition)	2.126, 20
$PGDP_c$	Price of GDP of commodity c (expenditure definition)	2.128, 20
$PGDP4$	Price of GDP (income definition)	2.134, 21
$PGDP^{bis}$	Price of GDP (expenditure definition, for verification)	2.130, 20
$PGDP^{ter}$	Price of GDP (production definition)	2.132, 20
PGM	Aggregate market price for imported Government final consumption	2.59, 11
PGM_c	Market price of imported Government final consumption c	3.43, 28
PGM_c (2)	Market price of imported Government final consumption c	12.30, 60
$PGOS$	Price of the aggregate gross operating surplus	2.122, 19
$\varphi_{E,ce,s}$	Share of energy ce into the total energy use of sector s	4.15, 31
$\varphi_{f,s}$	Cost share of input f for sector s	4.10, 31
$\varphi_{f,s}$ (2)	Share of the production input f by sector s	15.12, 68
φ_c^{CH}	Share of commodity c into the total household consumption	5.13, 34
φ_c^{CHM}	Import share of commodity c for household final consumption	7.8, 39
$\varphi_{c,s}^{CIM}$	Import share of intermediary consumption from sector s in domestically produced commodity c	7.17, 40
φ_c^{GM}	Import share φ_c of commodity c on the government final consumption	7.9, 39
$\varphi_{c,s}^{IM}$	Import share of intermediary consumption from sector s in imported commodity c	7.18, 41

φ_c^{MCH}	Share of commodity c into the total marginal household consumption	5.12, 34
$\varphi_{m,c}^{MGPD}$	Share of margin type m into the total margins paid on domestic commodity c	4.3, 30
$\varphi_{m,c}^{MGPM}$	Share of margin type m into the total margins paid on imported commodity c	4.6, 30
φ_m^{MGSM}	Import share of commodity c on supplied margins	7.7, 39
$\varphi^{PROP^{INC,G}}$	Propriety income of the government expressed in value	15.27, 69
φ^{RD^G}	Share of debt reimbursed every year	15.28, 69
$\varphi_{ct,s}^{TRSP}$	Share for transport ct into the total transport use of sector s	4.20, 32
φ_c^{XM}	Import share of commodity c exports	7.23, 41
PI	Aggregate market price for investment	2.83, 13
PI_c	Market price of the investment in commodity c	2.13, 5
PI_s	Market price of investment of sector s	2.37, 8
PI^{bis}	Market price of investment of sector s (for verification)	2.39, 8
PID	Aggregate market price for domestically produced investment	2.61, 11
$PID_{c,s}$	Market price of domestically produced investment c purchased by sector s	3.44, 28
$PID_{c,s}$ (2)	Market price of domestically produced investment c purchased by sector s	12.31, 60
PID_c	Market price for domestically produced commodity c used as investment	2.21, 6
PID_s	Market price of domestically produced investment of sector s	2.33, 8
PIM	Aggregate market price for imported investment	2.63, 11
$PIM_{c,s}$	Market price of imported investment c purchased by sector s	3.45, 28

$PIM_{c,s}$ (2)	Market price of imported investment c purchased by sector s	12.32, 60
PIM_c	Market price for imported commodity c used as investment	2.23, 6
PIM_s	Market price of imported investment of sector s	2.35, 8
PK_s	Price of capital in sector s	3.19, 24
PM	Aggregate basic price of imports	2.107, 17
PM_c	Price of imported commodity c, expressed at basic price	3.29, 26
$PMAT_s$	Price of materials in sector s	3.23, 25
PM_c^{bis}	Basic price of imports of commodity c (for verification)	2.93, 15
$PMGP_{m,c}$	Price of the margins paid to commodity m on commodity c	2.99, 16
$PMGPD$	Aggregate price of the margins paid on domestically produced commodity	2.101, 16
$PMGPD_c$	Price of the margins paid on domestically produced commodity c	2.95, 16
$PMGPD_{m,c}$	Market price of the margins paid to commodity m on domestically produced commodity c	3.34, 27
$PMGPM$	Aggregate price of the margins paid on imported commodities	2.103, 17
$PMGPM_c$	Price of the margins paid on imported commodity c	2.97, 16
$PMGPM_{m,c}$	Market price of the margins paid to commodity m on imported commodity c	3.35, 27
$PMGS$	Aggregate market price for supplied margins	2.75, 13
$PMGS_m$	Market price of the margins supplied by commodity m	2.5, 4
$PMGS_m^{bis}$	Market price of the margins supplied by commodity m (for verification)	2.7, 4

$PMGSD$	Aggregate market price for the margins supplied on domestically produced commodities	2.45, 9
$PMGSD_c$	Market price of margins supplied by domestically produced commodity c	3.36, 27
$PMGSD_c$ (2)	Market price of margins supplied by domestically produced commodity c	12.23, 59
$PMGSM$	Aggregate market price for the margins supplied on imported commodities	2.47, 9
$PMGSM_c$	Market price of margins supplied by imported commodity c	3.37, 27
$PMGSM_c$ (2)	Market price of margins supplied by imported commodity c	12.24, 59
PMS_c	Price of imported commodity c, expressed at market price	3.32, 27
$PMSBVAT_c$	Selling price before VAT for imported commodity c	12.21, 59
$PNCH$	Price of aggregate necessary households consumption	5.10, 34
$PNCH_c$	Price of necessary households consumption c	5.9, 34
$PNOS$	Price of the aggregate net operating surplus	2.124, 19
$PNTAXC$	Aggregate net taxes on commodity c expressed in value	6.11, 36
POP	Total population	15.37, 70
$POTHCT$	Aggregate market price for other product Tax	12.51, 62
$POTHCTD$	Aggregate market price for other product tax paid on domestically produced comodities	12.39, 61
$POTHCTD_c$	Price of other taxes on domestically produced commodity c	12.11, 58
$POTHCTM$	Aggregate market price for Other product Tax on imported commododities	12.45, 62
$POTHCTM_c$	Price other taxes on imported commodity c	12.13, 58
PQ	Aggregate market price for production	2.73, 13

PQ_c	Market price of the production of commodity c	2.9, 5
PQD	Aggregate market price for domestically produced commodities	2.41, 9
PQD_c	Market price for the domestically produced commodity c	2.1, 3
PQM	Aggregate market price for imported commodities	2.43, 9
PQM_c	Market price for imported commodity c	2.3, 3
$PROG_{f,s}$	Technical progress of the production factor f in sector s	4.21, 32
$prog_s^L$	Labor productivity in the sector s	15.23, 69
$PROP^{INC,G,VAL}$	Government property incomes in value	10.17, 49
$PROP^{INC,G,VAL,e}$	Expected Government property incomes in value	10.18, 49
$PROP^{INC,G,VAL,n}$	Notional property incomes of the Government expressed in value	6.18, 37
$PROP^{INC,H,VAL}$	Households property income in value	10.15, 48
$PROP^{INC,H,VAL,e}$	Expected Households property income in value	10.16, 49
$PROP^{INC,H,VAL,n}$	Property incomes expressed in value	5.4, 33
$PRSC$	Price of the aggregate employers' social security contribution paid by sector s	6.15, 36
$PRSC_s$	Price of the employers' social security contribution paid by sector s	6.10, 36
$PSUBC$	Aggregate market price for subsidies on commodities	12.53, 62
$PSUBCD$	Aggregate market price for subsidies on domestically produced commodities	12.41, 61
$PSUBCD_c$		12.15, 58
$PSUBCM$	Aggregate market price for subsidies on imported commododities	12.47, 62
$PSUBCM_c$	Price of subsidies on imported commodity c	12.17, 58
PVA	Value-added price	2.118, 18

$PVAT$	Aggregate market price for Value-added Tax on total households final consumption	12.49, 62
$PVATD$	Aggregate market price for value-added tax paid on domestically produced comodities	12.37, 61
$PVATD_c$	Price of value-added tax on domestically produced commodity c	12.7, 57
$PVATM$	Aggregate market price for value-added tax paid on imported comodities	12.43, 61
$PVATM_c$	Price of value-added tax on imported commodity c	12.9, 58
$PWAGES$	Gross wage index paid by sectors	2.120, 19
$Pwages$	Nominal price index	15.16, 68
$PWAGES_s$	Price index for gross wages in sector s	3.11, 23
PX	Aggregate market price for exports	2.85, 14
PX_c	Market price of exports c	3.53, 29
PXD	Aggregate market price for domestically produced exports	2.65, 11
PXD_c	Market price of domestically produced exports c	3.46, 28
PXD_c (2)	Market price of domestically produced exports c	12.33, 60
PXM	Aggregate market price for imported exports (re-exports)	2.67, 12
PXM_c	Market price of imported exports (re-exports) c	3.47, 28
PXM_c (2)	Market price of imported exports (re-exports) c	12.34, 60
PY	Basic price of aggregate production	2.116, 18
PY_s	Production price of sector s	10.10, 48
PY_s^e	Expected production price of sector s	10.11, 48
PY_s^n	Notional production price of sector s	3.1, 21
PY_s^n (2)	Nominal production prices of covered sectors	13.8, 65
PYQ	Aggregate basic price of domestic production	2.105, 17
PYQ_c	Price of domestically produced commodity c, expressed at basic price	3.28, 26

PYQ_c^{bis}	Basic price of the production of commodity c (for verification)	2.90, 15
$PYQS_c$	Price of domestically produced commodity c, expressed at market price	3.30, 26
$PYQSBVAT_c$	Selling price before VAT for domestically produced commodity c	12.19, 59
Q	Aggregate production, expressed at market price	2.74, 13
Q_c	Production of commodity c, expressed at market price	2.10, 5
$Q_{ce2,s}^{ETS}$	Quantity of emissions permits required for sector s relative to its $ce2$ energy consumption	13.3, 64
$Q_s^{ETS,free}$	Quantity of freely allocated permits to sector s	13.2, 64
QD	Aggregate domestically produced commodities, expressed at market price	2.42, 9
QD_c	Quantity of domestically produced commodity c expressed at market price	2.2, 3
QM	Aggregate imported commodities, expressed at market price	2.44, 9
QM_c	Quantity of imported commodity c expressed at market price	2.4, 3
R	Interest rate	10.14, 48
R_s	Interest rate paid on capital by sector s	3.13, 23
$r^{DEBT,G}$	Interest rate paid by the Government on its debt	3.14, 23
R^n	Notional key interest rate of the Central Bank (Taylor rule)	3.12, 23
$R2_{ghg,c}^{CH}$	Carbon tax rate on the greenhouse gas ghg associated to the household final consumption of the sector s	15.87, 75
$R2_{ghg,c,s}^{CI}$	Carbon tax rate on the greenhouse gas ghg associated to the intermediary consumption of commodity c by the sector s	15.84, 75

$R2^{MAT}_{ghg,s}$	Carbon tax rate on the greenhouse gas ghg associated to the material consumption of the sector s	15.85, 75
$R2^{Y}_{ghg,s}$	Carbon tax rate on the greenhouse gas ghg associated to the final production of the sector s	15.86, 75
$RBal^{G,Prim,VAL}$	Primary balance of the Government expressed in value (in percent of GDP)	6.28, 38
$RBal^{G,Tot,VAL}$	Total balance of the Government expressed in value (in percent of GDP)	6.29, 38
$RBal^{Trae,VAL}$	Balance of trade (in percent of GDP)	7.29, 42
$RDEBT^{G,VAL}$	Ratio of the Government's debt expressed in value (in percent of GDP)	6.30, 38
$\rho^{MPS,R}$	Elasticity of the marginal propensity to share to the growth rate of the interest rate	15.17, 68
$\rho^{MPS,UnR}$	Elasticity of the marginal propensity to share to the growth rate of unemployment	15.18, 68
$\rho^{PATR,UnR}$	Elasticity of unemployed population with the labor force participation	15.38, 70
$\rho^{Rn,Cons}$	Constant of the notional interest rate equation (Taylor rule).	15.9, 67
$\rho^{Rn,P}$	Elasticity of the notional interest rate to inflation	15.10, 67
$\rho^{Rn,UnR}$	Elasticity of the notional interest rate to the unemployment rate	15.11, 68
$\rho^{W,DU}_{s}$	Elasticity of the notional wage inflation to the variation of the unemployment rate for sector s	15.7, 67
$\rho^{W,L}_{s}$	Elasticity of the notional wage inflation to the growth rate of share of labor in sector s	15.8, 67
$\rho^{W,P}_{s}$	Elasticity of the notional wage inflation to prices inflation for sector s	15.2, 67
$\rho^{W,Pe}_{s}$	Elasticity of the notional wage inflation to expected price inflation for sector s	15.3, 67
$\rho^{W,PROG}_{s}$	Elasticity of the notional wage inflation to labor productivity growth for sector s	15.4, 67

$\rho_s^{W,U}$	Elasticity of the notional wage inflation to the unemployment rate for sector s	15.5, 67
$\rho_s^{W,X}$	Constant in the wage equation for sector s	15.1, 67
$RINC^{SOC,TAX}$	Rate of social taxes to the disposable income	15.19, 68
$riskprem$	Risk premium	15.15, 68
$RNTAXCD_c$	Average tax rate on domestically produced commodity c	12.3, 57
$RNTAXCM_c$	Average tax rate on imported commodity c	12.6, 57
$RNTAXS_s$	tax rate on the production of sector s	15.24, 69
$ROTHCT$	Average rate of other taxes on commodity	12.62, 63
$ROTHCTD$	Average rate of other taxes on domestically produced commodity	12.56, 63
$ROTHCTM$	Average rate of other taxes on imported commodity	12.59, 63
RR^{POP}	Population growth rate	15.20, 68
RR^{Un}	unemployment growth rate	15.21, 68
$RRSC$	Average employers' social security contribution rate	6.17, 36
$RRSC_s$	Employers' social security contribution rate of the sector s	15.25, 69
$RSAV^{G,VAL}$	Government's savings rate expressed in value (in percent of GDP)	6.27, 38
$RSAV^{H,VAL}$	Households savings rate	5.16, 35
RSC	Aggregate employers' social security contribution paid by sectors	6.16, 36
RSC_s	Employers' social security contribution paid by sector s	6.9, 36
RSC_s (2)	Employers' social security contribution paid by sector s	13.10, 65
$RSUBC$	Average rate of subsidies on commodity	12.63, 63

$RSUBCD$	Average rate of subsidies on domestically produced commodity	12.57, 63
$RSUBCM$	Average rate of subsidies on imported commodity	12.60, 63
$RVAT$	Average VAT rate	12.61, 63
$RVATD$	Average VAT rate on domestically produced commodity	12.55, 63
$RVATM$	Average VAT rate on imported commodity	12.58, 63
$SAV^{G,VAL}$	Savings of the Government expressed in value	6.22, 37
$SAV^{H,VAL}$	Households savings expressed in value	5.15, 34
$share_s^{ETS}$	Percentage of emissions covered by an ETS scheme for the sector s	15.88, 75
$share_s^{free}$	Percentage of freely allocated permits to sector s	15.89, 75
$SOC^{BENF,VAL}$	Social benefits expressed in value	5.5, 33
$SPEND^{G,VAL}$	Aggregate spending of the Government expressed in value	6.21, 37
$Stock^{SAV,H,VAL}$	Households savings stock	5.17, 35
$SUBC$	Aggregate subsidies on commodities	12.54, 62
$SUBCD$	Aggregate subsidies on domestically produced commodities	12.42, 61
$SUBCD_c$	Subsidies on domestically produced commodity c	12.16, 58
$SUBCM$	Aggregate subsidies on imported commodities	12.48, 62
$SUBCM_c$	Subsidies on imported commodity c	12.18, 58
$SUBST_c^{CHM}$	Substitution effect on the imported households final consumption for the commodity c	10.25, 50
$SUBST_c^{CHM,n}$	Notional substitution effect induced by a change in the relative price between imported and domestically produced commodity c for households final consumption	7.11, 40
$SUBST_{ce,s}^{CI}$	Substitution effect on the energy intermediate consumption ce in the sector s	10.22, 50

$SUBST_{ct,s}^{CI}$	Substitution effect on the transportation intermediate consumption ce in the sector s	10.23, 50
$SUBST_{ce,s}^{CI,n}$	Notional substitution between energy commodity ce and the other energy commodities cee in the sector s	4.14, 31
$SUBST_{ct,s}^{CI,n}$	Notional substitution between the transport ct and the other transports mt in the sector s	4.19, 32
$SUBST_{c,s}^{CIM}$	Substitution effect on the intermediate consumption for the imported commodity c in the sector s	10.28, 50
$SUBST_{c,s}^{CIM,n}$	Notional substitution effect induced by a change in the relative price between imported and domestic intermediary consumption in commodity c from the sector s	7.19, 41
$SUBST_{f,s}^{F}$	Substitution effect of the production factor f in the sector s	10.19, 49
$SUBST_{f,s}^{F,n}$	Notional substitution between input f and the other inputs ff	4.9, 30
$SUBST_{c}^{GM}$	Substitution effect on the imported government final consumption for the commodity c	10.26, 50
$SUBST_{c}^{GM,n}$	Notional substitution effect induced by a change in the relative price between imported and domestically produced commodity c for government final consumption	7.12, 40
$SUBST_{c,s}^{IM}$	Substitution effect on the investment for the imported commodity c in the sector s	10.29, 50
$SUBST_{c,s}^{IM,n}$	Notional substitution effect induced by a change in the relative price between imported and domestic investment in commodity c from the sector s	7.20, 41
$SUBST_{m,c}^{MGPD}$	Substitution effect of the domestic margin paid m for the commodity c	10.20, 49
$SUBST_{m,c}^{MGPD,n}$	Notional substitution between margin m and the other margin types mm paid on domestic commodity c	4.2, 29

$SUBST_{m,c}^{MGPM}$	Substitution effect on the imported margin paid m for the commodity c	10.21, 49
$SUBST_{m,c}^{MGPM,n}$	Notional substitution between margin m and the other margin types mm paid on imported commodity c	4.5, 30
$SUBST_{m}^{MGSM}$	Substitution effect on the imported margin supplied for the commodity m	10.24, 50
$SUBST_{c}^{MGSM,n}$	Notional substitution effect induced by a change in the relative price between imported and domestically produced commodity c for margins supplied	7.10, 40
$SUBST_{c}^{X}$	Substitution effect on the exports of the commodity c	10.30, 50
$SUBST_{c}^{X,n}$	Notional substitution effect induced by a change in the relative price between export prices and (converted in domestic currency) international prices for the commodity c	7.26, 42
$SUBST_{c}^{XM}$	Substitution effect on the exports for the imported commodity c	10.27, 50
$SUBST_{c}^{XM,n}$	Notional substitution effect induced by a change in the relative price between imported and domestic products c for exports	7.24, 41
$T2_{c}^{CH}$	Carbon tax in volume on households' consumption depending on commodity c	11.36, 55
$T2_{ghg,c}^{CH}$	Carbon tax in volume on households' consumption depending on ghg emission types and commodity c	11.33, 55
$T2_{ghg,c,s}^{CI}$	Carbon tax in volume on intermediary consumption emissions depending on ghg emission types, commodity c in sector s	11.2, 51
$T2_{c}^{CID}$	Carbon tax in volume on intermediary consumption emissions depending on domestic commodity c	11.13, 52

$T2^{CID}_{ghg,c}$	Carbon tax in volume on intermediary consumption emissions depending on ghg emission types and domestic commodity c	11.5, 51
$T2^{CIM}_{c}$	Carbon tax in volume on intermediary consumption emissions depending on imported commodity c	11.15, 53
$T2^{CIM}_{ghg,c}$	Carbon tax in volume on intermediary consumption emissions depending on ghg emission types and imported commodity c	11.7, 52
$T2^{MAT}_{ghg,s}$	Carbon tax in volume on material emissions depending on ghg emission types, commodity c in sector s	11.19, 53
$T2^{MAT}_{ghg}$	Carbon tax in volume on material emissions depending on ghg emission types	11.21, 53
$T2^{MAT}_{s}$	Carbon tax in volume on material emissions depending on commodity c	11.23, 54
$T2^{Y}_{ghg,s}$	Carbon tax in volume on production emissions depending on ghg emission types, commodity c in sector s	11.26, 54
$T2^{Y}_{ghg}$	Carbon tax in volume on production emissions depending on ghg emission types	11.28, 54
$T2^{Y}_{s}$	Carbon tax in volume on production emissions depending on sector s	11.30, 55
$T2VAL^{CH}$	Carbon tax in value on households' consumption depending on ghg emission types and commodity c	11.37, 55
$T2VAL^{CH}_{c}$	Carbon tax in value on households' consumption depending on commodity c	11.35, 55
$T2VAL^{CH}_{ghg,c}$	Carbon tax in value on households' consumption depending on ghg emission types and commodity c	11.32, 55
$T2VAL^{CH}_{ghg}$	Carbon tax in value on households' consumption depending on ghg emission types	11.34, 55
$T2VAL^{CI}$	Carbon tax in value on intermediary consumption emissions	11.17, 53

$T2VAL^{CI}_{c,s}$	Carbon tax in value on intermediary consumption emissions depending on commodity c and sector s	11.9, 52
$T2VAL^{CI}_{c}$	Carbon tax in value on intermediary consumption emissions depending on commodity c	11.11, 52
$T2VAL^{CI}_{ghg,c,s}$	Carbon tax in value on intermediary consumption emissions depending on ghg emission types, commodity c in sector s	11.1, 51
$T2VAL^{CI}_{ghg,c}$	Carbon tax in value on intermediary consumption emissions depending on ghg emission types and commodity c	11.3, 51
$T2VAL^{CI}_{ghg,s}$	Carbon tax in value on intermediary consumption emissions depending on ghg emission types and sector s	11.8, 52
$T2VAL^{CI}_{ghg}$	Carbon tax in value on intermediary consumption emissions depending on ghg emission types	11.10, 52
$T2VAL^{CI}_{s}$	Carbon tax in value on intermediary consumption emissions depending on sector s	11.16, 53
$T2VAL^{CID}_{c}$	Carbon tax in value on intermediary consumption emissions depending on domestic commodity c	11.12, 52
$T2VAL^{CID}_{ghg,c}$	Carbon tax in value on intermediary consumption emissions depending on ghg emission types and domestic commodity c	11.4, 51
$T2VAL^{CIM}_{c}$	Carbon tax in value on intermediary consumption emissions depending on imported commodity c	11.14, 53
$T2VAL^{CIM}_{ghg,c}$	Carbon tax in value on intermediary consumption emissions depending on ghg emission types and imported commodity c	11.6, 51
$T2VAL^{MAT}$	Carbon tax in value on material emissions	11.24, 54
$T2VAL^{MAT}_{ghg,s}$	Carbon tax in value on material emissions depending on ghg emission types, commodity c in sector s	11.18, 53
$T2VAL^{MAT}_{ghg}$	Carbon tax in value on material emissions depending on ghg emission types	11.20, 53

$T2VAL_s^{MAT}$	Carbon tax in value on material emissions depending on commodity c	11.22, 54
$T2VAL^Y$	Carbon tax in value on production emissions	11.31, 55
$T2VAL^Y_{ghg,s}$	Carbon tax in value on production emissions depending on ghg emission types, commodity c in sector s	11.25, 54
$T2VAL^Y_{ghg}$	Carbon tax in value on production emissions depending on ghg emission types	11.27, 54
$T2VAL^Y_s$	Carbon tax in value on production emissions depending on sector s	11.29, 54
$TRSF^{HH,VAL}$	Transfers to households	15.22, 68
$TRSP_s$	Transport demand of sector s	4.17, 32
Un	Unemployment	8.5, 43
UnR	Unemployment rate	8.6, 43
VA	Aggregate value-added	2.119, 19
VA_s	Value-added of sector s	2.111, 18
VA_s^{VAL}	Value-added of sector s expressed in value	2.110, 17
VAT	Aggregate Value-added Tax on total households final consumption	12.50, 62
$VATD$	Aggregate value-added tax paid on domestically produced comodities	12.38, 61
$VATD_c$	Value-added tax on domestically produced commodity c	12.8, 57
$VATM$	Aggregate value-added tax paid on imported comodities	12.44, 61
$VATM_c$	Value-added tax on imported commodity c	12.10, 58
W	Average wage	3.8, 23
W_s	Wages of the sector s	10.12, 48
W_s^n	Notional wage in sector s	3.7, 22
$WAGES$	Aggregate gross wages paid by sectors	2.121, 19

$WAGES_s$	Gross wages paid by sector s including employees (but not employers)' social contribution	3.10, 23
$WAPop$	Working-age population	8.1, 42
X	Aggregate exports, expressed at market price	2.86, 14
X_c	Foreign demand for exports of commodity c	7.25, 41
X_{ce}^{toe}	External demand for energy ce, expressed in toe	9.21, 46
XD	Aggregate domestically produced exports, expressed at market price	2.66, 12
XD_c	Exports of domestically produced commodity c	7.21, 41
XM	Aggregate imported exports (re-exports), expressed at market price	2.68, 12
XM_c	Exports of imported commodity c	7.22, 41
Y	Aggregate production, expressed at basic price	2.117, 18
$Y_{c,s}$	Production of commodity c by sector s	4.7, 30
Y_s	Production of sector s, expressed at basic price	2.109, 17
Y_s^e	Expected production	10.3, 47
$Y_{ce,s}^{toe}$	Final production of energy of ce by sector s, expressed in toe	9.22, 46
Y_{ce}^{toe}	Final production of energy of ce by sectors, expressed in toe	9.25, 46
$YCAP_s$	Production capacity of the sector s	3.4, 22
YQ	Domestic production, expressed at basic price	2.106, 17
YQ_c	Production of commodity c, expressed at basic price	2.89, 15
YQ_c^{bis}	Production of commodity c, expressed at basic price (for verification)	2.91, 15
YQS_c	Production of commodity c, expressed at market price	3.31, 26
$YQSBVAT_c$	Production of commodity c expressed at market price before VAT	12.20, 59