

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 approximatively 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.

$$\text{Production factors } f \quad f \in \{K, L, E, M\} \quad (1.1)$$

$$\text{Greenhouse Gases } ghg \quad ghg \in \{CO_2, CH_4, N_2O, SF_6, HFC, PFC\} \quad (1.2)$$

$$\text{Car energy labels } ecl \quad ecl \in \{CA, CB, CC, CD, CE, CF, CG\} \quad (1.3)$$

$$\text{Building energy labels } bcl \quad bcl \in \{CA, CB, CC, CD, CE, CF, CG, DES\} \quad (1.4)$$

$$\text{Sectors (or activities) } s \quad s \in S \quad (1.5)$$

$$\text{Commodities } c, cc \quad c, cc \in C \quad (1.6)$$

$$\text{Margins } m, mm \quad m, mm \in CMARG \subset C \quad (1.7)$$

$$\text{Commodities used as material input } cm \quad cm \in CMAT \subset C \quad (1.8)$$

$$\text{commodities used as transportation input } ct \quad ct \in CTRSP \subset C \quad (1.9)$$

$$\text{commodities used as energy input } ce \quad ce \in CE \subset C \quad (1.10)$$

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 exemple 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

$$PQD_c QD_c = PMGSD_c MGSD_c + PCID_c CID_c + PCHD_c CHD_c + PGD_c GD_c + PID_c ID_c + PXD_c XD_c + PDSD_c DSD_c \quad (2.1)$$

Quantity of domestically produced commodity c expressed at market price

$$QD_c = MGSD_c + CID_c + CHD_c + GD_c + ID_c + XD_c + DSD_c \quad (2.2)$$

Market price for imported commodity c

$$PQM_c QM_c = PMGSM_c MGSM_c + PCIM_c CIM_c + PCHM_c CHM_c + PGM_c GM_c + PIM_c IM_c + PXM_c XM_c + PDSM_c DSM_c \quad (2.3)$$

Quantity of imported commodity c expressed at market price

$$QM_c = MGSM_c + CIM_c + CHM_c + GM_c + IM_c + XM_c + DSM_c \quad (2.4)$$

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 proportionnally 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 disagrated 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

$$PMGS_m MGS_m = \sum_c PMGP_{m,c} MGP_{m,c} \quad (2.5)$$

Margins supplied by commodity m , expressed at market price

$$MGS_m = \sum_c MGP_{m,c} \quad (2.6)$$

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)

$$PMGS_m^{bis} MGS_m^{bis} = PMGSD_m MGSD_m + PMGSM_m MGSM_m \quad (2.7)$$

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

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

$$MGS_m^{bis} = MGSD_m + MGSM_m \quad (2.8)$$

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

$$PQ_c Q_c = PQD_c QD_c + PQM_c QM_c \quad (2.9)$$

Production of commodity c , expressed at market price

$$Q_c = QD_c + QM_c \quad (2.10)$$

Market price of the intermediate consumption of commodity c

$$PCI_c CI_c = PCID_c CID_c + PCIM_c CIM_c \quad (2.11)$$

Intermediate consumption of commodity c , expressed at market price

$$CI_c = CID_c + CIM_c \quad (2.12)$$

Market price of the investment in commodity c

$$PI_c I_c = PID_c ID_c + PIM_c IM_c \quad (2.13)$$

Investment in commodity c , expressed at market price

$$I_c = ID_c + IM_c \quad (2.14)$$

Market price of the change in inventories of commodity c

$$PDS_c DS_c = PDSD_c DSD_c + PDSM_c DSM_c \quad (2.15)$$

Change in inventories of commodity c , expressed at market price

$$DS_c = DSD_c + DSM_c \quad (2.16)$$

2.1.4 Agregation 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 sectoral data on the sector index.

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

$$PCID_c CID_c = \sum_s PCID_{c,s} CID_{c,s} \quad (2.17)$$

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

$$CID_c = \sum_s CID_{c,s} \quad (2.18)$$

Market price for imported commodity c used as intermediary consumption

$$PCIM_c CIM_c = \sum_s PCIM_{c,s} CIM_{c,s} \quad (2.19)$$

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

$$CIM_c = \sum_s CIM_{c,s} \quad (2.20)$$

Market price for domestically produced commodity c used as investment

$$PID_c ID_c = \sum_s PID_{c,s} ID_{c,s} \quad (2.21)$$

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

$$ID_c = \sum_s ID_{c,s} \quad (2.22)$$

Market price for imported commodity c used as investment

$$PIM_c IM_c = \sum_s PIM_{c,s} IM_{c,s} \quad (2.23)$$

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

$$IM_c = \sum_s IM_{c,s} \quad (2.24)$$

2.1.5 Agregation 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 sectoral data on the commodity index.

Market price of domestically produced intermediate consumption of sector s

$$PCID_s CID_s = \sum_c PCID_{c,s} CID_{c,s} \quad (2.25)$$

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

$$CID_s = \sum_c CID_{c,s} \quad (2.26)$$

Market price of imported intermediate consumption of sector s

$$PCIM_s CIM_s = \sum_c PCIM_{c,s} CIM_{c,s} \quad (2.27)$$

Imported intermediate consumption of sector s , expressed at market price

$$CIM_s = \sum_c CIM_{c,s} \quad (2.28)$$

Market price of intermediate consumption of sector s

$$PCI_s CI_s = PCID_s CID_s + PCIM_s CIM_s \quad (2.29)$$

Intermediate consumption of sector s , expressed at market price

$$CI_s = CID_s + CIM_s \quad (2.30)$$

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

$$PCI^{bis}.CI^{bis} = \sum_s PCI_s CI_s \quad (2.31)$$

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

$$CI^{bis} = \sum_s CI_s \quad (2.32)$$

Market price of domestically produced investment of sector s

$$PID_s ID_s = \sum_c PID_{c,s} ID_{c,s} \quad (2.33)$$

Domestically produced investment of sector s , expressed at market price

$$ID_s = \sum_c ID_{c,s} \quad (2.34)$$

Market price of imported investment of sector s

$$PIM_s IM_s = \sum_c PIM_{c,s} IM_{c,s} \quad (2.35)$$

Imported investment of sector s , expressed at market price

$$IM_s = \sum_c IM_{c,s} \quad (2.36)$$

Market price of investment of sector s

$$PI_s I_s = PID_s ID_s + PIM_s IM_s \quad (2.37)$$

Investment of sector s , expressed at market price

$$I_s = ID_s + IM_s \quad (2.38)$$

Market price of investment of sector s (for verification)

$$PI^{bis}.I^{bis} = \sum_s PI_s I_s \quad (2.39)$$

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

$$I^{bis} = \sum_s I_s \quad (2.40)$$

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

$$PQD.QD = \sum_c PQD_c QD_c \quad (2.41)$$

Aggregate domestically produced commodities, expressed at market price

$$QD = \sum_c QD_c \quad (2.42)$$

Aggregate market price for imported commodities

$$PQM.QM = \sum_c PQM_c QM_c \quad (2.43)$$

Aggregate imported commodities, expressed at market price

$$QM = \sum_c QM_c \quad (2.44)$$

Aggregate market price for the margins supplied on domestically produced commodities

$$PMGSD.MGSD = \sum_c PMGSD_c MGSD_c \quad (2.45)$$

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

$$MGSD = \sum_c MGSD_c \quad (2.46)$$

Aggregate market price for the margins supplied on imported commodities

$$PMGSM.MGSM = \sum_c PMGSM_c MGSM_c \quad (2.47)$$

Aggregate margins supplied on imported commodities, expressed at market price

$$MGSM = \sum_c MGSM_c \quad (2.48)$$

Aggregate market price for domestically produced intermediate consumption

$$PCID.CID = \sum_c PCID_c CID_c \quad (2.49)$$

Aggregate domestically produced intermediate consumption, expressed at market price

$$CID = \sum_c CID_c \quad (2.50)$$

Aggregate market price for imported intermediate consumption

$$PCIM.CIM = \sum_c PCIM_c CIM_c \quad (2.51)$$

Aggregate imported intermediate consumption, expressed at market price

$$CIM = \sum_c CIM_c \quad (2.52)$$

Aggregate market price for domestically produced households final consumption

$$PCHD.CHD = \sum_c PCHD_c CHD_c \quad (2.53)$$

Aggregate domestically produced final consumption, expressed at market price

$$CHD = \sum_c CHD_c \quad (2.54)$$

Aggregate market price for imported households final consumption

$$PCHM.CHM = \sum_c PCHM_c CHM_c \quad (2.55)$$

Aggregate imported households final consumption, expressed at market price

$$CHM = \sum_c CHM_c \quad (2.56)$$

Aggregate market price for domestically produced Government final consumption

$$PGD.GD = \sum_c PGD_c GD_c \quad (2.57)$$

Aggregate domestically produced Government final consumption, expressed at market price

$$GD = \sum_c GD_c \quad (2.58)$$

Aggregate market price for imported Government final consumption

$$PGM.GM = \sum_c PGM_c GM_c \quad (2.59)$$

Aggregate imported Government final consumption, expressed at market price

$$GM = \sum_c GM_c \quad (2.60)$$

Aggregate market price for domestically produced investment

$$PID.ID = \sum_c PID_c ID_c \quad (2.61)$$

Aggregate domestically produced investment, expressed at market price

$$ID = \sum_c ID_c \quad (2.62)$$

Aggregate market price for imported investment

$$PIM.IM = \sum_c PIM_c IM_c \quad (2.63)$$

Aggregate imported investment, expressed at market price

$$IM = \sum_c IM_c \quad (2.64)$$

Aggregate market price for domestically produced exports

$$PXD.XD = \sum_c PXD_c XD_c \quad (2.65)$$

Aggregate domestically produced exports, expressed at market price

$$XD = \sum_c XD_c \quad (2.66)$$

Aggregate market price for imported exports (re-exports)

$$PXM.XM = \sum_c PXM_c XM_c \quad (2.67)$$

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

$$XM = \sum_c XM_c \quad (2.68)$$

Aggregate market price for domestically produced change in inventories

$$PDSD.DSD = \sum_c PDSD_c DSD_c \quad (2.69)$$

Aggregate domestically produced change in inventories, expressed at market price

$$DSD = \sum_c DSD_c \quad (2.70)$$

Aggregate market price for imported change in inventories

$$PDSM.DSM = \sum_c PSDM_c DSM_c \quad (2.71)$$

Aggregate imported change in inventories, expressed at market price

$$DSM = \sum_c DSM_c \quad (2.72)$$

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

$$PQ.Q = PQD.QD + PQM.QM \quad (2.73)$$

Aggregate production, expressed at market price

$$Q = QD + QM \quad (2.74)$$

Aggregate market price for supplied margins

$$PMGS.MGS = PMGSD.MGSD + PMGSM.MGSM \quad (2.75)$$

Aggregate supplied margins

$$MGS = MGSD + MGSM \quad (2.76)$$

Aggregate market price for intermediate consumption

$$PCI.CI = PCID.CID + PCIM.CIM \quad (2.77)$$

Aggregate intermediate consumption, expressed at market price

$$CI = CID + CIM \quad (2.78)$$

Aggregate market price for household final (consumer price index)

$$PCH.CH = PCHD.CHD + PCHM.CHM \quad (2.79)$$

Aggregate household final consumption, expressed at market price

$$CH = CHD + CHM \quad (2.80)$$

Aggregate market price for Government final consumption

$$PG.G = PGD.GD + PGM.GM \quad (2.81)$$

Aggregate Government final consumption, expressed at market price

$$G = GD + GM \quad (2.82)$$

Aggregate market price for investment

$$PI.I = PID.ID + PIM.IM \quad (2.83)$$

Aggregate investment, expressed at market price

$$I = ID + IM \quad (2.84)$$

Aggregate market price for exports

$$PX.X = PXD.XD + PXM.XM \quad (2.85)$$

Aggregate exports, expressed at market price

$$X = XD + XM \quad (2.86)$$

Aggregate market price for change in inventories

$$PDS.DS = PDSD.DSD + PDSM.DSM \quad (2.87)$$

Aggregate change in inventories, expressed at market price

$$DS = DSD + DSM \quad (2.88)$$

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 consistancy, 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 consistancy, 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

$$PMGPD_c MGPD_c = \sum_m PMGPD_{m,c} MGPD_{m,c} \quad (2.95)$$

Margins paid on the domestically produced commodity c

$$MGPD_c = \sum_m MGPD_{m,c} \quad (2.96)$$

Price of the margins paid on imported commodity c

$$PMGPM_c MGPM_c = \sum_m PMGPM_{m,c} MGPM_{m,c} \quad (2.97)$$

Margins paid on imported commodity c

$$MGPM_c = \sum_m MGPM_{m,c} \quad (2.98)$$

Price of the margins paid to commodity m on commodity c

$$PMGP_{m,c} MGP_{m,c} = PMGPD_{m,c} MGPD_{m,c} + PMGPM_{m,c} MGPM_{m,c} \quad (2.99)$$

Margins paid to commodity m on commodity c

$$MGP_{m,c} = MGPD_{m,c} + MGPM_{m,c} \quad (2.100)$$

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

Aggregate price of the margins paid on domestically produced commodity

$$PMGPD.MGPD = \sum_c PMGPD_c MGPD_c \quad (2.101)$$

Margins paid on domestically produced commodities

$$MGPD = \sum_c MGPD_c \quad (2.102)$$

Aggregate price of the margins paid on imported commodities

$$PMGPM.MGPM = \sum_c PMGPM_c MGPM_c \quad (2.103)$$

Margins paid on imported commodities

$$MGPM = \sum_c MGPM_c \quad (2.104)$$

Aggregate basic price of domestic production

$$PYQ.YQ = \sum_c PYQ_c YQ_c \quad (2.105)$$

Domestic production, expressed at basic price

$$YQ = \sum_c YQ_c \quad (2.106)$$

Aggregate basic price of imports

$$PM.M = \sum_c PM_c M_c \quad (2.107)$$

Imports, expressed at basic price

$$M = \sum_c M_c \quad (2.108)$$

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

Production of sector s , expressed at basic price

$$Y_s = \sum_c Y_{c,s} \quad (2.109)$$

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

Value-added of sector s expressed in value

$$VA_s^{VAL} = PY_s Y_s - PCI_s CI_s \quad (2.110)$$

Value-added of sector s

$$VA_s = Y_s - CI_s \quad (2.111)$$

Gross operating surplus of sector s expressed in value

$$GOS_s^{VAL} = VA_s^{VAL} - PWAGES_s WAGES_s - PRSC_s RSC_s - NTAXS_s^{VAL} \quad (2.112)$$

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

$$GOS_s = VA_s - WAGES_s - RSC_s - NTAXS_s \quad (2.113)$$

Net operating surplus of sector s expressed in value

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

Net operating surplus of sector s

$$NOS_s = GOS_s - PK_{s,t-1} \delta_s F_{K,s,t-1} \quad (2.115)$$

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

Basic price of aggregate production

$$PY.Y = \sum_s PY_s Y_s \quad (2.116)$$

Aggregate production, expressed at basic price

$$Y = \sum_s Y_s \quad (2.117)$$

Value-added price

$$PVA.VA = \sum_s VA_s^{VAL} \quad (2.118)$$

Aggregate value-added

$$VA = \sum_s VA_s \quad (2.119)$$

Gross wage index paid by sectors

$$PWAGES.WAGES = \sum_s PWAGES_s WAGES_s \quad (2.120)$$

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

Aggregate gross wages paid by sectors

$$WAGES = \sum_s WAGES_s \quad (2.121)$$

Price of the aggregate gross operating surplus

$$PGOS.GOS = \sum_s GOS_s^{VAL} \quad (2.122)$$

Aggregate gross operating surplus

$$GOS = \sum_s GOS_s \quad (2.123)$$

Price of the aggregate net operating surplus

$$PNOS.NOS = \sum_s NOS_s^{VAL} \quad (2.124)$$

Aggregate net operating surplus

$$NOS = \sum_s NOS_s \quad (2.125)$$

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)

$$PGDP.GDP = PCH.CH + PG.G + PI.I + PX.X + PDS.DS - PM.M \quad (2.126)$$

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)

$$GDP = CH + G + I + X + DS - M \quad (2.127)$$

Price of GDP of commodity c (expenditure definition)

$$PGDP_c GDP_c = PCH_c CH_c + PG_c G_c + PI_c I_c + PX_c X_c + PDS_c DS_c - PM_c M_c \quad (2.128)$$

GDP of commodity c (expenditure definition)

$$GDP_c = CH_c + G_c + I_c + X_c + DS_c - M_c \quad (2.129)$$

Price of GDP (expenditure definition, for verification)

$$PGDP^{bis}.GDP^{bis} = \sum_c PGDP_c GDP_c \quad (2.130)$$

GDP (expenditure definition, for verification)

$$GDP^{bis} = \sum_c GDP_c \quad (2.131)$$

2.3.2 Production approach

Price of GDP (production definition)

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

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)

$$GDP^{ter} = VA + NTAXC \quad (2.133)$$

2.3.3 Income approach

Price of GDP (income definition)

$$\begin{aligned} PGDP4.GDP4 = & PGOS.GOS + PWAGES.WAGES + PRSC.RSC \\ & + NTAXS^{VAL} + PNTAXC.NTAXC \end{aligned} \quad (2.134)$$

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)

$$GDP4 = GOS + WAGES + RSC + NTAXS + NTAXC \quad (2.135)$$

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

$$PY_s^n = CU_s^n (1 + \mu_s) \quad (3.1)$$

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

$$\Delta(\log(1 + \mu_s^n)) = \rho^{\mu, Y} \cdot \Delta(\log CUR_s) \quad (3.2)$$

The notional mark-up is a positive function of the capacity utilization ratio. One can notice that this specification is strictly equivalent to: $\Delta(\log(1 + \mu_s^n)) = \rho^{\mu, Y} \cdot (\Delta(\log Y_s) - \Delta(\log YCAP_s))$ 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)

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

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

Production capacity of the sector s

$$\begin{aligned} \Delta(\log YCAP_s) = & \sum_f \varphi_{f,s,t-1} \Delta(\log(F_{f,s} PROG_{f,s})) \\ & + \alpha_s^{YCAP,Y} (\log Y_{s,t-1} - \log(YCAP_{s,t-1} CUR_{s,t0})) \end{aligned} \quad (3.4)$$

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

Capacity utilisation ratio of the sector s

$$CUR_s = \frac{Y_s}{YCAP_s} \quad (3.5)$$

Average mark-up on commodity c

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

3.1.2 Wage setting

Notional wage in sector s

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

This general specification combines various wage equations found in the literature: the Phillips curve and the WS curve. The WS curve 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

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

Consumer Price Index

$$P = PCH \quad (3.9)$$

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

$$WAGES_s PWAGES_s = W_s F_{L,s} \quad (3.10)$$

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

Price index for gross wages in sector s

$$PWAGES_s = P \quad (3.11)$$

3.1.3 Interest rate setting

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

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

Interest rate paid on capital by sector s

$$\Delta(R_s) = \Delta(R) \quad (3.13)$$

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

Interest rate paid by the Gouvernement on its debt

$$\Delta(r^{DEBT,G}) = \Delta(r) \quad (3.14)$$

3.2 Costs

Notional unit cost of production in sector s

$$CU_s^n Y_s = \sum_f C_{f,s} F_{f,s}^n + NTAX S_s^{VAL} \quad (3.15)$$

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

$$CU_s Y_s = \sum_f C_{f,s} F_{f,s} + NTAX S_s^{VAL} \quad (3.16)$$

Labor cost in sector s

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

Capital cost in sector s

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

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

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

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

$$C_{E,s} = P E_s \quad (3.20)$$

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

$$P E_s F_{E,s} = \sum_{ce} P C I_{ce,s} C I_{ce,s} \quad (3.21)$$

Materials costs in sector s

$$C_{MAT,s} = P M A T_s \quad (3.22)$$

Price of materials in sector s

$$P M A T_s F_{MAT,s} = \sum_{cm} P C I_{cm,s} C I_{cm,s} \quad (3.23)$$

Aggregate cost of capital

$$C_K F_K = \sum_s C_{K,s} F_{K,s} \quad (3.24)$$

Aggregate cost of labor

$$C_L F_L = \sum_s C_{L,s} F_{L,s} \quad (3.25)$$

Aggregate cost of energy

$$C_E F_E = \sum_s C_{E,s} F_{E,s} \quad (3.26)$$

Aggregate cost of materials

$$C_{MAT} F_{MAT} = \sum_s C_{MAT,s} F_{MAT,s} \quad (3.27)$$

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

$$PYQ_c YQ_c = \sum_s PY_s Y_{c,s} \quad (3.28)$$

Price of imported commodity c , expressed at basic price

$$PM_c = EXR.PWD_c \quad (3.29)$$

Price of domestically produced commodity c , expressed at market price

$$PYQS_c YQS_c = PYQ_c YQ_c + PMGPD_c MGPD_c + NTAXCD_c^{VAL} \quad (3.30)$$

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 proportionnal 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

$$\Delta(\log YQS_c) = \Delta(\log YQ_c) \quad (3.31)$$

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

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

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 commun 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 purshased by sector s

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

Market price of imported intermediate consumption c purshased by sector s

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

Market price of domestically produced households final consumption c

$$PCHD_c = PYQS_c \quad (3.40)$$

Market price of imported households final consumption c

$$PCHM_c = PMS_c \quad (3.41)$$

Market price of domestically produced Government final consumption c

$$PGD_c = PYQS_c \quad (3.42)$$

Market price of imported Government final consumption c

$$PGM_c = PMS_c \quad (3.43)$$

Market price of domestically produced investment c purchased by sector s

$$PID_{c,s} = PYQS_c \quad (3.44)$$

Market price of imported investment c purchased by sector s

$$PIM_{c,s} = PMS_c \quad (3.45)$$

Market price of domestically produced exports c

$$PXD_c = PYQS_c \quad (3.46)$$

Market price of imported exports (re-exports) c

$$PXM_c = PMS_c \quad (3.47)$$

Market price of domestically produced change in inventories c

$$PDSD_c = PYQS_c \quad (3.48)$$

Market price of imported change in inventories c

$$PDSM_c = PMS_c \quad (3.49)$$

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

Market price of intermediate consumption c purchased by sector s

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

Market price of households final consumption c

$$PCH_c CH_c = PCHD_c CHD_c + PCHM_c CHM_c \quad (3.51)$$

Market price of Government final consumption c

$$PG_c G_c = PGD_c GD_c + PGM_c GM_c \quad (3.52)$$

Market price of exports c

$$PX_c X_c = PXD_c XD_c + PXM_c XM_c \quad (3.53)$$

4 Producer

This file provides the equations defining the producer behaviour.

4.1 Margins

Margins paid to commodity m on the domestic commodity c

$$\Delta(\log MGPLD_{m,c}) = \Delta(\log YQ_c) + \Delta(SUBST_{m,c}^{MGPLD}) \quad (4.1)$$

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

$$SUBST_{m,c}^{MGPLD,n} = \sum_{mm} -\sigma_{m,mm,c}^{MGPLD} \varphi_{mm,c,t-1}^{MGPLD} \Delta(\log PMGPLD_{m,c} - \log PMGPLD_{mm,c}) \quad (4.2)$$

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

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

Margins paid to commodity m on the imported commodity c

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

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

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

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

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

4.2 Production factors

Production of commodity c by sector s

$$Y_{c,s} = \Phi Y_{c,s} YQ_c \quad (4.7)$$

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

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

Notional substitution between input f and the other inputs ff

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

Cost share of input f for sector s

$$\varphi_{f,s} = \frac{C_{f,s} F_{f,s}^n}{\sum_{ff} C_{ff,s} F_{ff,s}^n} \quad (4.10)$$

Aggregate production factors f

$$F_f = \sum_s F_{f,s} \quad (4.11)$$

Investment in commodity c by sector s

$$\Delta(\log I_{c,s}) = \Delta(\log IA_s) \quad (4.12)$$

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

$$\Delta(\log CI_{ce,s}) = \Delta(\log F_{E,s}) + \Delta(SUBST_{ce,s}^{CI}) \quad (4.13)$$

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

$$\Delta(SUBST_{ce,s}^{CI,n}) = \sum_{cee} -\sigma_{ce,cee,s}^{NRJ} \varphi_{E,cee,s,t-1} \Delta(\log PCI_{ce,s} - \log PCI_{cee,s}) \quad (4.14)$$

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

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

Material consumption cmo of sector s

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

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

Transport demand of sector s

$$\Delta(\log TRSP_s) = \Delta(\log F_{MAT,s}) \quad (4.17)$$

Demand for transport commodity ct by sector s

$$\Delta(\log CI_{ct,s}) = \Delta(\log TRSP_s) + \Delta(SUBST_{ct,s}^{CI}) \quad (4.18)$$

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

$$\Delta(SUBST_{ct,s}^{CI,n}) = \sum_{ctt} -\sigma_{ct,ctt,s}^{TRSP} \varphi_{ctt,s,t-1}^{TRSP} \Delta(\log PCI_{ct,s} - \log PCI_{ctt,s}) \quad (4.19)$$

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

$$\varphi_{ct,s}^{TRSP} = \frac{PCI_{ct,s} CI_{ct,s}}{\sum_{ctt} PCI_{ctt,s} CI_{ctt,s}} \quad (4.20)$$

Technical progress of the production factor f in sector s

$$PROG_{f,s} = PROG_{f,s,t-1} (1 + GR_{f,s}^{PROG}) \quad (4.21)$$

Energy efficiency gains in sector s

$$GR_{E,s}^{PROG} = GR_{E,s,t_0}^{PROG} + \rho^{PROG,E,PE} \cdot (\log PE_s - \log P > 0) \Delta(\log PE_s - \log P) \quad (4.22)$$

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

$$DISPINC^{BT,VAL} = PWAGES.WAGES + PROP^{INC,H,VAL} + SOC^{BENF,VAL} + TRSF^{HH,VAL} \quad (5.1)$$

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

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

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

$$PNCH_c = PCH_c \quad (5.9)$$

Price of agregate necessary households consumption

$$PNCH.NCH = \sum_c PNCH_c NCH_c \quad (5.10)$$

Aggregate necessary households final consumption

$$NCH = \sum_c NCH_c \quad (5.11)$$

Share of commodity c into the total marginal household consumption

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

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

Share of commodity c into the total household consumption

$$\varphi_c^{CH} = \frac{CH_c}{CH} \quad (5.13)$$

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

CES consumption price index

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

Households savings expressed in value

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

Households savings rate

$$RSAV^{H,VAL} = \frac{SAV^{H,VAL}}{DISPINC^{AT,VAL}} \quad (5.16)$$

Households savings stock

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

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 coherent 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

$$NTAXCD_c^{VAL} = RNTAXCD_c PYQ_c YQ_c \quad (6.1)$$

Net taxes on domestically produced commodity c

$$NTAXCD_c = RNTAXCD_{c,t_0} YQ_c \quad (6.2)$$

Net taxes on imported commodity c expressed in value

$$NTAXCM_c^{VAL} = RNTAXCM_c PM_c M_c \quad (6.3)$$

Net taxes on imported commodity c

$$NTAXCM_c = RNTAXCM_{c,t_0} M_c \quad (6.4)$$

Net taxes on commodity c expressed in value

$$NTAXC_c^{VAL} = NTAXCD_c^{VAL} + NTAXCM_c^{VAL} \quad (6.5)$$

Net taxes on commodity c

$$NTAXC_c = NTAXCD_c + NTAXCM_c \quad (6.6)$$

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

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

Aggregate incomes of the Government expressed in value

$$INC^{G,VAL} = PNTAXC.NTAXC + NTAXS^{VAL} + INC^{SOC,TAX,VAL} + PRSC.RSC + PROP^{INC,G,VAL} \quad (6.19)$$

6.2 Spendings

Government final consumption of commodity c

$$\Delta(\log G_c) = \Delta(\log EXPG) \quad (6.20)$$

Aggregate spendings of the Government expressed in value

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

6.3 Deficit and debt

Savings of the Government expressed in value

$$SAV^{G,VAL} = INC^{G,VAL} - SPEND^{G,VAL} \quad (6.22)$$

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)

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

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)**

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

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

$$MGSD_m = (1 - \varphi_m^{MGSM}) MGS_m \quad (7.1)$$

Private final consumption of domestically produced commodity c

$$CHD_c = (1 - \varphi_c^{CHM}) CH_c \quad (7.2)$$

Public final consumption of domestically produced commodity c

$$GD_c = (1 - \varphi_c^{GM}) G_c \quad (7.3)$$

Margins supplied from imported commodity m

$$MGSM_m = \varphi_m^{MGSM} MGS_m \quad (7.4)$$

Private final consumption of imported commodity c

$$CHM_c = \varphi_c^{CHM} CH_c \quad (7.5)$$

Public final consumption of imported commodity c

$$GM_c = \varphi_c^{GM} G_c \quad (7.6)$$

Import share of commodity c on supplied margins

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

Import share of commodity c for household final consumption

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

Import share φ_c of commodity c on the government final consumption

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

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

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

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

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

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

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

Intermediary consumption from sector s in domestically produced commodity c

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

Investment from sector s in domestically produced commodity c

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

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

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

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

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

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

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

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

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

7.2 Exports

Exports of domestically produced commodity c

$$XD_c = (1 - \varphi_c^{XM}) X_c \quad (7.21)$$

Exports of imported commodity c

$$XM_c = \varphi_c^{XM} X_c \quad (7.22)$$

Import share of commodity c exports

$$\varphi_c^{XM} = \frac{1}{\left(1 + \frac{XD_c}{XM_{c,t_0}} \exp SUBST_c^{XM}\right)} \quad (7.23)$$

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

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

Foreign demand for exports of commodity c

$$\Delta(\log X_c) = \Delta(\log WD_c) + \Delta(SUBST_c^X) \quad (7.25)$$

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

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

Balance of trade of commodity c

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

Aggregate balance of trade

$$Bal^{Trade,VAL} = \sum_c Bal_c^{Trade,VAL} \quad (7.28)$$

Balance of trade (in percent of GDP)

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

8 Demography

Working-age population

$$\Delta (\log WAPop) = \Delta (\log POP) \quad (8.1)$$

The working age population linearly grows with the total population.

Labor force

$$LF = PARTR.WAPop \quad (8.2)$$

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

Labor force participation ratio

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

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

Employment (ILO definition)

$$\Delta(\log empl) = \Delta(\log F_L) \quad (8.4)$$

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

$$Un = LF - Empl \quad (8.5)$$

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

Unemployment rate

$$UnR = \frac{Un}{LF} \quad (8.6)$$

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 equations are defined depending on the emission basis: intermediary consumption, household consumption or production.

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

$$\Delta(\log EMS_{ghg,c,s}^{CI}) = \Delta(\log (CI_{c,s} IEMS_{ghg,c,s}^{CI})) \quad (9.1)$$

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 ghg related to the materials consumption of sector s

$$\Delta(\log EMS_{ghg,s}^{MAT}) = \Delta(\log(F_{MAT,s} IEMS_{ghg,s}^{MAT})) \quad (9.2)$$

This mainly corresponds to the CO2 emissions from decarbonation.

Emissions ghg related to the final production of sector s

$$\Delta(\log EMS_{ghg,s}^Y) = \Delta(\log(Y_s IEMS_{ghg,s}^Y)) \quad (9.3)$$

This mainly correspond to the emissions from agriculture.

Emissions ghg related to the household consumption c

$$\Delta(\log EMS_{ghg,c}^{CH}) = \Delta(\log(CH_c IEMS_{ghg,c}^{CH})) \quad (9.4)$$

Emissions ghg related to the intermediary consumption of commodity c

$$EMS_{ghg,c}^{CI} = \sum_s EMS_{ghg,c,s}^{CI} \quad (9.5)$$

Emissions ghg related to the intermediary consumption by sector s

$$EMS_{ghg,s}^{CI} = \sum_c EMS_{ghg,c,s}^{CI} \quad (9.6)$$

Emissions of the greenhouse gas ghg related to the intermediary consumption

$$EMS_{ghg}^{CI} = \sum_s EMS_{ghg,s}^{CI} \quad (9.7)$$

Aggregation by sector s .

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

$$EMS_{ghg}^{CI,bis} = \sum_c EMS_{ghg,c}^{CI} \quad (9.8)$$

Aggregation by commodity c .

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

$$EMS_{ghg}^{MAT} = \sum_s EMS_{ghg,s}^{MAT} \quad (9.9)$$

Emissions of the greenhouse gas ghg related to the final production

$$EMS_{ghg}^Y = \sum_s EMS_{ghg,s}^Y \quad (9.10)$$

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

$$EMS_{ghg}^{CH} = \sum_c EMS_{ghg,c}^{CH} \quad (9.11)$$

Aggregate emissions of the greenhouse gas ghg

$$EMS_{ghg} = EMS_{ghg}^{CI} + EMS_{ghg}^{MAT} + EMS_{ghg}^Y + EMS_{ghg}^{CH} \quad (9.12)$$

Aggregate emissions related to the intermediary consumption

$$EMS^{CI} = \sum_{ghg} EMS_{ghg}^{CI} \quad (9.13)$$

Aggregate emissions related to the material consumption

$$EMS^{MAT} = \sum_{ghg} EMS_{ghg}^{MAT} \quad (9.14)$$

Aggregate emissions related to the final production

$$EMS^Y = \sum_{ghg} EMS_{ghg}^Y \quad (9.15)$$

Aggregate emissions related to the households final consumption

$$EMS^{CH} = \sum_{ghg} EMS_{ghg}^{CH} \quad (9.16)$$

Aggregate emissions

$$EMS = EMS^{CI} + EMS^{MAT} + EMS^Y + EMS^{CH} \quad (9.17)$$

Aggregate emissions by type of substance

$$EMS^{bis} = \sum_{ghg} EMS_{ghg} \quad (9.18)$$

9.1 Final production and demand

Demand for energy ce of sector s , expressed in toe

$$\Delta(\log CI_{ce,s}^{toe}) = \Delta(\log CI_{ce,s}) \quad (9.19)$$

Demand for energy ce of households, expressed in toe

$$\Delta(\log CH_{ce}^{toe}) = \Delta(\log CH_{ce}) \quad (9.20)$$

External demand for energy ce , expressed in toe

$$\Delta(\log X_{ce}^{toe}) = \Delta(\log X_{ce}) \quad (9.21)$$

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

$$\Delta(\log Y_{ce,s}^{toe}) = \Delta(\log Y_{ce,s}) \quad (9.22)$$

Imported energy ce , expressed in toe

$$M_{ce}^{toe} = CI_{ce}^{toe} + CH_{ce}^{toe} + X_{ce} - Y_{ce}^{toe} \quad (9.23)$$

Demand for energy ce of sectors, expressed in toe

$$CI_{ce}^{toe} = \sum_s CI_{ce,s}^{toe} \quad (9.24)$$

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

$$Y_{ce}^{toe} = \sum_s Y_{ce,s}^{toe} \quad (9.25)$$

9.2 Primary production and demand

10 Other equations

10.1 Adjustment equations and anticipation

Mark-up in the sector s

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

Expected inflation.

$$\Delta(\log P^e) = \alpha^{Pe,P1} \cdot \Delta(\log P_{t-1}) + (1 - \alpha^{Pe,P1}) \cdot \Delta(\log P_{t-1}^e) \quad (10.2)$$

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

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

Quantity of Labor, Energy and Material inputs in sector s

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

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

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

Capital stock of sector s

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

Investment in sector s

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

Households final consumption of commodity c

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

Expected households final consumption of commodity c

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

Production price of sector s

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

Expected production price of sector s

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

Wages of the sector s

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

Labor participation ratio

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

Interest rate

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

Households property income in value

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

Expected Households property income in value

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

Government property incomes in value

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

Expected Government property incomes in value

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

10.2 Substitutions

Substitution effect of the production factor f in the sector s

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

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

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

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

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

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

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

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

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

Substitution effect on the imported margin supplied for the commodity m

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

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

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

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

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

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

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

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

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

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

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

Substitution effect on the exports of the commodity c

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

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

$$T2VAL_{ghg,c,s}^{CI} = R2_{ghg,c,s}^{CI} EMS_{ghg,c,s}^{CI} \quad (11.1)$$

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

$$T2_{ghg,c,s}^{CI} = R2_{ghg,c,s,t_0}^{CI} EMS_{ghg,c,s}^{CI} \quad (11.2)$$

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

$$T2VAL_{ghg,c}^{CI} = \sum_s T2VAL_{ghg,c,s}^{CI} \quad (11.3)$$

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

$$T2VAL_{ghg,c}^{CID} = \sum_s T2VAL_{ghg,c,s}^{CI} \frac{CID_{c,s}}{CI_{c,s}} \quad (11.4)$$

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

$$T2_{ghg,c}^{CID} = \sum_s T2_{ghg,c,s}^{CI} \frac{CID_{c,s}}{CI_{c,s}} \quad (11.5)$$

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

$$T2VAL_{ghg,c}^{CIM} = \sum_s T2VAL_{ghg,c,s}^{CI} \frac{CIM_{c,s}}{CI_{c,s}} \quad (11.6)$$

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

$$T2_{ghg,c}^{CIM} = \sum_s T2_{ghg,c,s}^{CI} \frac{CIM_{c,s}}{CI_{c,s}} \quad (11.7)$$

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

$$T2VAL_{ghg,s}^{CI} = \sum_c T2VAL_{ghg,c,s}^{CI} \quad (11.8)$$

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

$$T2VAL_{c,s}^{CI} = \sum_{ghg} T2VAL_{ghg,c,s}^{CI} \quad (11.9)$$

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

$$T2VAL_{ghg}^{CI} = \sum_c T2VAL_{ghg,c}^{CI} \quad (11.10)$$

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

$$T2VAL_c^{CI} = \sum_{ghg} T2VAL_{ghg,c}^{CI} \quad (11.11)$$

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

$$T2VAL_c^{CID} = \sum_{ghg} T2VAL_{ghg,c}^{CID} \quad (11.12)$$

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

$$T2_c^{CID} = \sum_{ghg} T2_{ghg,c}^{CID} \quad (11.13)$$

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

$$T2VAL_c^{CIM} = \sum_{ghg} T2VAL_{ghg,c}^{CIM} \quad (11.14)$$

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

$$T2_c^{CIM} = \sum_{ghg} T2_{ghg,c}^{CIM} \quad (11.15)$$

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

$$T2VAL_s^{CI} = \sum_{ghg} T2VAL_{ghg,s}^{CI} \quad (11.16)$$

Carbon tax in value on intermediary consumption emissions

$$T2VAL^{CI} = \sum_s T2VAL_s^{CI} \quad (11.17)$$

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

$$T2VAL_{ghg,s}^{MAT} = R2_{ghg,s}^{MAT} EMS_{ghg,s}^{MAT} \quad (11.18)$$

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

$$T2_{ghg,s}^{MAT} = R2_{ghg,s,t_0}^{MAT} EMS_{ghg,s}^{MAT} \quad (11.19)$$

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

$$T2VAL_{ghg}^{MAT} = \sum_s T2VAL_{ghg,s}^{MAT} \quad (11.20)$$

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

$$T2_{ghg}^{MAT} = \sum_s T2_{ghg,s}^{MAT} \quad (11.21)$$

Carbon tax in value on material emissions depending on commodity c

$$T2VAL_s^{MAT} = \sum_{ghg} T2VAL_{ghg,s}^{MAT} \quad (11.22)$$

Carbon tax in volume on material emissions depending on commodity c

$$T2_s^{MAT} = \sum_{ghg} T2_{ghg,s}^{MAT} \quad (11.23)$$

Carbon tax in value on material emissions

$$T2VAL^{MAT} = \sum_s T2VAL_s^{MAT} \quad (11.24)$$

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

$$T2VAL_{ghg,s}^Y = R2_{ghg,s}^Y EMS_{ghg,s}^Y \quad (11.25)$$

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

$$T2_{ghg,s}^Y = R2_{ghg,s,t_0}^Y EMS_{ghg,s}^Y \quad (11.26)$$

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

$$T2VAL_{ghg}^Y = \sum_s T2VAL_{ghg,s}^Y \quad (11.27)$$

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

$$T2_{ghg}^Y = \sum_s T2_{ghg,s}^Y \quad (11.28)$$

Carbon tax in value on production emissions depending on sector s

$$T2VAL_s^Y = \sum_{ghg} T2VAL_{ghg,s}^Y \quad (11.29)$$

Carbon tax in volume on production emissions depending on sector s

$$T2_s^Y = \sum_{ghg} T2_{ghg,s}^Y \quad (11.30)$$

Carbon tax in value on production emissions

$$T2VAL^Y = \sum_s T2VAL_s^Y \quad (11.31)$$

11.1.4 Incomes generated by households' emissions

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

$$T2VAL_{ghg,c}^{CH} = R2_{ghg,c}^{CH} EMS_{ghg,c}^{CH} \quad (11.32)$$

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

$$T2_{ghg,c}^{CH} = R2_{ghg,c,t_0}^{CH} EMS_{ghg,c}^{CH} \quad (11.33)$$

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

$$T2VAL_{ghg}^{CH} = \sum_c T2VAL_{ghg,c}^{CH} \quad (11.34)$$

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

$$T2VAL_c^{CH} = \sum_{ghg} T2VAL_{ghg,c}^{CH} \quad (11.35)$$

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

$$T2_c^{CH} = \sum_{ghg} T2_{ghg,c}^{CH} \quad (11.36)$$

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

$$T2VAL^{CH} = \sum_c T2VAL_c^{CH} \quad (11.37)$$

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

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

Net taxes on domestically produced commodity c

$$NTAXCD_c = VATD_c + OTHCTD_c + SUBCD_c + T2_c^{CH} \frac{CHD_c}{CH_c + T2_c^{CID}} \quad (12.2)$$

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

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

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

definition.

Net taxes on imported commodity c expressed in value

$$NTAXCM_c^{VAL} = PVATM_c VATM_c + POTHCTM_c OTHCTM_c + PSUBCM_c SUBCM_c + T2VAL_c^{CH} \frac{CHM_c}{CH_c + T2VAL_c^{CIM}} \quad (12.4)$$

Net taxes on imported commodity c

$$NTAXCM_c = VATM_c + OTHCTM_c + SUBCM_c + T2_c^{CH} \frac{CHM_c}{CH_c + T2_c^{CIM}} \quad (12.5)$$

Average tax rate on imported commodity c

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

12.1.2 Value-added tax (value & volume)

Price of value-added tax on domestically produced commodity c

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

Value-added tax on domestically produced commodity c

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

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

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

Production of commodity c expressed at market price before VAT

$$\Delta(\log YQSBVAT_c) = \Delta(\log YQ_c) \quad (12.20)$$

$YQSBVAT_c$ 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

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

Imports of commodity c expressed at market price before VAT

$$\Delta(\log MSBVAT_c) = \Delta(\log M_c) \quad (12.22)$$

Market price of margins supplied by domestically produced commodity c

$$PMGSD_c = PYQSBVAT_c \quad (12.23)$$

Market price of margins supplied by imported commodity c

$$PMGSM_c = PMSBVAT_c \quad (12.24)$$

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

$$PCID_{c,s} = PYQSBVAT_c + \frac{T2VAL_{c,s}^{CI}}{CI_{c,s}} \quad (12.25)$$

Market price of imported intermediate consumption c purchased by sector s

$$PCIM_{c,s} = PMSBVAT_c + \frac{T2VAL_{c,s}^{CI}}{CI_{c,s}} \quad (12.26)$$

Market price of domestically produced households final consumption c

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

Market price of imported households final consumption c

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

Market price of domestically produced Government final consumption c

$$PGD_c = PYQSBVAT_c \quad (12.29)$$

Market price of imported Government final consumption c

$$PGM_c = PMSBVAT_c \quad (12.30)$$

Market price of domestically produced investment c purchased by sector s

$$PID_{c,s} = PYQSBVAT_c \quad (12.31)$$

Market price of imported investment c purchased by sector s

$$PIM_{c,s} = PMSBVAT_c \quad (12.32)$$

Market price of domestically produced exports c

$$PXD_c = PYQSBVAT_c \quad (12.33)$$

Market price of imported exports (re-exports) c

$$PXM_c = PMSBVAT_c \quad (12.34)$$

Market price of domestically produced change in inventories c

$$PDSD_c = PYQSBVAT_c \quad (12.35)$$

Market price of imported change in inventories c

$$PDSM_c = PMSBVAT_c \quad (12.36)$$

12.2.1 Aggregation of taxes

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

$$PVATD.VATD = \sum_c PVATD_c VATD_c \quad (12.37)$$

Aggregate value-added tax paid on domestically produced commodities

$$VATD = \sum_c VATD_c \quad (12.38)$$

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

$$POTHCTD.OTHCTD = \sum_c POTHCTD_c OTHCTD_c \quad (12.39)$$

Aggregate other product tax paid on domestically produced commodities

$$OTHCTD = \sum_c OTHCTD_c \quad (12.40)$$

Aggregate market price for subsidies on domestically produced commodities

$$PSUBCD.SUBCD = \sum_c PSUBCD_c SUBCD_c \quad (12.41)$$

Aggregate subsidies on domestically produced commodities

$$SUBCD = \sum_c SUBCD_c \quad (12.42)$$

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

$$PVATM.VATM = \sum_c PVATM_c VATM_c \quad (12.43)$$

Aggregate value-added tax paid on imported commodities

$$VATM = \sum_c VATM_c \quad (12.44)$$

Aggregate market price for Other product Tax on imported commodities

$$POTHCTM.OTHCTM = \sum_c POTHCTM_c OTHCTM_c \quad (12.45)$$

Aggregate Other product Tax on imported commodities

$$OTHCTM = \sum_c OTHCTM_c \quad (12.46)$$

Aggregate market price for subsidies on imported commodities

$$PSUBCM.SUBCM = \sum_c PSUBCM_c SUBCM_c \quad (12.47)$$

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

$$RVATD = \frac{PVATD.VATD}{PCHD.CHD - PVATD.VATD} \quad (12.55)$$

Average rate of other taxes on domestically produced commodity

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

Average rate of subsidies on domestically produced commodity

$$RSUBCD = PSUBCD \cdot \frac{SUBCD}{YQ} \quad (12.57)$$

Average VAT rate on imported commodity

$$RVATM = \frac{PVATM.VATM}{PCHM.CHM - PVATM.VATM} \quad (12.58)$$

Average rate of other taxes on imported commodity

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

Average rate of subsidies on imported commodity

$$RSUBCM = PSUBCM \cdot \frac{SUBCM}{M} \quad (12.60)$$

Average VAT rate

$$RVAT = \frac{PVAT.VAT}{PCH.CH - PVAT.VAT} \quad (12.61)$$

Average rate of other taxes on commodity

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

Average rate of subsidies on commodity

$$RSUBC = PSUBC \cdot \frac{SUBC}{(YQ + M)} \quad (12.63)$$

13 Integration of an Emission Trading Scheme

Nominal price of emissions permits

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

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.

$$Q_s^{ETS,free} = share_s^{free} share_s^{ETS} EMS_s \quad (13.2)$$

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

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

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

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

Nominal value of emissions permits required for sector s

$$ETS_s^{VAL} = \sum_{ce2} ETS_{ce2,s}^{VAL} \quad (13.5)$$

Total nominal value of emissions permits on the trading market

$$ETS^{VAL,TOT} = \sum_s ETS_s^{VAL} \quad (13.6)$$

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

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

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

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

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

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

Employers' social security contribution paid by sector s

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

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

$$NCH_{ccon} = PNewBUIL_{t_0} NewBUIL + PREHAB_{t_0} REHAB + CH_{CCON}^{OTH} \quad (13.11)$$

14 Exogenous variables

14.1 From prices block

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

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

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

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

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

14.6. $DNAIRU$ – Change in the long term NAIRU

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

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

14.9. $\rho^{Rn,Cons}$ – 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.

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

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

14.2 From producer block

14.12. $\varphi_{f,s}$ – Production share of commodity c by sector s

14.3 From block ETC.... @ Paul: Et ce pour tous les blocs gnrs

14.4 From ETS block

14.13. $share_s^{free}$ – Percentage 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.

14.14. $alpha^{exo}$ – Alpha variable (used as a test for exogenous variable documentation)

Test exogenous variable

15 Glossary

α^{exo}	Alpha variable (used as a test for exogenous variable documentation)	14.14, 67
$Bal^{G,Prim,VAL}$	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, 47
CH_c^e	Expected households final consumption of commodity c	10.9, 47
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_{ce}^{toe}	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
$CI_{ce,s}^{toe}$	Demand for energy ce of sector s , expressed in toe	9.19,	46
CI_{ce}^{toe}	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 utilisation 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	14.6, 66
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, 45
EMS_{ghg}	Aggregate emissions of the greenhouse gas ghg	9.12, 45
EMS^{CH}	Aggregate emissions related to the households final consumption	9.16, 45
$EMS_{ghg,c}^{CH}$	Emissions ghg related to the household consumption c	9.4, 44
EMS_{ghg}^{CH}	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
$EMS_{ghg,c,s}^{CI}$	Emissions ghg related to the intermediary consumption of commodity c by sector s	9.1, 43
$EMS_{ghg,c}^{CI}$	Emissions ghg related to the intermediary consumption of commodity c	9.5, 44
$EMS_{ghg,s}^{CI}$	Emissions ghg related to the intermediary consumption by sector s	9.6, 44
EMS_{ghg}^{CI}	Emissions of the greenhouse gas ghg related to the intermediary consumption	9.7, 44
$EMS_{ghg}^{CI,bis}$	Emissions of the greenhouse gas ghg related to the intermediary consumption (for verification)	9.8, 44
EMS^{MAT}	Aggregate emissions related to the material consumption	9.14, 45
$EMS_{ghg,s}^{MAT}$	Emissions ghg related to the materials consumption of sector s	9.2, 44
EMS_{ghg}^{MAT}	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
$EMS_{ghg,s}^Y$	Emissions ghg related to the final production of sector s	9.3, 44
EMS_{ghg}^Y	Emissions of the greenhouse gas ghg related to the final production	9.10, 45
EMS^{bis}	Aggregate emissions by type of substance	9.18, 45
$ETS_{ce2,s}^{VAL}$	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
$F_{f,s}$	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
$F_{f,s}^e$	Expected quantity of Labor, Energy and Material inputs in sector s	10.5, 47
$F_{f,s}^n$	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_s^{VAL}	Gross operating surplus of sector s expressed in value	2.112, 18
$GR_{E,s}^{PROG}$	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
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, 46
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 commodities	12.40, 61
$OTHCTD_c$	Other taxes on domestically produced commodity c	12.12, 58

$OTHCTM$	Aggregate Other product Tax on imported commodities	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, 46
$P^{ETS,nominal}$	Nominal price of emissions permits	13.1, 64
$PARTR$	Labor participation ratio	10.13, 48
$PARTR^n$	Labor force participation ratio	8.3, 42
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
$\varphi_{f,s} (2)$	Production share of commodity c by sector s	14.12, 67
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
$\varphi_{ct,s}^{TRSP}$	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
$POTHCT$	Aggregate market price for other product Tax	12.51, 62

$POTHCTD$	Aggregate market price for other product tax paid on domestically produced commodities	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 commodities	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
$PROP^{INC,G,VAL}$	Government property incomes in value	10.17, 48
$PROP^{INC,G,VAL,e}$	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, 48
$PROP^{INC,H,VAL,n}$	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 commodities	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 commodities	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 commodities	12.43, 61
$PVATM_c$	Price of value-added tax on imported commodity c	12.9, 57
$PWAGES$	Gross wage index paid by sectors	2.120, 19
$PWAGES_s$	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, 47

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 Gouvernement on its debt	3.14, 23
R^n	Notional key interest rate of the Central Bank (Taylor rule)	3.12, 23

$RBal^{G,Prim,VAL}$	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
$\rho^{Rn,Cons}$	Constant of the notional interest rate equation (Taylor rule).	14.9, 66
$\rho^{Rn,P}$	Elasticity of the notional interest rate to inflation	14.10, 66
$\rho^{Rn,UnR}$	Elasticity of the notional interest rate to the unemployment rate	14.11, 67
$\rho_s^{W,DU}$	Elasticity of the notional wage inflation to the variation of the unemployment rate for sector s	14.7, 66
$\rho_s^{W,L}$	Elasticity of the notional wage inflation to the growth rate of share of labor in sector s	14.8, 66
$\rho_s^{W,P}$	Elasticity of the notional wage inflation to prices inflation for sector s	14.2, 66
$\rho_s^{W,Pe}$	Elasticity of the notional wage inflation to expected price inflation for sector s	14.3, 66
$\rho_s^{W,PROG}$	Elasticity of the notional wage inflation to labor productivity growth for sector s	14.4, 66
$\rho_s^{W,U}$	Elasticity of the notional wage inflation to the unemployment rate for sector s	14.5, 66
$\rho_s^{W,X}$	Constant in the wage equation for sector s	14.1, 66
$RNTAXCD_c$	Average tax rate on domestically produced commodity c	12.3, 56
$RNTAXCM_c$	Average tax rate on imported commodity c	12.6, 57
$ROTHCT$	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
$RRSC$	Average employers' social security contribution rate	6.17, 36
$RSAG^{G,VAL}$	Government's savings rate expressed in value (in percent of GDP)	6.27, 38
$RSAG^{H,VAL}$	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
$share_s^{free}$	Percentage of freely allocated permits to sector s	14.13, 67
$SOC^{BENF,VAL}$	Social benefits expressed in value	5.5, 33
$SPEND^{G,VAL}$	Aggregate spendings 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, 49
$SUBST_{ct,s}^{CI}$	Substitution effect on the transportation intermediate consumption ce in the sector s	10.23, 49
$SUBST_{ce,s}^{CI,n}$	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, 49
$SUBST_c^{MGSM,n}$	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 government final consumption 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
$T2_{ghg,c}^{CID}$	Carbon tax in volume on intermediary consumption emissions depending on ghg emission types and domestic commodity c	11.5, 51
$T2_c^{CIM}$	Carbon tax in volume on intermediary consumption emissions depending on imported commodity c	11.15, 52
$T2_{ghg,c}^{CIM}$	Carbon tax in volume on intermediary consumption emissions depending on ghg emission types and imported commodity c	11.7, 51
$T2_{ghg,s}^{MAT}$	Carbon tax in volume on material emissions depending on ghg emission types, commodity c in sector s	11.19, 53
$T2_{ghg}^{MAT}$	Carbon tax in volume on material emissions depending on ghg emission types	11.21, 53
$T2_s^{MAT}$	Carbon tax in volume on material emissions depending on commodity c	11.23, 53
$T2_{ghg,s}^Y$	Carbon tax in volume on production emissions depending on ghg emission types, commodity c in sector s	11.26, 54
$T2_{ghg}^Y$	Carbon tax in volume on production emissions depending on ghg emission types	11.28, 54

$T2_s^Y$	Carbon tax in volume on production emissions depending on sector s	11.30, 54
$T2VAL^{CH}$	Carbon tax in value on households' consumption depending on ghg emission types and commodity c	11.37, 55
$T2VAL_c^{CH}$	Carbon tax in value on households' consumption depending on commodity c	11.35, 55
$T2VAL_{ghg,c}^{CH}$	Carbon tax in value on households' consumption depending on ghg emission types and commodity c	11.32, 54
$T2VAL_{ghg}^{CH}$	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
$T2VAL_{c,s}^{CI}$	Carbon tax in value on intermediary consumption emissions depending on commodity c and sector s	11.9, 52
$T2VAL_c^{CI}$	Carbon tax in value on intermediary consumption emissions depending on commodity c	11.11, 52
$T2VAL_{ghg,c,s}^{CI}$	Carbon tax in value on intermediary consumption emissions depending on ghg emission types, commodity c in sector s	11.1, 50
$T2VAL_{ghg,c}^{CI}$	Carbon tax in value on intermediary consumption emissions depending on ghg emission types and commodity c	11.3, 51
$T2VAL_{ghg,s}^{CI}$	Carbon tax in value on intermediary consumption emissions depending on ghg emission types and sector s	11.8, 51
$T2VAL_{ghg}^{CI}$	Carbon tax in value on intermediary consumption emissions depending on ghg emission types	11.10, 52
$T2VAL_s^{CI}$	Carbon tax in value on intermediary consumption emissions depending on sector s	11.16, 53
$T2VAL_c^{CID}$	Carbon tax in value on intermediary consumption emissions depending on domestic commodity c	11.12, 52
$T2VAL_{ghg,c}^{CID}$	Carbon tax in value on intermediary consumption emissions depending on ghg emission types and domestic commodity c	11.4, 51

$T2VAL_c^{CIM}$	Carbon tax in value on intermediary consumption emissions depending on imported commodity c	11.14, 52
$T2VAL_{ghg,c}^{CIM}$	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, 53
$T2VAL_{ghg,s}^{MAT}$	Carbon tax in value on material emissions depending on ghg emission types, commodity c in sector s	11.18, 53
$T2VAL_{ghg}^{MAT}$	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, 53
$T2VAL^Y$	Carbon tax in value on production emissions	11.31, 54
$T2VAL_{ghg,s}^Y$	Carbon tax in value on production emissions depending on ghg emission types, commodity c in sector s	11.25, 54
$T2VAL_{ghg}^Y$	Carbon tax in value on production emissions depending on ghg emission types	11.27, 54
$T2VAL_s^Y$	Carbon tax in value on production emissions depending on sector s	11.29, 54
$TRSP_s$	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 commodities	12.38, 61

$VATD_c$	Value-added tax on domestically produced commodity c	12.8, 57
$VATM$	Aggregate value-added tax paid on imported commodities	12.44, 61
$VATM_c$	Value-added tax on imported commodity c	12.10, 57
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