Chapter 7

The Government Sector

The government sector in DREAM acts as a producer, collects taxes and pays out subsidies to firms and transfers to households and various foreign recipients, and provides government consumption. Because one of the main purposes of DREAM is to be able to assess consequences of various shocks and policy measures for the government budget and the sustainability of fiscal policy, the government sector is modelled relatively detailedly.

Note that when calibrating production sectors, DREAM uses data from ADAM's data bank for producers of government services ("offentligt erhverv"), whereas when calibrating revenues and expenditures, data for the general government sector (NA: "offentlig forvaltning og service", ADAM: "offentlig sektor") are used[1]. To equate figures from production to the corresponding NA figures in the government budget, DREAM consequently has to introduce various correction terms when calculating investment expenditure and data for gross operating surplus, cf. below.

This chapter describes in further detail the individual elements of the government budget (revenue and expenditure), indexation of a number of variables of the government sector, and the government intertemporal budget constraint including the issue of fiscal sustainability.

[1] In this documentation, the term government sector is used throughout meaning general government sector. When referring to production, the terms "producer of government services" or "government producer" are used.

7.1 Government revenue

Total government revenue Rev_t^G can be divided into the revenue sources listed in table 1, following standard NA conventions. With the exception of interest income, each of these revenue sources is modelled independently in DREAM, in some cases subdivided into its constituents. Interest income is modelled only as a net income, cf. section 7.3. Note that the last term in the table is a DREAM lump-sum correction term which does not have any direct NA counterpart, but has been introduced to the model to ensure that total revenues are consistent with NA figures.

Total current and capital revenues	Rev_t^G
Gross Operating Surplus	TR_t^{GrOS}
Revenue from interests and rents	
Revenue from quasi corporations	OR_t^{Quasi}
Interest income	
Land Rent	$OR_t^{LandRent}$
Indirect taxes	TR_t^{Indir}
VAT	TR_t^{VAT}
Motor vehicle registration duties	TR_t^{Reg}
Customs revenue, net of EU payments	TR_t^{Cus}
Excise Duties	TR_t^{Duty}
Property taxes	TR_t^{Land}
Motor vehicle weight duties, producers	$TR_t^{P,Weight}$
Labour market contributions, employers	$TR_t^{Emp} + TR_t^{W}$
Other taxes on production	$TR_t^{P,Res}$
Direct taxes	TR_t^{Dir}
Source taxes	TR_t^{Source}
Payroll taxes	$TR_t^{Payroll}$
Other personal income taxes	TR_t^{CapPen}
Motor vehicle weight duties, households	$TR_t^{H,Weight}$
Corporate taxes	TR_t^{Cor}
Tax on yields of pension scheme assets	$TR_t^{PensInt}$
Social contributions	$TR_t^{SocCont}$
Current transfers	OR_t^{G}
Tax on bequests	TR_t^{Beq}
Capital transfers	OR_t^{Ocap}
Lump-sum correction term	$\sum_{a \in ax0} N_{a,t}^{Adult} o_t^{H,G,LumpRev}$

The modelling of the individual revenue sources are described in more details below.

7.1.1 Gross Operating Surplus

The first term TR_t^{GrOS}, gross operating surplus, is identically equal to consumption of fixed capital. In DREAM, the additive correction term $k_{j,t}^{Depr}$ ensures that total depreciation is equal to gross operating surplus for producers of government services, cf. (7.1). Furthermore, as explained above, DREAM uses a multiplicative correction term k_t^{GrOS} to equate gross operating surplus for producers of government services to gross operating surplus in the government sector:

$$TR_t^{GrOS} = \left(1 + k_t^{GrOS}\right) \sum_{j \in \{G\}} \left(1 + k_{j,t}^{Depr}\right) \left(P_{j,t}^{I,P,M} \delta_{j,t}^{P,M} K_{j,t-1}^{P,M} + P_{j,t}^{I,P,B} \delta_{j,t}^{P,B} K_{j,t-1}^{P,B}\right). \qquad (7.1)$$

7.1.2 Land Rent

Land rent is revenue from government-owned firms and activities yielding a surplus. In the standard version of DREAM, land is not a separate factor of production. Consequently, in the calibration process, the revenue from these sources is transformed into an amount $o_t^{P,G,LandRent}$ which is paid lump-sum by the firms in the private production sectors:

$$OR_t^{LandRent} = \sum_{j \in \{P,C\}} o_{j,t}^{P,G,LandRent}. \qquad (7.2)$$

7.1.3 Withdrawals from Quasi Corporations

Like land rent, withdrawals from quasi corporations represent revenue from government-owned firms and are in the present version of DREAM simply paid in the form of a lump-sum transfer $o_t^{P,G,Quasi}$ from the firms in the private production sectors:

$$OR_t^{Quasi} = \sum_{j \in \{P,C\}} o_{j,t}^{P,G,Quasi}. \qquad (7.3)$$

7.1.4 Indirect taxes

Indirect taxes can be subdivided into product taxes (which are levied on either the quantities or the value of the specific units of production), and other taxes on production, which are levied independently of the actual production. In DREAM, product taxes are subdivided into the following components: VAT (moms), motor vehicle registration duties (registreringsafgifter), customs taxes (told) and (exicse) duties (punktafgifter). Other taxes on production consist of labour market contributions from employers and wage-sum taxes, land taxes, motor vehicle weight duties from the production sector and a residual "Other taxes on production". Each of these elements are described in more detail in the following.

Labour market contributions from employers and wage-sum taxes

Labour market contributions from employers TR_t^{Emp} and wage-sum taxes TR_t^W are both assumed to be paid by all employers proportionally to their wage-sum, cf. (7.4) and (7.5):

$$TR_t^{Emp} = W_t \sum_{j \in \{C,P,G\}} t_{j,t}^{Emp} L_{j,t}^D, \tag{7.4}$$

$$TR_t^W = W_t \sum_{j \in \{C,P,G\}} t_{j,t}^W L_{j,t}^D. \tag{7.5}$$

Land taxes

Land taxes (representing the taxes "grundskyld" and "afløsningsafgifter") are paid by households and by producers, cf. (7.6). In the household sector, it is levied as a proportional tax $t_t^{H,Land}$ on the total value of land owned by all age groups. In the production sector, land is not an explicit factor of production. Instead, the tax is levied on the value of buildings in each production sector, where the tax rate is $t_{j,t}^{P,Land}$.

$$TR_t^{Land} = \sum_{j \in \{D\}} t_t^{H,Land} P_{j,t-1}^{K,H,L} \sum_a K_{a-1,t-1}^{H,L,Ind} N_{a-1,t-1}^{Adult,Eq} + \sum_{j \in \{C,P,G\}} t_{j,t}^{P,Land} P_{j,t-1}^{I,P,B} K_{j,t-1}^{P,B}. \tag{7.6}$$

Motor vehicle weight duties paid by producers

As DREAM does not explicitly model means of transportation, weight duties on motor vehicles paid by producers $TR_t^{P,Weight}$ are transformed into a tax on the stock of machine capital in each production sector, cf. (7.7). The implicit assumption is that the stock of motor vehicles will develop proportionally to machine capital. Note that weight duties paid by households are classified as direct taxes (cf. below).

$$TR_t^{P,Weight} = \sum_{j\in\{C,P,G\}} t_{j,t}^{P,Weight} K_{j,t-1}^{P,M}. \tag{7.7}$$

Customs taxes

Customs taxes are levied on behalf of EU. The gross revenues are modelled with separate proportional tax rates for imported goods used for government and household consumption, materials, building, machinery and inventory investment, cf. (7.8). As TR_t^{Cus} denotes the final customs tax revenue accruing to the Danish government, we have to subtract the total payments to the EU due to customs taxation $OR_t^{G,EU,Cus}$ from the immediate customs tax revenues (note that $OR_t^{G,EU,Cus}$ is in fact larger than the sum of all other terms in (7.8), so that the net customs tax revenue TR_t^{Cus} is a negative number, cf. chapter 8 on the foreign sector .

$$\begin{aligned} TR_t^{Cus} = P_t^F \Bigg[& \sum_{e\in\{D,R,G,P\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} t_{e,t}^{H,Cus} C_{e,k,c,t}^{H,2} \\ & + \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} t_t^{G,Cus} C_{k,c,t}^{G,2} \\ & + \sum_{j\in\{C,P,G\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} t_{j,t}^{M,Cus} M_{j,k,c,t}^{2} \\ & + \sum_{j\in\{C,P,G\}} \sum_{k\in\{P\}} \sum_{c\in\{F\}} t_{j,t}^{I,M,Cus} I_{j,k,c,t}^{M,2} \\ & + \sum_{j\in\{C,P,G\}} \sum_{k\in\{C,P\}} \sum_{c\in\{F\}} t_{j,t}^{I,B,Cus} I_{j,k,c,t}^{P,B,2} \\ & + \sum_{j\in\{C,P\}} t_t^{I,I,Cus} I_{j,t}^{F,I} \Bigg] - OR_t^{G,EU,Cus}. \end{aligned} \tag{7.8}$$

VAT

VAT is assumed to be paid as a proportional rate on the value added of the various sectors, cf. (7.9). VAT is paid on household and government consumption, material inputs in production and machinery and building investments. For each individual sector, the rate (e.g. $t_{d,t}^{H,Cus}$) is calibrated to reproduce the exact VAT payments of that particular sector in the base year:

$$
\begin{aligned}
TR_t^{VAT} = & \sum_{e\in\{D,R,G,P\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} t_{e,t}^{H,VAT}\left(1+t_{e,t}^{H,Cus}\right) P_t^F C_{e,k,c,t}^{H,2} \\
& + \sum_{e\in\{D,R,G,P\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} t_{e,t}^{H,VAT} P_{k,t}^Y C_{e,k,c,t}^{H,2} \\
& + \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} t_t^{G,VAT}\left(1+t_t^{G,Cus}\right) P_t^F C_{k,c,t}^{G,2} \\
& + \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} t_t^{G,VAT} P_{k,t}^Y C_{k,c,t}^{G,2} \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} t_{j,t}^{M,VAT}\left(1+t_{j,t}^{M,Cus}\right) P_t^F M_{j,k,c,t}^2 \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} t_{j,t}^{M,VAT} P_{k,t}^Y M_{j,k,c,t}^2 \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{P\}} \sum_{c\in\{F\}} t_{j,t}^{I,M,VAT}\left(1+t_{j,t}^{I,M,Cus}\right) P_t^F I_{j,k,c,t}^{P,M,2} \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{P\}} \sum_{c\in\{D\}} t_{j,t}^{I,M,VAT} P_{k,t}^Y I_{j,k,c,t}^{P,M,2} \\
& + \sum_{j\in\{C,P,D,G\}} \sum_{k\in\{C,P\}} \sum_{c\in\{F\}} t_{j,t}^{I,B,VAT}\left(1+t_{j,t}^{I,B,Cus}\right) P_t^F I_{j,k,c,t}^{P,B,2} \\
& + \sum_{j\in\{C,P,D,G\}} \sum_{k\in\{C,P\}} \sum_{c\in\{D\}} t_{j,t}^{I,B,VAT} P_{k,t}^Y I_{j,k,c,t}^{P,B,2} .
\end{aligned}
\tag{7.9}
$$

Duties

Excise duties (punktafgifter) are basically treated in the same way as VAT, cf. (7.10). However, because of the tax freeze, DREAM distinguishes between duties levied on the quantities of goods (with the superscript $DutyQ$) and duties levied on the values of goods (with the superscript $DutyV$). The distinction is relevant when implementing the present Danish tax freeze policy (cf. page 193), even though both kinds are actually represented in the model by a calibrated tax rate on the value of the relevant tax base. Hence, $t_{d,t}^{H,DutyV}$ is the duty rate on the value of households' consumption of kind d. In the case of duties levied as quantity taxes, e.g. $t_{d,k,c,t}^{H,DutyQ}$, additional subscripts for origin country and consequently delivering sector are needed because of the tax freeze. Also, in addition to the sectors which pay VAT, duties are levied on exports and inventory investments.

$$
\begin{aligned}
TR_t^{Duty} = & \sum_{e\in\{D,R,G,P\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} \left(t_{e,t}^{H,DutyV} + t_{e,k,c,t}^{H,DutyQ}\right) \left(1 + t_{e,t}^{H,Cus}\right) P_t^F C_{e,k,c,t}^{H,2} \\
& + \sum_{e\in\{D,R,G,P\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} \left(t_{e,t}^{H,DutyV} + t_{e,k,c,t}^{H,DutyQ}\right) P_{k,t}^Y C_{e,k,c,t}^{H,2} \\
& + \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} \left(t_t^{G,DutyV} + t_{k,c,t}^{G,DutyQ}\right) \left(1 + t_t^{G,Cus}\right) P_t^F C_{k,c,t}^{G,2} \\
& + \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} \left(t_t^{G,DutyV} + t_{k,c,t}^{G,DutyQ}\right) P_{k,t}^Y C_{k,c,t}^{G,2} \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} \left(t_{j,t}^{M,DutyV} + t_{j,k,c,t}^{M,DutyQ}\right) \left(1 + t_{j,t}^{M,Cus}\right) P_t^F M_{j,k,c,t}^2 \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} \left(t_{j,t}^{M,DutyV} + t_{j,k,c,t}^{I,M,DutyQ}\right) P_{k,t}^Y M_{j,k,c,t}^2 \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{P\}} \sum_{c\in\{F\}} \left(t_{j,t}^{I,M,DutyV} + t_{j,k,c,t}^{I,M,DutyQ}\right) \left(1 + t_{j,t}^{I,M,Cus}\right) P_t^F I_{j,k,c,t}^{P,M,2} \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{P\}} \sum_{c\in\{D\}} \left(t_{j,t}^{I,M,DutyV} + t_{j,k,c,t}^{I,M,DutyQ}\right) P_{k,t}^Y I_{j,k,c,t}^{P,M,2} \\
& + \sum_{j\in\{C,P,D,G\}} \sum_{k\in\{C,P\}} \sum_{c\in\{F\}} \left(t_{j,t}^{I,B,DutyV} + t_{j,k,c,t}^{I,B,DutyQ}\right) \left(1 + t_{j,t}^{I,B,Cus}\right) P_t^F I_{j,k,c,t}^{P,B,2} \\
& + \sum_{j\in\{C,P,D,G\}} \sum_{k\in\{C,P\}} \sum_{c\in\{D\}} \left(t_{j,t}^{I,B,DutyV} + t_{j,k,c,t}^{I,B,DutyQ}\right) P_{k,t}^Y I_{j,k,c,t}^{P,B,2} \\
& + \sum_{j\in\{C,P,G\}} \left(t_t^{X,DutyV} + t_{j,t}^{X,DutyQ}\right) P_{j,t}^Y X_{j,t} \\
& + \sum_{k\in\{C,P\}} \sum_{c\in\{D\}} \left(t_t^{I,I,DutyV} + t_{k,c,t}^{I,I,DutyQ}\right) P_{k,t}^Y I_{k,t}^{P,I} \\
& + \sum_{k\in\{C,P\}} \sum_{c\in\{F\}} \left(t_t^{I,I,DutyV} + t_{k,c,t}^{I,I,DutyQ}\right) \left(1 + t_t^{I,I,Cus}\right) P_t^F I_{k,t}^{F,I}.
\end{aligned}
\tag{7.10}
$$

Motor vehicle registration duties

Motor vehicle registration duties are paid by households, the government sector and by producers, cf. (7.11). As means of transportation are not modelled independently in DREAM, for households and the government sector, the tax is modelled as a proportional tax rate ($t_{e,t}^{H,Reg}$ respectively $t_t^{G,Reg}$) on the value of total consumption. For the private production sectors, the proportional tax $t_{j,t}^{P,Reg}$ is levied on the value of machinery investments.

$$
\begin{aligned}
TR_t^{Reg} \quad = \quad & \sum_{e\in\{D,R,G,P\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} t_{e,t}^{H,Reg} \left(1 + t_{e,t}^{H,Cus}\right) P_t^F C_{e,k,c,t}^{H,2} \\
& + \sum_{e\in\{D,R,G,P\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} t_{e,t}^{H,Reg} P_{k,t}^Y C_{e,k,c,t}^{H,2} \\
& + \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} t_t^{G,Reg} \left(1 + t_t^{G,Cus}\right) P_t^F C_{k,c,t}^{G,2} \\
& + \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} t_t^{G,Reg} P_{k,t}^Y C_{k,c,t}^{G,2} \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{P\}} \sum_{c\in\{F\}} t_{j,t}^{P,Reg} \left(1 + t_{j,t}^{I,M,Cus}\right) P_t^F I_{j,k,c,t}^{P,M,2} \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{P\}} \sum_{c\in\{D\}} t_{j,t}^{P,Reg} P_{k,t}^Y I_{j,k,c,t}^{P,M,2}.
\end{aligned}
\tag{7.11}
$$

Other taxes on production

Finally, remaining indirect taxes on production are simply calibrated residually as proportional taxes on the value of material inputs into production, cf. (7.12):

$$
\begin{aligned}
TR_t^{Res} \quad = \quad & \sum_{j\in\{C,P,G\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} t_{j,t}^{Res} \left(1 + t_{j,t}^{M,Cus}\right) P_t^F M_{j,k,c,t}^2 \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} t_{j,t}^{Res} P_{k,t}^Y M_{j,k,c,t}^2.
\end{aligned}
\tag{7.12}
$$

7.1.5 Source taxes

Source taxation is the largest single component of government revenue. It comprises income tax payments from households to central and local governments on labour, capital, transfer and funded pensions income as well as the revenue from owner-occupied dwellings. As described in chapter 5 on households, in DREAM, taxation on capital income (income from bond and stock holdings) is completely separated from taxation on personal, i.e. non-capital income.

(7.13b) - (7.13d) show the revenue from county, municipality and church taxation: the relevant tax rates times the tax base which is taxable personal income per person $Y_{o,s,a,t}^{H,Pers}$ minus the basic personal tax allowance $allow_t^{Pers}$, personal payments to unemployment funds and early retirement benefits, other assessment-oriented allowances $allow_t^{Assess}$, the earned income tax credit (EITC), and finally a calibration correction term k_t^{Source} which ensures that the whole source tax revenue replicates the NA figures.

In the Danish tax system, the EITC is an assessment-oriented allowance reducing local-government income taxation. The size of the allowance is a certain fraction of wage income until a limit. In DREAM, this has been transformed into an effective proportional earned income tax credit rate $t_t^{EITCEff}$, which has been exogenously calculated in a pre-model using micro-data from a representative sample of the Danish population. The total revenue loss due to the EITC is consequently equal to the sum of wage income (less deduction of pension payments) times the tax rates of county, municipality and church taxes times the effective earned income tax credit rate $t_t^{EITCEff}$.

(7.13e) shows the revenue from the bottom-bracket state tax, which is similar, except that certain tax reliefs are not deducted from the bottom tax base.

(7.13f) represents revenue from middle-bracket and top-bracket income taxes, where $TR_{o,s,a,t}^{MidInd}$ is the middle-bracket tax payments from each person of origin o, sex s and age a, etc (cf. chapter 5 on Households). (7.13g) is equal to the total tax revenue from owner-occupied dwellings (ejendomsværdiskat). The correction term $k_t^{t,Dwe}$ is necessary because the tax base in (7.13g) overestimates the total value of owner-occupied dwellings in Denmark. This is the case because all residential homes are owner-occupied dwellings in DREAM as the model does not consider consider rented building.

The remaining part of the source tax revenue expression shows revenues from various kinds of capital income taxation. (7.13h) shows tax revenue from the taxation of interest income and of dividends from equity. (7.13i) shows revenue from the tax on capital gains of the equity stocks of the households. Line (7.13j) is a special term only used in shock periods to tax capital gains following from the shock, cf. chapter 5 on households. Finally, the last line (7.13k) represents the lump-sum transfers to all adults used to make total revenue from source taxation replicate the national accounts of the base-line year.

$$TR_t^{Source} = \tag{7.13a}$$

$$\left(t_t^{Cou} + t_t^{Mun} + t_t^{Chu}\right) \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} \left(Y_{o,s,a,t}^{H,Pers} - k_t^{Source} - allow_t^{Pers} - allow_t^{Assess}\right. \tag{7.13b}$$

$$-r_{s,a,t}^{PEWq} k_t^{PEW} w_t^{PEW} Unemp_t^{Max} - r_{s,a,t}^{Unempq} k_t^{Unemp} w_t^{Unemp} Unemp_t^{Max} \tag{7.13c}$$

$$-t_t^{EITCEff} adj_t^{Hours} r_{o,s,a,t}^{LabFull} \left(1 + adj_t^{LS}\right) L_{o,s,a,t}^{S} \left(\rho_{o,s,a,t} W_t \left(1 - q_{o,s,a,t}^{ZF} - q_{s,a,t}^{ZP}\right) - q_{a,t}^{ATP}\right)\Big) \tag{7.13d}$$

$$+t_t^{Bot} \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} \left[N_{o,s,a,t}^{Ind} \left(Y_{o,s,a,t}^{H,Pers} - k_t^{Source} - allow_t^{Pers}\right)\right] \tag{7.13e}$$

$$+ \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} \left(TR_{o,s,a,t}^{MidInd} + TR_{o,s,a,t}^{TopInd}\right) \tag{7.13f}$$

$$+ \left(1 + k_t^{Dwe}\right) t_t^{Dwe} \sum_{j\in\{D\}} \sum_{a\in a} \left(P_{j,t-1}^{K,H,B} K_{a-1,t-1}^{H,B} + P_{j,t-1}^{K,H,L} K_{a-1,t-1}^{H,L,Ind}\right) N_{a-1,t-1}^{Adult,Eq} \tag{7.13g}$$

$$+t_t^{H,Int} i_t \left(1 + w^{Assets}\right) A_{t-1}^{H,Fin} + t_t^{H,Div} \sum_{j\in\{C,P\}} DIV_{j,t} w^{Assets} \frac{A_{t-1}^{H,Fin}}{\sum_{j\in\{C,P\}} V_{j,t-1}} \tag{7.13h}$$

$$+t_t^{H,Gain} \sum_{j\in\{C,P\}} V_{j,t} - V_{j,t-1} w^{Assets} \frac{A_{t-1}^{H,Fin}}{\sum_{j\in\{C,P\}} V_{j,t-1}} \tag{7.13i}$$

$$+d^{TC,Gain,Ini} t_{t-1}^{H,Gain} w^{Assets} \frac{A_{t-1}^{H,NoShock}}{\sum_{j\in\{C,P\}} V_j^{NoShock}} \sum_{j\in\{C,P\}} \left(V_{j,t-1} - V_j^{NoShock}\right), \text{ (if shock period)} \tag{7.13j}$$

$$-o_t^{G,H,Lump,Int} \sum_{a\in Ax0} N_{a,t}^{Adult}. \tag{7.13k}$$

7.1.6 Other revenue sources

Payroll tax

The payroll tax (arbejdsmarkedsbidrag) $TR_t^{Payroll}$ is levied on the total wage sum of the whole population except for ATP contributions which are deducted in advance, cf. (7.14). $t_t^{Payroll}$ is the actual (not a calibrated) rate; to make the total revenue replicate that of the national accounts, the correction factor $k_t^{Payroll}$ is used.

$$\begin{aligned} TR_t^{Payroll} &= \left(1 + k_t^{Payroll}\right) t_t^{Payroll} \\ &\times \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} adj_t^{Hours} r_{o,s,a,t}^{Lab,Full} \left(1 + adj_t^{LS}\right) L_{o,s,a,t}^{S} \left(\rho_{o,s,a,t} W_t - q_{a,t}^{ATP}\right). \end{aligned} \tag{7.14}$$

Other personal income taxes

The term other personal income taxes covers the taxation of pensions receipts from private pension funds and from LD (Lønmodtagernes Dyrtidsfond). They are paid out as one-time payments and are consequently taxed with the corresponding tax rate in the Danish tax system of 40 per cent. That is, unlike other kinds of pensions payments, they do not form part of the notion "taxable personal income" of each tax-payer ($Y^{H,Pers}_{o,s,a,t}$), which is taxed progressively and makes up the largest part of the source tax revenue.

$$TR^{CapPen}_t = t^{CapPen}_t \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N^{Able}_{s,a,t} \left(b^{ZPR}_{a,t} + b^{LD}_{a,t}\right). \tag{7.15}$$

Motor vehicle weight duties

The motor vehicle weight duty $TR^{H,Weight}_t$ paid by households is represented by a proportional rate $t^{H,Weight}_t$ levied on the value of total consumption of all households. Again, this modelling has been chosen because DREAM does not explicitly treat consumption of motor vehicles:

$$TR^{H,Weight}_t = t^{H,Weight}_t P^{C,H}_{C,t} \sum_{a\in Ax0} N^{AdultEq}_{a,t} C^{H}_{C,a,t}. \tag{7.16}$$

Corporation taxes

The corporation tax rate t^{Cor}_t is levied on the taxable profits of firms: value of total production in the two private sectors, which includes the pure rent from the North Sea, minus expenses for materials inputs, wages including contributions for LG (Lønmodtagernes Garantifond) q^{LG}_t, depreciation allowances, interest expenses on debt, and other taxes less subsidies on production (i.e. employers' and wage-sum taxes, motor vehicle weight duties and property taxes of firms are subtracted from, and agricultural subsidies from the EU and capital transfers from the government are added to the taxable profits).

$$
\begin{aligned}
TR_t^{Cor} = \; & t_t^{Cor}\left(1+k_t^{Cor}\right)\sum_{j\in\{C,P\}}\Big[P_{j,t}^{Y}\left(Y_{j,t}+Y_{j,t}^{NorthSea}\right)-P_{j,t}^{M}M_{j,t} \\
& -\left(1+t_{j,t}^{Emp}+t_{j,t}^{W}+q_t^{LG}\right)W_tL_{j,t}^{D} \\
& -\left(\delta_{j,t}^{P,M,Book}K_{j,t-1}^{P,M,Book}+\delta_{j,t}^{P,B,Book}K_{j,t-1}^{P,B,book}\right) \\
& -i_tD_{j,t-1}^{P} \\
& -t_{j,t}^{P,Weight}K_{j,t-1}^{P,M}-t_{j,t}^{P,Land}P_{j,t-1}^{I,P,B}K_{j,t-1}^{P,B} \\
& +s_{j,t}^{EU,P,SetAside}+s_{j,t}^{EU,P,Rural}+o_{j,t}^{G,P,Cap}\Big].
\end{aligned} \tag{7.17}
$$

Taxes on pension yields

The tax t_t^Z on yields of pension scheme assets is levied on interest income, dividends and capital gains of private and labour market pension funds including the LD, ATP and SP funds. Note, however, that these tree funds are assumed to hold only bonds. The last line of 7.18 represents a special term for taxing capital gains when a surprise shock takes place.

$$
\begin{aligned}
TR_t^{PensInt} = \; & t_t^Z i_t\left(A_{t-1}^Z-w_{t-1}^{Z,Shares}\sum_{j\in\{C,P\}}V_{j,t-1}\right) \\
& +t_t^Z w_{t-1}^{Z,Shares}\sum_{j\in\{C,P\}}DIV_{j,t} \\
& +t_t^Z w_{t-1}^{Z,Shares}\sum_{j\in\{C,P\}}\left(V_{j,t}-V_{j,t-1}\right) \\
& +d^{T,Gain,Ini}t_{t-1}^{Z}w_{t-1}^{Z,Shares,NoShock}\sum_{j\in\{C,P\}}\left(V_{j,t-1}-V_j^{NoShock}\right), \ \text{(if shock period)}.
\end{aligned} \tag{7.18}
$$

Social contributions

Government revenue from compulsory and voluntary social contributions $TR_t^{SocCont}$ consists of six different components, cf. (7.19). The first term is contributions to the LG fund, which are proportional to the wage sum. The second and third term represent contributions to unemployment funds and the post-employment wage arrangement, respectively. Finally, there are two terms representing remaining mandatory and voluntary social contributions, respectively (which are modelled simply as lump-sum payments from all adults) and a term OR_t^{CSImp} representing imputed contributions to pensions for civil servants.

$$
\begin{aligned}
TR_t^{SocCont} = {} & W_t \sum_{j\in\{C,P\}} q_t^{LG} L_{j,t}^{D} \\
& + \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} r_{s,a,t}^{PEWq} k_t^{PEW} w_t^{PEW} Unemp_t^{Max} \\
& + \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} r_{s,a,t}^{Unempq} k_t^{Unemp} w_t^{Unemp} Unemp_t^{Max} \\
& + \sum_{a\in Ax0} N_{a,t}^{Adult} o_t^{H,G,Soc} + \sum_{a\in Ax0} N_{a,t}^{Adult} o_t^{H,G,Soc,Opt} + OR_t^{CS,Imp}.
\end{aligned}
\tag{7.19}
$$

Tax on bequests

The tax on bequests is a proportional tax on the inheritance at the end of last period plus its interest (where $Ax0pu$ is the last planning generation):

$$
TR_t^{Beq} = \sum_{a\in Ax0pu} N_{a,t-1}^{Adult,Eq} t_t^{Beq} \left(1 + i_t^H\right) A_{t-1}^{H,Beq}. \tag{7.20}
$$

Current and capital transfers

Finally, general government revenue includes a number of current and capital transfers which are handled simply as lump-sum income from domestic and foreign sources, cf. (7.21) and (7.22). Current transfers include transfers to the government from the EU $OR_t^{EU,G}$, residually from foreign countries $OR_t^{F,G,Res}$, and from households, where $o_t^{H,G}$ is the transfer from each adult:

$$
OR_t^{G} = OR_t^{EU,G} + OR_t^{F,G,Res} + \sum_{a\in Ax0} N_{a,t}^{Adult} o_t^{H,G}. \tag{7.21}
$$

Capital transfers to the government originate from two sources: from the rest of the world generally, and from households, cf. (7.22):

$$
TR_t^{Ocap} = OR_t^{F,G,Cap} + \sum_{a\in Ax0} N_{a,t}^{Adult} o_t^{H,G,Cap}. \tag{7.22}
$$

7.2 Government Expenditure

Like government revenue, total government expenditure can be divided into a number of sub-categories, cf. table 2. Again, we do not treat interest expenditure here, as only net interest payments are modelled in DREAM, cf. section 7.3. It is evident from the table that total government expenditure consists of expenditure for government consumption ($P_t^{C,G}C_t^G$), government investment ($Exp_t^{I,G}$), subsidies (excluding subsidies financed by the EU) (SR_t), current transfers to households and other current transfers to domestic and foreign recipients (OR_t) and capital transfers ($OR_t^{G,H,Cap}$). The last term in the table is the calibrated lump-sum transfer to households which ensures that the amount of total government expenditure corresponds to the national accounts of the base year, where $o_t^{G,H,LumpExp}$ is the lump-sum received by each adult. The remaining categories are dealt with below.

Total current and capital expenditure	Exp_t^G
Government consumption	$P_t^{C,G}C_t^G$
Investment expenditure	$Exp_t^{I,G}$
Subsidies	SR_t
Interest expenditure	
Current transfers	OR_t
Capital transfers	$OR_t^{G,H,Cap}$
Lump-sum correction term	$\sum_{a\in Ax0} N_{a,t}^{Adult} o_t^{G,H,LumpExp}$

7.2.1 Government Consumption

Total government consumption C_t^G can be divided into individual government consumption $C_t^{G,Ind}$ (which accounts for about two thirds of the total in the base year) and collective government consumption $C_t^{G,Coll}$ (the remaining third), cf. (7.23). Individual government consumption comprises all those elements of consumption which can be directly attributed to specific individuals, e.g. health care, education, institutions for children, elderly, etc. Collective government consumption is the part of consumption expenditure which is non-rival so that it benefits the whole population. Examples are research, central administration, defence and the judicial system.

$$C_t^G = C_t^{G,Ind} + C_t^{G,Coll}. \tag{7.23}$$

Incidentally, note that government consumption does not explicitly enter the utility function of

Figure 7.1:

the agents. One interpretation of this is that the utility function of the agents has an implicit additively separable argument containing government consumption, so that the amount of government consumption does not affect the marginal utility of private consumption and vice versa. This specification of government consumption in the utility function (i.e. it is omitted) implies that the model is ill-suited to analyze welfare effects of changes in the size of government consumption *per se*.

The nest structure of the components of government consumption demand is illustrated in Figure 1. C_t^G is made up by intermediate inputs from the construction sector, the private production sector and the producer of government services, which are combined in a CES function:

$$C_t^G = \sum_{k\in\{C,P,G\}} \left[\left(\mu_k^{C,G,1}\right)^{\frac{1}{\sigma^{C,G}}} \left(C_{k,t}^{G,1}\right)^{\frac{\sigma^{C,G}-1}{\sigma^{C,G}}} \right]^{\frac{\sigma^{C,G}}{\sigma^{C,G}-1}}. \tag{7.24}$$

The intermediate inputs into this function $C_{k,t}^{G,1}$ are themselves potential CES aggregates over domestic and imported consumption goods, cf. (7.25):

$$C_{k,t}^{G,1} = \sum_{k\in\{C,P,G\}} \left[\left(\mu_{k,c}^{C,G,2}\right)^{\frac{1}{\sigma^{C,G,1}}} \left(C_{k,c,t}^{G,2}\right)^{\frac{\sigma^{C,G,1}-1}{\sigma^{C,G,1}}} \right]^{\frac{\sigma^{C,G,1}}{\sigma^{C,G,1}-1}}. \tag{7.25}$$

In practice, however, only in the case of intermediates from the private production sector are imported goods actually used. In the case of deliverances from the producer of government services and the construction sector, $\mu^{C,G,2}_{k,c}$ acts as a dummy ensuring that $C^{G,1}_{k,t} = C^{G,2}_{k,d,t}$.

The government minimizes its costs of providing a given aggregate consumption level C^G_t. This is a standard CES problem, and the solution (cf. appendix) leads to the following demand function for $C^{G,1}_{k,t}$ and price index $P^{C,G}_t$:

$$C^{G,1}_{k,t} = \mu^{C,G,1}_k \left(\frac{P^{C,G}_t}{P^{C,G,1}_{k,t}} \right)^{\sigma^{C,G}} C^G_t, \tag{7.26}$$

$$P^{C,G}_t = \left[\sum_{k \in \{C,P,G\}} \mu^{C,G,1}_k \left(P^{C,G,1}_{k,t} \right)^{1-\sigma^{C,G}} \right]^{\frac{1}{1-\sigma^{C,G}}}. \tag{7.27}$$

Correspondingly, standard cost-minimizing procedures lead to the following demand function for $C^{G,2}_{k,t}$ and price index $P^{C,G,1}_t$:

$$C^{G,2}_{k,c,t} = \mu^{C,G,2}_{k,c} \left(\frac{P^{C,G,1}_{k,t}}{P^{C,G,2}_{k,c,t}} \right)^{\sigma^{C,G1}} C^{G,1}_{k,t}, \tag{7.28}$$

$$P^{C,G,1}_{k,t} = \left[\sum_{c \in \{C,D\}} \mu^{C,G,2}_{k,c} \left(P^{C,G,2}_{k,c,t} \right)^{1-\sigma^{C,G,1}_k} \right]^{\frac{1}{1-\sigma^{C,G,1}_k}}. \tag{7.29}$$

Finally, the price index for the aggregates used in the second nest depends on the domestic producer price $P^Y_{k,t}$ adjusted for the relevant taxes in the case of domestically produced goods, whereas in the case of imported goods, it is equal to the foreign price P^F_t plus customs duties.

$$P^{C,G,2}_{k,c,t} = \left(1 - s^{G,G,Dwe}_t + t^{G,Reg}_t + t^{G,VAT}_t + t^{G,DutyV}_t + t^{G,DutyQ}_{k,c,t} - s^{G,G,Spe}_t - s^{G,EU,Spe}_t\right) P^Y_{k,t} \quad , c \in \{D\}, \tag{7.30a}$$

$$P^{C,G,2}_{k,c,t} = \left(1 - s^{G,G,Dwe}_t + t^{G,Reg}_t + t^{G,VAT}_t + t^{G,DutyV}_t + t^{G,DutyQ}_{k,c,t} - s^{G,G,Spe}_t - s^{G,EU,Spe}_t\right) \times \left(1 + t^{G,Cus}_t\right) P^F_t \quad , c \in \{F\}. \tag{7.30b}$$

7.2.2 Investment Expenditure

Investment expenditure consists of machinery and building investment multiplied by a term containing the correction factor $k_t^{G,I}$, which originates in the calibration process to catch the difference between investment in the government sector and investment carried out by the producer of government services:

$$Exp_t^{I,G} = \left(1 + k_t^{G,I}\right) \left(\sum_{j \in \{G\}} P_{j,t}^{I,P,M} I_{j,t}^{P,M} + \sum_{j \in \{G\}} P_{j,t}^{I,P,B} I_{j,t}^{P,B} \right). \tag{7.31}$$

7.2.3 Subsidies

Like indirect taxes, subsidies can be divided into product subsidies, paid directly in proportion to the value or number of units of production, and other subsidies on production, which are independent of the amount of actual production. Furthermore, subsidies are paid either by the EU or by the government sector. Consequently, superscripts for subsidy rates denote first the sector paying the subsidy (G or EU), then the sector receiving the subsidy, and finally an extra identification. Total expenditure for subsidies are shown in (7.32). Concerning product subsidies, DREAM distinguishes between EU-financed rural subsidies (hektarstøtte) with the superscript $Rural$, EU-financed export subsidies with the superscript Exp, and remaining subsidies with the superscript Spe (for product-specific), which may be financed by either the EU or the government. Concerning other subsidies on production, a distinction is made between EU-financed set-aside schemes (braklægningsstøtte), subsidies for dwelling purposes paid by the government (with the superscript Dwe), and residual subsidies (with the superscript Res), which may be financed by either EU or the government. As land does not figure as a production factor in DREAM, rural subsidies as well as set-aside schemes are both represented in the model by a lump-sum ($s_{j,t}^{EU,P,SetAside}$ and $s_{j,t}^{EU,P,Rural}$, respectively) transfer to the private production sectors. The remaining subsidies are modelled as proportional rates on the value of various demand categories: imported and domestic materials, government and household consumption, machinery and building investments, and export goods, respectively. Consequently, $s_{j,t}^{EU,P,Spe}$ is the rate for product-specific subsidies from the EU in sector j, $s_{j,t}^{G,P,Dwe}$ is the subsidy rate for dwelling subsidies for production sector j, etc. The rates are calibrated to fit the actual subsidies paid in the base-line year.

$$\begin{aligned}
SR_t = & \sum_{j\in\{C,P\}} \left(s_{j,t}^{EU,P,SetAside} + s_{j,t}^{EU,P,Rural} \right) \qquad (7.32) \\
& + \sum_{j\in\{C,P,G\}} \Bigg[\left(s_{j,t}^{G,P,Dwe} + s_{j,t}^{G,P,Res} + s_{j,t}^{EU,P,Res} + s_{j,t}^{G,P,Spe} + s_{j,t}^{EU,P,Spe} \right) \\
& \quad \times \left(\sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} \left(1 + t_{j,t}^{M,Cus}\right) P_t^F M_{j,k,c,t}^2 + \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} P_{k,t}^Y M_{j,k,c,t}^2 \right) \Bigg] \\
& + \left(s_t^{G,G,Dwe} + s_t^{G,G,Spe} + s_t^{EU,G,Spe} \right) \\
& \quad \times \left(\sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} \left(1 + t_{k,t}^{G,Cus}\right) P_t^F C_{k,c,t}^{G,2} + \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} P_{k,t}^Y C_{k,c,t}^{G,2} \right) \\
& + \left(s_t^{G,X,Spe} + s_t^{EU,X,Exp} + s_t^{EU,X,Spe} \right) \sum_{k\in\{C,P,G\}} P_{k,t}^Y X_{k,t} \\
& + \sum_{e\in\{D,R,G,P\}} \sum_{k\in\{C,P,G\}} \Bigg[\left(s_{e,t}^{G,H,Dwe} + s_{e,t}^{G,H,Spe} + s_{e,t}^{EU,H,Spe} \right) \\
& \quad \times \left(\sum_{c\in\{F\}} \left(1 + t_{d,t}^{H,Cus}\right) P_t^F C_{d,k,c,t}^{H,2} + \sum_{c\in\{D\}} P_{k,t}^Y C_{d,k,c,t}^{H,2} \right) \Bigg] \\
& + \sum_{j\in\{C,P,G\}} \Bigg[\left(s_{j,t}^{G,I,M,Spe} + s_{j,t}^{EU,I,M,Spe} \right) \\
& \quad \times \left(\sum_{k\in\{P\}} \sum_{c\in\{F\}} \left(1 + t_{j,t}^{I,M,Cus}\right) P_t^F I_{j,k,c,t}^{P,M,2} + \sum_{k\in\{P\}} \sum_{c\in\{D\}} P_{k,t}^Y I_{j,k,c,t}^{P,M,2} \right) \Bigg] \\
& + \sum_{j\in\{C,P,D,G\}} \Bigg[\left(s_{j,t}^{G,I,B,Dwe} + s_{j,t}^{G,I,B,Spe} + s_{j,t}^{EU,I,B,Spe} \right) \\
& \quad \times \left(\sum_{k\in\{C,P\}} \sum_{c\in\{F\}} \left(1 + t_{j,t}^{I,B,Cus}\right) P_t^F I_{j,k,c,t}^{P,B,2} + \sum_{k\in\{C,P\}} \sum_{c\in\{D\}} P_{k,t}^Y I_{j,k,c,t}^{P,B,2} \right) \Bigg] \\
& - SR_t^{EU,G}.
\end{aligned}$$

Finally, it can be seen from (7.32) that the subsidies which are financed by the EU, $SR_t^{EU,G}$, are subtracted from the total number of subsidies in order to achieve the expenditure for subsidies by the domestic government. ($SR_t^{EU,G}$ is defined in chapter 8 on the foreign sector on page 230).

7.2.4 Transfers

Most transfers are given from the government to the households. In DREAM, a major distinction is made between income-replacing transfers (like old-age pensions, unemployment benefits, students' allowances, etc.) and non-income-replacing transfers to households, which include housing and child benefits among others. Income-replacing transfers are distributed to each population group of a certain origin, sex and age according to the number of people in the group eligible to receive the transfer in question. Some of the non-income-replacing transfers are distributed in the same ways (i.e. they are "age-dependent"), whereas others are distributed lump-sum because of lack of data. Also civil servants' pensions schemes belong to the category of transfers given from the government sector to households. Finally, a number of current and capital transfers from the NA, which in DREAM are modelled in a rather simple lump-sum fashion, are also included.

Total current transfers are shown in (7.33):

$$OR_t = OR_t^{IncomeRepl} \tag{7.33a}$$

$$+ \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{s,a,t}^{Able} o_{a,t}^{G,H,CS} \tag{7.33b}$$

$$+ \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} \left(o_{s,a,t}^{G,H,AgeDepNoTax} + o_{s,a,t}^{G,H,AgeDepTax} + o_t^{G,H,NonAgeDep} \right) \tag{7.33c}$$

$$+OR_t^{G,EU,GNI} + OR_t^{G,EU,Res} + OR_t^{G,EU,VAT} + OR_t^{G,Gr} + OR_t^{G,FI} + OR_t^{G,F,Res} \tag{7.33d}$$

$$+ \sum_{a\in Ax0} N_{a,t}^{Adult} o_t^{G,H}. \tag{7.33e}$$

The majority of the current transfers are income-replacing transfers $OR_t^{IncomeRepl}$, which are subdivided in more detail in (7.34) below. Line 7.33b refers to the pension for civil servants $o_{a,t}^{G,H,CS}$, which is given out as a lump-sum supplement to all people over a certain age. Line 7.33c refers to various age-dependent (taxable as well as non-taxable) transfers which are distributed to the population after ethnic origin, sex and age according to the micro-data sample provided by the Law Model. Their composition is specified further below, cf. (7.35) and (7.36). Remaining current transfers in line 7.33d include GNI ($OR_t^{G,EU,GNI}$), VAT ($OR_t^{G,EU,VAT}$) and remaining government payments ($OR_t^{G,EU,Res}$) to the EU, transfers to Greenland ($OR_t^{G,Gr}$), the Faroe Isles ($OR_t^{G,FI}$) and the rest of the world generally ($OR_t^{G,F,Res}$), and in line 7.33e per capita (adult-equivalent) transfers to households $o_t^{G,H}$.

DREAM distinguishes between 12 different income-replacing transfers to households, cf. (7.34), of which the 11 are treated in basically the same way: students' allowances $o_t^{G,H,S}$, post-employment wage (efterløn) $o_t^{G,H,PEW}$, leave allowances (orlovsydelse) $o_t^{G,H,LA}$, maternity benefits $o_t^{G,H,MB}$, sickness benefits $o_t^{G,H,SB}$, bridging benefits (overgangsydelse) $o_t^{G,H,BB}$, anticipatory pensions (førtidspension) $o_t^{G,H,AP}$, old age pensions $o_{s,a,t}^{G,H,OAP}$, cash assistance (kontanthjælp) for people who are not unemployed $o_t^{G,H,CA}$, activation benefits $o_t^{G,H,AB}$, and finally introduction benefits for newly arrived immigrants $o_t^{G,H,IB}$. In all these cases, the number of people in each arrangement is projected exogenously.

The amount of people receiving the 12th income-replacing transfer, unemployment benefits (the last line in (7.34)), is endogenous in the model, however, because of the endogenous effective labour supply.

$$
\begin{aligned}
OR_t^{IncomeRepl} = \; & o_t^{G,H,S} \sum_{o \in oLab} \sum_{s \in \{m,f\}} \sum_{a \in Ax0} N_{o,s,a,t}^{Ind} \left(r_{o,s,a,t}^{S} + r_{o,s,a,t}^{LabS} \right) \\
& + o_t^{G,H,Pew} \sum_{o \in oLab} \sum_{s \in \{m,f\}} \sum_{a \in Ax0} N_{o,s,a,t}^{Ind} r_{o,s,a,t}^{Pew} \\
& + o_t^{G,H,LA} \sum_{o \in oLab} \sum_{s \in \{m,f\}} \sum_{a \in Ax0} N_{o,s,a,t}^{Ind} r_{o,s,a,t}^{LA} \\
& + o_t^{G,H,MB} \sum_{o \in oLab} \sum_{s \in \{m,f\}} \sum_{a \in Ax0} N_{o,s,a,t}^{Ind} r_{o,s,a,t}^{MB} \\
& + o_t^{G,H,SB} \sum_{o \in oLab} \sum_{s \in \{m,f\}} \sum_{a \in Ax0} N_{o,s,a,t}^{Ind} \left(r_{o,s,a,t}^{SB} + r_{o,s,a,t}^{LabSB} \right) \\
& + o_t^{G,H,BB} \sum_{o \in oLab} \sum_{s \in \{m,f\}} \sum_{a \in Ax0} N_{o,s,a,t}^{Ind} r_{o,s,a,t}^{BB} \\
& + o_t^{G,H,AP} \sum_{o \in oLab} \sum_{s \in \{m,f\}} \sum_{a \in Ax0} N_{o,s,a,t}^{Ind} \left(r_{o,s,a,t}^{AP} + r_{o,s,a,t}^{LabAP} \right) \\
& + \sum_{o \in oLab} \sum_{s \in \{m,f\}} \sum_{a \in Ax0} N_{o,s,a,t}^{Ind} \left(r_{o,s,a,t}^{OAP} + r_{o,s,a,t}^{LabOAP} \right) o_{s,a,t}^{G,H,OAP} \\
& + o_t^{G,H,CA} \sum_{o \in oLab} \sum_{s \in \{m,f\}} \sum_{a \in Ax0} N_{o,s,a,t}^{Ind} r_{o,s,a,t}^{CA} \\
& + o^{G,H,AB} \sum_{o \in oLab} \sum_{s \in \{m,f\}} \sum_{a \in Ax0} N_{o,s,a,t}^{Ind} r_{o,s,a,t}^{AB} \\
& + o_t^{G,H,IB} \sum_{o \in oLab} \sum_{s \in \{m,f\}} \sum_{a \in Ax0} N_{o,s,a,t}^{Ind} r_{o,s,a,t}^{IB} \\
& + \sum_{o \in oLab} \sum_{s \in \{m,f\}} \sum_{a \in Ax0} N_{o,s,a,t}^{Ind} adj_t^{Hours} r_{o,s,a,t}^{LabFull} \left(L_{o,s,a,t}^{Max} - L_{o,s,a,t}^{S} \right) o_{o,s,a,t}^{G,H,Unemp}.
\end{aligned}
\tag{7.34}
$$

Non-income-replacing transfers can be subdivided into two groups: Non-age-dependent transfers ($o_t^{G,H,NonAgeDep}$), which are given out lump-sum to all adults, and age-dependent transfers. The last group is further subdivided into two groups for taxing purposes, as some of them are taxed as personal income. The taxable age-dependent transfers (which are elements of the set bTax) are aggregated into $o_{s,a,t}^{G,H,AgeDepTax}$, and the non-taxable transfers into $o_{s,a,t}^{G,H,AgeDepNoTax}$:

$$o_{s,a,t}^{G,H,AgeDepNoTax} = \sum_{b \notin bTax} o_{b,s,a,t}^{G,H,AgeDep}, \tag{7.35}$$

$$o_{s,a,t}^{G,H,AgeDepTax} = \sum_{b \in bTax} o_{b,s,a,t}^{G,H,AgeDep}. \tag{7.36}$$

Finally, capital transfers $OR_t^{G,H,Cap}$ are of three kinds: to households, producers and the rest of the world:

$$OR_t^{G,H,Cap} = \sum_{a \in Ax0} N_{a,t}^{Adult} o_t^{G,H,Cap} + \sum_{j \in \{C,P\}} o_{j,t}^{G,P,Cap} + OR_t^{G,F,Cap}. \tag{7.37}$$

7.3 The primary budget and government debt

The government primary budget balance is equal to total revenue minus total expenditure minus the lump-sum payment paid to all adults if sustainability is ensured by the use of lump-sum taxes (o_t^{lump}):

$$PrimBudg_t = Rev_t^G - Exp_t^G - \sum_{a \in Ax0} N_{a,t}^{Adult} o_t^{G,H,LumpSustain}. \tag{7.38}$$

Government debt in each period D_t^G is equal to government debt from last period plus its interest minus the primary surplus, cf. (7.39):

$$D_t^G = D_{t-1}^G + \left(i_t + i_t^{G,add}\right) D_{t-1}^G - PrimBudg_t. \tag{7.39}$$

Here, $i_t^{G,add}$ is a supplement to the interest rate for assets for the government sector, which may differ from the bond interest rate i_t. The reason is that net government assets is a sum of gross assets and liabilities which may have different interest rates. As a default, the supplement is set to zero in DREAM's baseline in all years after the calibration year.

7.4 Projection of government sector variables

In the projections of DREAM, the future development of the variables of the government sector are treated in a number of different ways which are summed up here:

1) Some variables are simply constant. This is true for most tax and all subsidy rates and for multiplicative correction terms.

2) Some variables rise with the exogenous Harrod-neutral labour productivity growth rate and/or with foreign inflation (i.e., they are constant in "growth- and inflation-corrected terms"). This is true for some additive correction terms from the calibration process (e.g. k^{Depr}) .

3) Some variables rise with the endogenous wage, or more precisely: they follow the official indexation rules (satsreguleringen), which replicate wage indexation except for some minor details, cf. below. This is true for most transfers given to households and for contributions to unemployment funds, cf. (7.4.3).

4) Tax rates which are affected by the present Danish tax freeze are effectively reduced in line with the relevant endogenous inflation rate during the periods in which the tax freeze is effective, cf. section 7.4.1.

5) Some variables follow various other endogenous economic activities or price developments, possibly in combination with exogenously projected developments. E.g. the exogenous population projection plays a large role in the development of some variables, notably age-dependent government consumption and age-dependent transfers.

The endogenous policy rule which ensures that fiscal policy is sustainable belongs to this category. As described below, various policy rules have been used for this purpose in DREAM, usually either a tax rate or collective government consumption. Other important components are government investments, which are proportional to government production, and collective government consumption (even outside sustainability adjustment periods), which normally follows GDP. Lump-sum transfers which are results of the calibration process are normally indexed to particular kinds of economic activity, e.g. investment flows or labour market variables.

6) A few variables are simply set exogenously according to specially provided figures from various sources. An example is the projection of expenses for civil servants' pensions. In this category also belongs variables which are set to zero after the initial calibration year, notably the supplement to the normal interest rate with which the debt of the general government sector is paid in the initial year.

7.4.1 Special indexation equations used in connection with the Danish tax freeze

The Danish tax freeze was instituted from 2002. Its main principle is that tax rates cannot be raised. In DREAM, the normal rule is that all tax rates are kept constant during the projection, so that the tax freeze does not necessitate any particular modifications. However, there are two exceptions to this: The first is that some indirect taxes are levied as a fixed amount per quantity used. These taxes are effectively reduced in line with the inflation. As these taxes are represented in DREAM by ad valorem tax rates, it is necessary to reduce these effective tax rates following inflation using the special equations below. The second exception is that for the tax on owner-occupied dwellings (only), the tax freeze states that for existing buildings, the nominal tax paid cannot exceed the amount paid in 2001.

Consequently, in DREAM three kinds of taxes are assumed to be affected by the tax freeze: motor vehicle weight duties (vægtafgifter), excise duties (punktafgifter) in so far as they are quantity-based as opposed to ad valorem-based, and the tax on owner-occupied dwellings (ejendomsværdiskatten)[2]. The rates for motor vehicle weight duties and excise duties are reduced at a rate equal to the relevant inflation rate during the periods in which the tax freeze are in force. The relevant inflation rate is itself dependent on the origin of the taxed good: For imported goods, only the exogenous foreign inflation rate is taken into account, whereas for goods produced domestically, we adjust also for endogenous domestic price changes.

For motor vehicle weight duties on households, the relevant rate is the rise in the consumer price index $P_t^{C,H}$ times the foreign inflation rate:

[2] That is, we ignore minor consequences of the tax freeze for other taxes as motor vehicle registration duties and property taxes (grundskyld).

$$t_t^{H,Weight} = t_{t-1}^{H,Weight} \frac{P_{C,t-1}^{C,H}}{P_{C,t}^{C,H}}. \tag{7.40}$$

For motor vehicle weight duties levied on firms, only the rate of foreign inflation is used:

$$t_{j,t}^{P,Weight} = t_{j,t-1}^{P,Weight} \frac{1}{(1+g_t^P)} \quad , j \in \{P, C, G\}. \tag{7.41}$$

For quantity taxes, the rise in the net output price index times foreign inflation is used for taxes on domestic goods and services:

$$t_{k,c,t}^{G,DutyQ} = t_{k,c,t-1}^{G,DutyQ} \frac{P_{k,t-1}^{Y}}{P_{k,t}^{Y}} \quad , c = d, \, k \in \{C, P, G\}. \tag{7.42}$$

In the case of imported goods and services, only the foreign inflation rate is used:

$$t_{k,c,t}^{G,DutyQ} = t_{k,c,t-1}^{G,DutyQ} \frac{1}{(1+g_t^P)} \quad , c = f., \, k \in \{C, P, G\}. \tag{7.43}$$

For the following duties $t_{j,k,c,t}^{H,DutyQ}$, $t_{j,k,c,t}^{I,B,DutyQ}$, $t_{j,k,c,t}^{I,M,DutyQ}$, $t_{j,k,c,t}^{M,DutyQ}$, $t_{j,t}^{X,DutyQ}$, and $t_{j,c,t}^{I,I,DutyQ}$, we distinguish in the same way between indexation for tax rates on imported goods and tax rates on domestically produced goods, although the following equations present only the domestic case:

$$t_{d,k,c,t}^{H,DutyQ} = t_{d,k,c,t-1}^{H,DutyQ} \frac{P_{k,t-1}^{Y}}{P_{k,t}^{Y}} \quad , c = d, d \in \{D, R, G, P\}, \, k \in \{C, P, G\}, \tag{7.44}$$

$$t_{j,k,c,t}^{I,B,DutyQ} = t_{j,k,c,t-1}^{I,B,DutyQ} \frac{P_{k,t-1}^{Y}}{P_{k,t}^{Y}} \quad , c = d, j \in \{C, P, D, G\}, k \in \{C, P\}, \tag{7.45}$$

$$t_{j,k,c,t}^{I,M,DutyQ} = t_{j,k,c,t-1}^{I,M,DutyQ} \frac{P_{k,t-1}^{Y}}{P_{k,t}^{Y}} \quad , c = d, j \in \{C, P, D, G\}, k \in \{P\}, \tag{7.46}$$

$$t_{j,k,c,t}^{M,DutyQ} = t_{j,k,c,t-1}^{M,DutyQ} \frac{P_{k,t-1}^{Y}}{P_{k,t}^{Y}} \quad , c = d, j \in \{C, P, D, G\}, k \in \{C, P, G\}, \tag{7.47}$$

$$t_{k,t}^{X,DutyQ} = t_{k,t-1}^{X,DutyQ} \frac{P_{k,t-1}^{Y}}{P_{k,t}^{Y}}, \tag{7.48}$$

$$t_{j,c,t}^{I,I,DutyQ} = t_{j,c,t-1}^{I,I,DutyQ} \sum_{k\in\{C,P,D,G\}} \frac{P_{k,t-1}^{Y}}{P_{k,t}^{Y}} \qquad ,c = d, j \in \{C,P\}\,. \tag{7.49}$$

For the tax on owner-occupied dwellings t_t^{Dwe}, the final expression becomes rather complex for periods in which the tax freeze is active, cf. (7.51). This is due to the fact that we must distinguish between changes in the nominal value of the housing stock due to price changes and changes in the nominal value due to depreciation and the building of new houses.

Start out by supposing that the stock of buildings was unchanged from period to period. Then the correct expression for the effective tax rate during tax freeze periods would be:

$$t_{t+1}^{Dwe} = t_t^{Dwe} \frac{\sum\limits_{j\in\{D\}}\sum\limits_{a\in A}\left(P_{j,t-1}^{K,H,B}K_{a-1,t-1}^{H,B} + P_{j,t-1}^{K,H,L}K_{a-1,t-1}^{H,L}\right)N_{a-1,t-1}^{AdultEq}}{\sum\limits_{j\in\{D\}}\sum\limits_{a\in A}\left(P_{j,t}^{K,H,B}K_{a-1,t}^{H,B} + P_{j,t}^{K,H,L}K_{a-1,t}^{H,L}\right)N_{a-1,t}^{AdultEq}}, \tag{7.50}$$

where the numerator of the fraction is the nominal value of the housing stock at time $t-1$, and the denominator is the nominal value at time t. However, we have to take into account that the housing stock does actually change from period to period. Thus, (7.50) should be corrected for this by multiplying with the growth factor of the housing stock. The growth factor of the housing stock is the fraction

$$\frac{\sum\limits_{j\in\{D\}}\sum\limits_{a\in A}\left(P_{j,tFreeze}^{K,H,B}K_{a-1,t}^{H,B} + P_{j,tFreeze}^{K,H,L}K_{a-1,t}^{H,L}\right)N_{a-1,t}^{AdultEq}}{\sum\limits_{j\in\{D\}}\sum\limits_{a\in A}\left(P_{j,tFreeze}^{K,H,B}K_{a-1,t-1}^{H,B} + P_{j,tFreeze}^{K,H,L}K_{a-1,t-1}^{H,L}\right)N_{a-t,t-1}^{AdultEq}},$$

where buildings and land at time t (the numerator) and time $t-1$ (the denominator) are both measured at the same prices ($P_{j,tFreeze}^{K,H,B}$), i.e. the prices which were in force when the tax freeze was instituted. Mulitplying (7.50) with this growth factor leads to the expression

$$\begin{aligned} t_{t+1}^{Dwe} &= t_t^{Dwe} \times \frac{\sum\limits_{j\in\{D\}}\sum\limits_{a\in A}\left(P_{j,tFreeze}^{K,H,B}K_{a-1,t}^{H,B} + P_{j,tFreeze}^{K,H,L}K_{a-1,t}^{H,L,Ind}\right)N_{a-1,t}^{AdultEq}}{\sum\limits_{j\in\{D\}}\sum\limits_{a\in A}\left(P_{j,tFreeze}^{K,H,B}K_{a-1,t-1}^{H,B} + P_{j,tFreeze}^{K,H,L}K_{a-1,t-1}^{H,L,Ind}\right)N_{a-t,t-1}^{AdultEq}} \\ &\times \frac{\sum\limits_{j\in\{D\}}\sum\limits_{a\in A}\left(P_{j,t-1}^{K,H,B}K_{a-1,t-1}^{H,B} + P_{j,t-1}^{K,H,L}K_{a-1,t-1}^{H,L,Ind}\right)N_{a-1,t-1}^{AdultEq}}{\sum\limits_{j\in\{D\}}\sum\limits_{a\in A}\left(P_{j,t}^{K,H,B}K_{a-1,t}^{H,B} + P_{j,t}^{K,H,L}K_{a-1,t}^{H,L,Ind}\right)N_{a-1,t}^{AdultEq}}, \end{aligned} \tag{7.51}$$

which consequently states that the tax rate falls proportionally as prices on dwellings rise.

For periods in which the tax freeze is not active, the tax rates of the equations in this subsection are simply constant, e.g. (7.51) becomes

$$t_{t+1}^{Dwe} = t_t^{Dwe},$$

etc.

7.4.2 Indexation of government consumption

The development of individual government consumption $C_t^{G,Ind}$ can be indexed so that age-, gender- and origin-specific per capita expenses follow either the exogenous productivity growth and foreign inflation rates or so that per capita expenses follow GDP. In the first case, the expression becomes

$$\frac{C_t^{G,Ind}}{C_{t-1}^{G,Ind}} = \frac{C_t^{G,IndExo}}{C_{t-1}^{G,IndExo}} adj_t^{C,G}, \tag{7.52}$$

where the exogenous variable $C_t^{G,IndExo}$ represents the pure demographic development of consumers, and the variable $adj_t^{C,G}$ can be used to adjust government consumption in certain periods. Normally, it is simply equal to one. However, it may be used for modifying the general indexation rule during the first periods of the model's projection , when figures for government consumption are partly already historical and partly forecasted in short-term forecasts.

When per capita individual government consumption is indexed to GDP, (7.52) alternatively takes the form

$$\frac{C_t^{G,Ind}}{C_{t-1}^{G,Ind}} = \frac{C_t^{G,IndExo}}{C_{t-1}^{G,IndExo}} \frac{\frac{Y_t^{GDP}}{P_t^{C,G}}}{\frac{Y_{t-1}^{GDP}}{P_{t-1}^{C,G}}} adj_t^{C,G}. \tag{7.53}$$

The two equations can be united as in (7.54) using the dummy d_t^{CGInd}, which taking the value of zero (the default in DREAM's usual projections) reproduces (7.52) and when taking the value of one results in (7.53):

$$C_t^{G,Ind} = \frac{C_t^{G,IndExo}}{C_{t-1}^{G,IndExo}} \left(1 + d_t^{CGInd} \left(\frac{\frac{Y_t^{GDP}}{P_t^{C,G}}}{\frac{Y_{t-1}^{GDP}}{P_{t-1}^{C,G}}} - 1 \right)\right) C_{t-1}^{G,Ind} adj_t^{C,G}. \tag{7.54}$$

Correspondingly, collective government consumption can be represented either as a constant percentage of GDP (except for the jump variable $adj_t^{C,G}$), cf. (7.55), or be indexed to total population, cf. (**??**).

$$C_t^{G,Coll} = \frac{\frac{Y_t^{GDP}}{P_t^{C,G}}}{\frac{Y_{t-1}^{GDP}}{P_{t-1}^{C,G}}} C_{t-1}^{G,Coll} adj_t^{C,G}, \tag{7.55}$$

$$C_t^{G,Coll} = \frac{N_t^{Tot}}{N_{t-1}^{Tot}} C_{t-1}^{G,Coll} adj_t^{C,G}. \tag{7.56}$$

In (7.57), these possibilities are unified using the dummy d_t^{CGColl}. When this dummy has the default value of one, (7.57) is equal to (7.55), while with the dummy value of zero, (7.57) replicates (**??**).

$$C_t^{G,Coll} = \left(\left(1 - d_t^{CGColl}\right) \frac{N_t^{Tot}}{N_{t-1}^{Tot}} + d_t^{CGColl} \frac{\frac{Y_t^{GDP}}{P_t^{C,G}}}{\frac{Y_{t-1}^{GDP}}{P_{t-1}^{C,G}}} \right) C_{t-1}^{G,Coll} adj_t^{C,G}. \tag{7.57}$$

7.4.3 Indexation according to wage regulation

Indexation of transfers to households generally follow the wage indexation variable W^{Reg}. This variable follows the growth in the annual wage for full-time employed wage-earners working standard hours. The actual equation is

$$W_t^{Reg} = \frac{\dfrac{\sum\limits_{o\in oLab}\sum\limits_{s\in\{m,f\}}\sum\limits_{a\in Ax0}\left(1-t_t^{Payroll}\right)adj_t^{Hours} r_{o,s,a,t}^{LabFull} L_{o,s,a,t}^{S}\left(\rho_{o,s,a,t}W_t\left(1-q_{o,s,a,t}^{Z,F}\right)-q_{a,t}^{ATP}\right)N_{o,s,a,t}^{Ind}}{\sum\limits_{o\in oLab}\sum\limits_{s\in\{m,f\}}\sum\limits_{a\in Ax0} r_{o,s,a,t}^{LabFull} L_{o,s,a,t}^{S} N_{o,s,a,t}^{Ind}}}{\dfrac{\sum\limits_{o\in oLab}\sum\limits_{s\in\{m,f\}}\sum\limits_{a\in Ax0}\left(1-t_{t-1}^{Payroll}\right)adj_{t-1}^{Hours} r_{o,s,a,t-1}^{LabFull} L_{o,s,a,t-1}^{S}\left(\rho_{o,s,a,t-1}W_{t-1}\left(1-q_{o,s,a,t-1}^{Z,F}\right)-q_{a,t-1}^{ATP}\right)N_{o,s,a,t-1}^{Ind}}{\sum\limits_{o\in oLab}\sum\limits_{s\in\{m,f\}}\sum\limits_{a\in Ax0} r_{o,s,a,t-1}^{LabFull} L_{o,s,a,t-1}^{S} N_{o,s,a,t-1}^{Ind}}}, \tag{7.58}$$

where the denominator and the numerator of the main fraction are identical, except that in the denominator all terms are lagged one period. The numerator and denominator both make out an expression for the average wage per time unit, which itself takes the form of a fraction, of which the numerator is the total wage sum after deduction of payments for labour market and ATP pensions (but not SP pensions) and payroll taxes. The denominator is total working time, except for the exogenous variable adj_t^{Hours}, which represents collective changes in working time instituted by collective labour-market negotiations or by law. This variable appears only in the numerator. The reason is that such changes in average working time will affect indexation of transfers, as opposed to individual changes in working time. (7.58) ensures that this difference is also taken into account in DREAM.

Some of the age-dependent transfers are in some periods only indexed with consumer prices. When this is the case, the dummy $d_{b,t}^{WReg}$ in (7.59) is zero. Otherwise, it is one. In addition, some age-dependent transfers (housing benefits) are potentially affected by changes in the official age for eligibility of receiving old-age pensions. This is taken care of by the adjustment term $adj_{b,s,a,t}^{OAPAge}$. With these adjustments, age-dependent transfers follow the development in the corresponding exogenous variable $o_{b,s,a,t}^{G,H,AgeDepExo}$, which is governed by demographics:

$$\begin{aligned} o_{b,s,a,t}^{G,H,AgeDep} &= (1+adj_{b,s,a,t}^{OAPAge})\left(W_t^{Reg}d_{b,t}^{WReg} + \frac{P_{C,t}^{C,H}}{\frac{P_{C,t-1}^{C,H}}{(1+g_t)}}(1-d_{b,t}^{WReg}) - adj_t^{WReg}\right) \\ &\times \frac{o_{b,s,a,t}^{G,H,AgeDepExo}}{o_{b,s,a,t-1}^{G,H,AgeDepExo}} o_{b,s,a,t-1}^{G,H,AgeDep}. \end{aligned} \tag{7.59}$$

The growth rate in the majority of income-replacing transfers is simply equal to W_t^{Reg} minus an exogenous variable adj_t^{WReg}, which can be introduced to represent a reduction in the full-scale wage indexation. However, adj_t^{WReg} is normally set to zero. (7.60) shows this indexation rule for students' allowances. In exactly the same way, the following transfers are indexed: anticipatory pensions (førtidspension) $o_t^{G,H,AP}$, post-employment wages (efterløn) $o_t^{G,H,PEW}$, bridging benefits (overgangsydelse) $o_t^{G,H,BB}$, labour market leave allowances (orlovsydelse) $o_t^{G,H,LA}$, maternity leave scheme benefits $o_t^{G,H,MB}$, sickness benefits $o_t^{G,H,SB}$, cash assistance $o_t^{G,H,CA}$, activation benefits $o_t^{G,H,AB}$, introductory benefits (introduktionsydelse/starthjælp) $o_t^{G,H,IB}$ and unemployment benefits $o_{o,s,a,t}^{G,H,Unemp}$. The rule also applies to tax-free non-income-replacing non-age-dependent transfers $o_t^{G,H,NonAgeDep}$ and to k_t^{Source} (calibrated correction of tax allowance per person), $allow_t^{Pers}$ (Personal tax allowance for each tax payer (= person-fradrag)) and $allow_t^{Assess}$ (Exogenous part of assessment allowances (= fagforeningskontingent + kørselsfradrag + velgørende formål + øvrige fradrag)).

$$\frac{o_t^{G,H,S}}{o_{t-1}^{G,H,S}} = W_t^{Reg} - adj_t^{WReg}. \tag{7.60}$$

In some other cases, there are special rules: Old-age pensions (folkepension) $o_t^{G,H,OAP}$ are divided in a basic pensions benefit $o_t^{G,H,OAPbase}$ and a supplementary pensions benefit $o_t^{G,H,OAPadd}$, cf. (7.61). $o_t^{G,H,OAPbase}$ follows the ordinary indexation rule ((7.62)), whereas $o_t^{G,H,OAPadd}$ is subject to some reduction over time because of the exogenous parameter $adj_{s,a,t}^{OAP}$, which represents the reduction in supplementary pensions due to a higher average income level in future, cf. (7.63):

$$o_{s,a,t}^{G,H,OAP} = o_{s,a,t}^{G,H,OAP,Base} + o_{s,a,t}^{G,H,OAP,Add}, \tag{7.61}$$

$$\frac{o_{s,a,t}^{G,H,OAP,Base}}{o_{s,a,t-1}^{G,H,OAP,Base}} = W_t^{Reg} - adj_t^{WReg}, \tag{7.62}$$

$$\frac{o_{s,a,t}^{G,H,OAP,Add}}{o_{s,a,t-1}^{G,H,OAP,Add}} = \left(1 - adj_{s,a,t}^{OAP}\right)\left(W_t^{Reg} - adj_t^{WReg}\right). \tag{7.63}$$

Pensions for civil servants $o_{a,t}^{G,H,CivPen}$ are projected according to the exogenous $o_{a,t}^{G,H,CivPenExo}$ following information from the Ministry of Finance; however, it is additionally indexed to the endogenous wage development of DREAM W_t (and consequently not indexed to W_t^{Reg}):

$$o_{a,t}^{G,H,CS} = o_{a,t}^{G,H,CSExo} W_t. \tag{7.64}$$

Finally, also contributions to unemployment funds $Unemp_t^{Max}$ (strictly speaking, maximal unemployment benefits) are indexed to the wages:

$$\frac{Unemp_t^{Max}}{Unemp_{t-1}^{Max}} = W_t^{Reg} - adj_t^{WReg}. \tag{7.65}$$

7.4.4 Indexation of current and capital transfers following GDP

A number of current and capital transfers between the government and domestic and foreign agents are modelled very simply: In the projection, they are indexed either to the development in GDP alone or to GDP per adult. The last solution is preferred when the transfers are given to or taken from households.

Indexation to GDP is used for transfers from the government to the EU $OR_t^{G,EU,Res}$ (cf. (7.66)), and following the same pattern for transfers to foreign countries (mostly aid to developing countries) $OR_t^{G,F,Res}$ and $OR_t^{G,F,Cap}$, to Greenland $OR_t^{G,Gr}$ and to the Faroe Isles $OR_t^{G,FI}$, capital transfers to domestic producers $o_t^{G,P,Cap}$, transfers from the EU to the Danish government $OR_t^{EU,G}$, and from the rest of the world generally to the Danish government $OR_t^{F,G,Res}$

and $OR_t^{F,G,Cap}$, and for government income from land rent $o_t^{P,G,landrent}$ and withdrawals from quasi corporations $o_t^{P,G,Quasi}$.

$$OR_t^{G,EU,Res} = OR_{t-1}^{G,EU,Res} \frac{Y_t^{GDP}}{Y_{t-1}^{GDP}}. \tag{7.66}$$

Indexation to GDP per adult is the rule for the following transfers from the government to households and vice versa: $o_t^{G,H}$, $o_t^{G,H,Cap}$,$o_t^{H,G}$ and $o_t^{H,G,Cap}$, for mandatory and voluntary social contributions $o_t^{H,G,soc}$ and $o_t^{H,G,SocOpt}$. The actual equation is shown here only for $o_t^{G,H}$:

$$\sum_{a \in Ax0} N_{a,t}^{Adult} o_t^{G,H} = \sum_{a \in Ax0} N_{a,t-1}^{Adult} o_{t-1}^{G,H} \frac{Y_t^{GDP}}{Y_{t-1}^{GDP}}. \tag{7.67}$$

7.4.5 Lump-sum transfers resulting from the calibration process

There exist eight different lump-sum transfers which are results of the calibration process. The sign of some of these cannot be decided a priori. It may be either positive or negative, changing with the calibration year, as the term catches various forms of noise in the data. In some other cases, the terms adjust for a particular modelling choice in DREAM and consequently have a clear economic interpretation and a constant sign.

Of these lump-sum transfers, $o_t^{H,G,LumpRev}$ and $o_t^{G,H,LumpExp}$ are treated above. They represent adjustments which ensure that total government revenue and expenditure correspond to the actual figures from the NA. They follow the development in the adult population. The six remaining transfers are described here.

$o_{o,s,a,t}^{H,G,LumpPayroll}$ is the lump-sum transfer from the payroll tax payments. In the projection, the correction term $k_t^{Payroll}$ is kept constant so that the lump-sum transfer is a constant fraction of the payroll tax revenue per person.

$$o_{o,s,a,t}^{H,G,LumpPayroll} = k_t^{Payroll} t_t^{Payroll} N_{o,s,a,t}^{Ind} adj_t^{Hours} r_{o,s,a,t}^{LabFull} \left(1 + adj_t^{LS}\right) L_{o,s,a,t}^{S} \left(\rho_{o,s,a,t} W_t - q_{a,t}^{ATP}\right). \tag{7.68}$$

In the same way, the lump-sum transfer $o_{a,t}^{H,G,LumpDwe}$ from the tax on owner-occupied dwellings is a constant fraction of the appropriate tax payments of each representative household:

$$o_{a,t}^{H,G,LumpDwe} = k_t^{Dwe} t_t^{Dwe} \sum_{j\in\{D\}} \left(P_{j,t-1}^{K,H,B} K_{a-1,t-1}^{H,B} + P_{j,t-1}^{K,H,L} K_{a-1,t-1}^{H,L} \right) N_{a-1,t-1}^{AdultEq}. \tag{7.69}$$

The transfer $o_t^{H,G,LumpInt}$, which is rather large in magnitude, is necessary because there is a large discrepancy between the taxable interest income of households in DREAM and the actual Danish capital income tax base (which, unlike in DREAM, is negative). DREAMs interest income figures are due to the figures from the national accounts for the private capital stock (corrected for net financial debt). When actual interest income is lower, one reason may be that the value and/or returns of non-incorporated firms is higher in the national accounts than in tax statistics. The difference is transferred back to households in lump-sum fashion. This lump-sum transfer is adjusted in future in line with the development of the private capital stock relative to the capital stock in period 1:

$$\sum_{a\in Ax0} N_{a,t}^{Adult} o_t^{H,G,LumpInt} = \sum_{a\in Ax0} N_{a,1}^{Adult} o_1^{H,G,LumpInt} \frac{\sum_{j\in\{C,P\}} K_{j,t}^{P,W}}{\sum_{j\in\{C,P\}} K_{j,1}^{P,W}}. \tag{7.70}$$

The transfer $o_t^{H,G,LumpGrOS}$ is due to the difference in the gross operating surplus of the government sector and the government producer in the national accounts. As explained above, DREAM does not distinguish between these concepts. As the correction term k_t^{GrOS} is constant over time, the transfer per adult is always proportional to the gross operating surplus.

$$o_t^{H,G,LumpGrOS} = \frac{k_t^{GrOS} \sum_{j\in\{G\}} \left(\left(1 + k_{j,t}^{Depr}\right) \left(P_{j,t}^{I,P,M} \delta_{j,t}^{P,M} K_{j,t-1}^{P,M} + P_{j,t}^{I,P,B} \delta_{j,t}^{P,B} K_{j,t-1}^{P,B} \right)\right)}{\sum_{a\in Ax0} N_{a,t}^{Adult}}. \tag{7.71}$$

Parallelly, $o_t^{H,G,LumpGI}$ is the result of a discrepancy in government investment and consequently proportional to future government investment.

$$o_t^{H,G,LumpGI} = \frac{k_t^{GI} \sum_{j\in\{G\}} \left(P_{j,t}^{I,P,M} I_{j,t}^{P,M} + P_{j,t}^{I,P,B} I_{j,t}^{P,B} \right)}{\sum_{a\in Ax0} N_{a,t}^{Adult}}. \tag{7.72}$$

Finally, $o_{s,a,t}^{H,G,LumpSP}$ originates from the calibration of the total contributions to the SP fund and is transferred back to adults proportionally to these contributions.

$$o_{s,a,t}^{H,SP,LumpSP} = k_t^{SP} \sum_{o\in oLab} N_{o,s,a,t}^{Ind} q_{a,t}^{SP} adj_t^{Hours} r_{o,s,a,t}^{LabFull} \left(1 + adj_t^{LS}\right) L_{o,s,a,t}^{S} \left(\rho_{o,s,a,t} W_t \left(1 - q_{o,s,a,t}^{ZF}\right) - q_{a,t}^{ATI} \right. \tag{7.73}$$

$$
\begin{aligned}
o_{j,t}^{P,G,LumpCor} = {} & k_t^{Cor} t_t^{Cor} \cdot P_{j,t}^{Y}\left(Y_{j,t} + Y_{j,t}^{NorthSea}\right) - P_{j,t}^{M} M_{j,t} \\
& - \left(1 + t_{j,t}^{Emp} + t_{j,t}^{W} + q_t^{LG}\right) W_t LD_{j,t} \\
& - \left(\delta_{j,t}^{PM,Book} K_{j,t-1}^{PM,Book} + \delta_{j,t}^{PB,Book} k_{j,t-1}^{PB,Book}\right) \\
& - i_t \; D_{j,t-1}^{P} - t_{j,t}^{P,Weight} K_{j,t-1}^{PM} \\
& - t_{j,t}^{P,Land} P_{j,t-1}^{IPB} K_{j,t-1}^{PB} \\
& + s_{j,t}^{EU,P,SetAside} + s_{j,t}^{EU,P,Rural} + o_{j,t}^{G,P,Cap}.
\end{aligned} \tag{7.74}
$$

7.5 Sustainability of fiscal policy

The government fulfils its intertemporal budget constraint (its No-Ponzi Game condition), which states that the initial government debt D_t^G cannot exceed the present value of all future primary budgets:

$$D_t^G \leq \sum_{s=t+1}^{\infty} \frac{PrimBudg_s}{\Pi_{v=t+1}^{s}\left(1 + i_v^G\right)}. \tag{7.75}$$

Here, $PrimBudg_t$ represent all primary surpluses, and i_t^G is the bond interest rate applicable to government assets, so that the denominator in (7.75) represents the relevant discount factor for the government sector. If the NPG condition were not fulfilled, private agents would not be willing to hold government bonds. The NPG condition necessitates a policy reaction function (an endogenous response from at least one variable to make sure that (7.75) is fulfilled with equality). Many different policy reaction functions are possible, and the model does not dictate a single one to be carried out. Traditionally, the following have been popular:

1) A one-time permanent increase in the bottom-bracket tax rate t_t^{Bot} from the first future time period.

2) A one-time permanent decrease in the ratio of collective government consumption to GDP from the first future time period.

Many other solutions are possible, such as lump-sum taxation, time-varying responses (e.g. keeping a constant debt-to-GDP ratio by varying one of the two instruments mentioned above in each period) or a proportional decrease in the number of persons in all government income-replacing transfer arrangements accompanied by a corresponding increase in the labour force, which saves government expenditure and increases tax incomes.

In steady state, the interest rate is constant, and $PrimBudg_t$ grows with the product of constant productivity growth and foreign inflation, so that

$$PrimBudg_t = (1+g)\left(1+g^P\right) PrimBudg_{t-1}. \tag{7.76}$$

Then, (7.75) with equality can be written[3]

$$D_t^G = \sum_{n=1}^{\infty} \left(\frac{(1+g)\left(1+g^P\right)}{1+i^G} \right)^n PrimBudg_t = \frac{(1+g)\left(1+g^P\right)}{(i^G - g - g^P - gg^P)} PrimBudg_t, \tag{7.77}$$

which is the actual NPG condition used in DREAM.

7.6 Appendix: Equations describing Government Sector in growth- and inflation-corrected terms

In this section, the equations from the chapter "The Government Sector" which is actually udes in the computer version of the model are written i growth- and inflation-corrected terms.

7.6.1 Government revenue

The government revenue Rev_t^G is divided into revenue sources, following standard NA conventions:

[3] assuming that $\frac{(1+g)((1+g^P)}{1+i^G} < 1$.

$$
\begin{aligned}
Rev_t^G = {} & TR_t^{GrOS} + OR_t^{LandRent} + OR_t^{Quasi} \\
& + TR_t^{Emp} + TR_t^{W} + TR_t^{Land} + TR_t^{P,Weight} + TR_t^{Cus} \\
& + TR_t^{VAT} + TR_t^{Duty} + TR_t^{Reg} + TR_t^{Res} \\
& + TR_t^{Source} + TR_t^{Payroll} + TR_t^{CapPen} \\
& + TR_t^{H,Weight} + TR_t^{Cor} + TR_t^{PensInt} \\
& + TR_t^{SocCont} + TR_t^{Beq} \\
& + OR_t^{G} + OR_t^{Ocap} + \sum_{a \in Ax0} N_{a,t}^{Adult} o_t^{H,G,LumpRev},
\end{aligned}
$$

where the first line is revenue from interests and rent, line 2 and 3 is revenue from indirect taxes, line 4 and 5 is revenue from direct taxes and finally line 6 and 7 are other revenue sources.

Revenue from interests and rents

The first term is gross operating surplus, given in (7.1):

$$
TR_t^{GrOS} = \left(1 + k_t^{GrOS}\right) \sum_{j \in \{G\}} \left(1 + k_{j,t}^{Depr}\right) \left(P_{j,t}^{I,P,M} \delta_{j,t}^{P,M} \frac{K_{j,t-1}^{P,M}}{1 + g_t} + P_{j,t}^{I,P,B} \delta_{j,t}^{P,B} \frac{K_{j,t-1}^{P,B}}{1 + g_t} \right).
$$

Land rent is revenue from government-owned firms and activities yielding a surplus and given by equation (7.2):

$$
OR_t^{LandRent} = \sum_{j \in \{P,C\}} o_{j,t}^{P,G,LandRent}.
$$

Like land rent, withdrawals from quasi corporations represent revenue from government-owned firms and are given by equation (7.3):

$$
OR_t^{Quasi} = \sum_{j \in \{P,C\}} o_{j,t}^{P,G,Quasi}.
$$

Indirect taxes

Indirect taxes are given by 1) labour market contributions from employers and wage-sum taxes, eqs. (7.4) and (7.5) :

$$
\begin{aligned}
TR_t^{Emp} &= W_t \sum_{j\in\{C,P,G\}} t_{j,t}^{Emp} L_{j,t}^{D}, \\
TR_t^{W} &= W_t \sum_{j\in\{C,P,G\}} t_{j,t}^{W} L_{j,t}^{D},
\end{aligned}
$$

2) land taxes (”grundskyld” and ”afløsningsafgifter”) paid by households and producers, eq. (7.6):

$$
TR_t^{Land} = \sum_{j\in\{D\}} t_t^{H,Land} P_{j,t-1}^{K,H,L} \sum_a \frac{K_{a-1,t-1}^{H,L,Ind} N_{a-1,t-1}^{Adult,Eq}}{(1+g_t)\left(1+g_t^P\right)} + \sum_{j\in\{C,P,G\}} t_{j,t}^{P,Land} \frac{P_{j,t-1}^{I,P,B} K_{j,t-1}^{P,B}}{(1+g_t)\left(1+g_t^P\right)},
$$

3) motor vehicle weight duties paid by producers, eq. (7.7):

$$
TR_t^{P,Weight} = \sum_{j\in\{C,P,G\}} t_{j,t}^{P,Weight} \frac{K_{j,t-1}^{P,M}}{1+g_t},
$$

4) customs taxes, eq. (7.8):

$$
\begin{aligned}
TR_t^{Cus} = P_t^F \times \Bigg[& \sum_{e\in\{D,R,G,P\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} t_{e,t}^{H,Cus} C_{e,k,c,t}^{H,2} \\
& + \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} t_t^{G,Cus} C_{k,c,t}^{G,2} \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} t_{j,t}^{M,Cus} M_{j,k,c,t}^{2} \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{C,P\}} \sum_{c\in\{F\}} t_{j,t}^{I,B,Cus} I_{j,k,c,t}^{P,B,2} \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{P\}} \sum_{c\in\{F\}} t_{j,t}^{I,M,Cus} I_{j,k,c,t}^{M,2} \\
& + \sum_{j\in\{C,P\}} t_t^{I,I,Cus} I_{j,t}^{F,I} \Bigg] - OR_t^{G,EU,Cus},
\end{aligned}
$$

5) VAT given by equation (7.9):

$$
\begin{aligned}
TR_t^{VAT} = & \sum_{e\in\{D,R,G,P\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} t_{e,t}^{H,VAT} \left(1+t_{e,t}^{H,Cus}\right) P_t^F C_{e,k,c,t}^{H,2} \\
& + \sum_{e\in\{D,R,G,P\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} t_{e,t}^{H,VAT} P_{k,t}^Y C_{e,k,c,t}^{H,2} \\
& + \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} t_t^{G,VAT} \left(1+t_t^{G,Cus}\right) P_t^F C_{k,c,t}^{G,2} \\
& + \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} t_t^{G,VAT} P_{k,t}^Y C_{k,c,t}^{G,2} \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} t_{j,t}^{M,VAT} \left(1+t_{j,t}^{M,Cus}\right) P_t^F M_{j,k,c,t}^2 \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} t_{j,t}^{M,VAT} P_{k,t}^Y M_{j,k,c,t}^2 \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{P\}} \sum_{c\in\{F\}} t_{j,t}^{I,M,VAT} \left(1+t_{j,t}^{I,M,Cus}\right) P_t^F I_{j,k,c,t}^{P,M,2} \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{P\}} \sum_{c\in\{D\}} t_{j,t}^{I,M,VAT} P_{k,t}^Y I_{j,k,c,t}^{P,M,2} \\
& + \sum_{j\in\{C,P,D,G\}} \sum_{k\in\{C,P\}} \sum_{c\in\{F\}} t_{j,t}^{I,B,VAT} \left(1+t_{j,t}^{I,B,Cus}\right) P_t^F I_{j,k,c,t}^{P,B,2} \\
& + \sum_{j\in\{C,P,D,G\}} \sum_{k\in\{C,P\}} \sum_{c\in\{D\}} t_{j,t}^{I,B,VAT} P_{k,t}^Y I_{j,k,c,t}^{P,B,2} \, ,
\end{aligned}
$$

6) excise duties (”punktafgifter”), eq. (7.10)

$$
\begin{aligned}
TR_t^{Duty} = & \sum_{e\in\{D,R,G,P\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} \left(t_{e,t}^{H,DutyV} + t_{e,k,c,t}^{H,DutyQ}\right)\left(1+t_{e,t}^{H,Cus}\right) P_t^F C_{e,k,c,t}^{H,2} \\
& + \sum_{e\in\{D,R,G,P\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} \left(t_{e,t}^{H,DutyV} + t_{e,k,c,t}^{H,DutyQ}\right) P_{k,t}^Y C_{e,k,c,t}^{H,2} \\
& + \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} \left(t_t^{G,DutyV} + t_{k,c,t}^{G,DutyQ}\right)\left(1+t_t^{G,Cus}\right) P_t^F C_{k,c,t}^{G,2} \\
& + \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} \left(t_t^{G,DutyV} + t_{k,c,t}^{G,DutyQ}\right) P_{k,t}^Y C_{k,c,t}^{G,2} \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} \left(t_{j,t}^{M,DutyV} + t_{j,k,c,t}^{M,DutyQ}\right)\left(1+t_{j,t}^{M,Cus}\right) P_t^F M_{j,k,c,t}^2 \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} \left(t_{j,t}^{M,DutyV} + t_{j,k,c,t}^{I,M,DutyQ}\right) P_{k,t}^Y M_{j,k,c,t}^2 \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{P\}} \sum_{c\in\{F\}} \left(t_{j,t}^{I,M,DutyV} + t_{j,k,c,t}^{I,M,DutyQ}\right)\left(1+t_{j,t}^{I,M,Cus}\right) P_t^F I_{j,k,c,t}^{P,M,2} \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{P\}} \sum_{c\in\{D\}} \left(t_{j,t}^{I,M,DutyV} + t_{j,k,c,t}^{I,M,DutyQ}\right) P_{k,t}^Y I_{j,k,c,t}^{P,M,2} \\
& + \sum_{j\in\{C,P,D,G\}} \sum_{k\in\{C,P\}} \sum_{c\in\{F\}} \left(t_{j,t}^{I,B,DutyV} + t_{j,k,c,t}^{I,B,DutyQ}\right)\left(1+t_{j,t}^{I,B,Cus}\right) P_t^F I_{j,k,c,t}^{P,B,2} \\
& + \sum_{j\in\{C,P,D,G\}} \sum_{k\in\{C,P\}} \sum_{c\in\{D\}} \left(t_{j,t}^{I,B,DutyV} + t_{j,k,c,t}^{I,B,DutyQ}\right) P_{k,t}^Y I_{j,k,c,t}^{P,B,2} \\
& + \sum_{j\in\{C,P,G\}} \left(t_t^{X,DutyV} + t_{j,t}^{X,DutyQ}\right) P_{j,t}^Y X_{j,t} \\
& + \sum_{k\in\{C,P\}} \sum_{c\in\{D\}} \left(t_t^{I,I,DutyV} + t_{k,c,t}^{I,I,DutyQ}\right) P_{k,t}^Y I_{k,t}^{P,I} \\
& + \sum_{k\in\{C,P\}} \sum_{c\in\{F\}} \left(t_t^{I,I,DutyV} + t_{k,c,t}^{I,I,DutyQ}\right)\left(1+t_t^{I,I,Cus}\right) P_t^F I_{k,t}^{F,I},
\end{aligned}
$$

7) motor vehicle registration duties paid by households, the government sector and by producers, eq. (7.11):

$$
\begin{aligned}
TR_t^{Reg} = & \sum_{e\in\{D,R,G,P\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} t_{e,t}^{H,Reg} \left(1 + t_{e,t}^{H,Cus}\right) P_t^F C_{e,k,c,t}^{H,2} \\
& + \sum_{e\in\{D,R,G,P\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} t_{e,t}^{H,Reg} P_{k,t}^Y C_{e,k,c,t}^{H,2} \\
& + \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} t_t^{G,Reg} \left(1 + t_t^{G,Cus}\right) P_t^F C_{k,c,t}^{G,2} \\
& + \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} t_t^{G,Reg} P_{k,t}^Y C_{k,c,t}^{G,2} \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{P\}} \sum_{c\in\{F\}} t_{j,t}^{P,Reg} \left(1 + t_{j,t}^{I,M,Cus}\right) P_t^F I_{j,k,c,t}^{P,M,2} \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{P\}} \sum_{c\in\{D\}} t_{j,t}^{P,Reg} P_{k,t}^Y I_{j,k,c,t}^{P,M,2},
\end{aligned}
$$

and finally 8), other taxes on production, eq. (7.12):

$$
\begin{aligned}
TR_t^{Res} = & \sum_{j\in\{C,P,G\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} t_{j,t}^{Res} \left(1 + t_{j,t}^{M,Cus}\right) P_t^F M_{j,k,c,t}^2 \\
& + \sum_{j\in\{C,P,G\}} \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} t_{j,t}^{Res} P_{k,t}^Y M_{j,k,c,t}^2.
\end{aligned}
$$

Direct taxes

Direct taxes are given by 1) source taxes, equation (7.13):

$$
\begin{aligned}
& TR_t^{Source} = \\
& \left(t_t^{Cou} + t_t^{Mun} + t_t^{Chu}\right) \sum_{o \in oLab} \sum_{s \in \{m,f\}} \sum_{a \in Ax0} N_{o,s,a,t}^{Ind} \left(Y_{o,s,a,t}^{H,Pers} - k_t^{Source} - allow_t^{Pers} - allow_t^{Assess}\right. \\
& \quad -r_{s,a,t}^{PEWq} k_t^{PEW} w_t^{PEW} Unemp_t^{Max} - r_{s,a,t}^{Unempq} k_t^{Unemp} w_t^{Unemp} Unemp_t^{Max} \\
& \left. -t_t^{EITCEff} adj_t^{Hours} r_{o,s,a,t}^{LabFull} \left(1 + adj_t^{LS}\right) L_{o,s,a,t}^{S} \left(\rho_{o,s,a,t} W_t \left(1 - q_{o,s,a,t}^{ZF} - q_{s,a,t}^{ZP}\right) - q_{a,t}^{ATP}\right)\right) \\
& + t_t^{Bot} \sum_{o \in oLab} \sum_{s \in \{m,f\}} \sum_{a \in Ax0} \left[N_{o,s,a,t}^{Ind} \left(Y_{o,s,a,t}^{H,Pers} - k_t^{Source} - allow_t^{Pers}\right)\right] \\
& + \sum_{o \in oLab} \sum_{s \in \{m,f\}} \sum_{a \in Ax0} N_{o,s,a,t}^{Ind} \left(TR_{o,s,a,t}^{MidInd} + TR_{o,s,a,t}^{TopInd}\right) \\
& + \left(1 + k_t^{Dwe}\right) t_t^{Dwe} \sum_{j \in \{D\}} \sum_{a} \left(P_{j,t-1}^{K,H,B} K_{a-1,t-1}^{H,B} + P_{j,t-1}^{K,H,L} K_{a-1,t-1}^{H,L,Ind}\right) \frac{N_{a-1,t-1}^{Adult,Eq}}{\left(1 + g_t\right)\left(1 + g_t^P\right)} \\
& + t_t^{H,Int}\ i_t\ \left(1 + w^{Assets}\right)\ \frac{A_{t-1}^{H,Fin}}{\left(1 + g_t\right)\left(1 + g_t^P\right)} \\
& + t_t^{H,Div} \sum_{j \in \{C,P\}} DIV_{j,t} w^{Assets} \frac{A_{t-1}^{H,Fin}}{\sum_{j \in \{C,P\}} V_{j,t-1}} \\
& + t_t^{H,Gain} \sum_{j \in \{C,P\}} V_{j,t} - \frac{V_{j,t-1}}{\left(1 + g_t\right)\left(1 + g_t^P\right)} w^{Assets} \frac{A_{t-1}^{H,Fin}}{\sum_{j \in \{C,P\}} V_{j,t-1}} \\
& + d^{T,Gain,Ini} t_{t-1}^{H,Gain} w^{Assets} \frac{A_{t-1}^{H,NoShock}}{\sum_{j \in \{C,P\}} V_j^{NoShock}} \sum_{j \in \{C,P\}} \frac{\left(V_{j,t-1} - V_j^{NoShock}\right)}{\left(1 + g_t\right)\left(1 + g_t^P\right)}, \text{ (if shock period)} \\
& - o_t^{G,H,Lump,Int} \sum_{a \in Ax0} N_{a,t}^{Adult},
\end{aligned}
$$

2) the payroll tax ("arbejdsmarkedsbidrag"), eq. (7.14):

$$
\begin{aligned}
TR_t^{Payroll} &= \left(1 + k_t^{Payroll}\right) t_t^{Payroll} \\
& \times \sum_{o \in oLab} \sum_{s \in \{m,f\}} \sum_{a \in Ax0} N_{o,s,a,t}^{Ind} adj_t^{Hours} r_{o,s,a,t}^{Lab,Full} \left(1 + adj_t^{LS}\right) L_{o,s,a,t}^{S} \left(\rho_{o,s,a,t} W_t - q_{a,t}^{ATP}\right),
\end{aligned}
$$

3) taxation of pensions from private pension funds and from LD ("Lønmodtagernes Dyrtidsfond"), eq. (7.15):

$$
TR_t^{CapPen} = t_t^{CapPen} \sum_{s \in \{m,f\}} \sum_{a \in Ax0} N_{s,a,t}^{Able} \left(b_{a,t}^{ZPR} + b_{a,t}^{LD}\right),
$$

4) the motor vehicle weight duty paid by households, eq. (7.16):

$$TR_t^{H,Weight} = t_t^{H,Weight} P_{C,t}^{C,H} \sum_{a \in Ax0} N_{a,t}^{AdultEq} C_{C,a,t}^{H}$$

5) the corporation tax rate, eq. (7.17):

$$\begin{aligned} TR_t^{Cor} = \; & t_t^{Cor}\left(1+k_t^{Cor}\right) \sum_{j \in \{C,P\}} \Big[\; P_{j,t}^{Y}\left(Y_{j,t}+Y_{j,t}^{NorthSea}\right) - P_{j,t}^{M} M_{j,t} \\ & - \left(1+t_{j,t}^{Emp}+t_{j,t}^{W}+q_t^{LG}\right) W_t L_{j,t}^{D} \\ & - \frac{\left(\delta_{j,t}^{P,M,Book} K_{j,t-1}^{P,M,Book} + \delta_{j,t}^{P,B,Book} K_{j,t-1}^{P,B,book}\right)}{\left(1+g_t\right)\left(1+g_t^{p}\right)} \\ & - \frac{i_t D_{j,t-1}^{P}}{\left(1+g_t\right)\left(1+g_t^{p}\right)} \\ & - \frac{t_{j,t}^{P,Weight} K_{j,t-1}^{P,M}}{\left(1+g_t\right)} \\ & - \frac{t_{j,t}^{P,Land} P_{j,t-1}^{I,P,B} K_{j,t-1}^{P,B}}{\left(1+g_t\right)\left(1+g_t^{p}\right)} \\ & + s_{j,t}^{EU,P,SetAside} + s_{j,t}^{EU,P,Rural} + o_{j,t}^{G,P,Cap} \; \Big], \end{aligned}$$

and finally 6) tax on yields of pension scheme assets, equation (7.18):

$$\begin{aligned} TR_t^{PensInt} = \; & t_t^{Z} i_t \left(A_{t-1}^{Z} - w_{t-1}^{Z,Shares} \sum_{j \in \{C,P\}} \frac{V_{j,t-1}}{\left(1+g_t\right)\left(1+g_t^{P}\right)} \right) \\ & + t_t^{Z} w_{t-1}^{Z,Shares} \sum_{j \in \{C,P\}} DIV_{j,t} \\ & + t_t^{Z} w_{t-1}^{Z,Shares} \sum_{j \in \{C,P\}} \frac{\left(V_{j,t}-V_{j,t-1}\right)}{\left(1+g_t\right)\left(1+g_t^{P}\right)} \\ & + d^{T,Gain,Ini} t_{t-1}^{Z} w_{t-1}^{Z,Shares,NoShock} \sum_{j \in \{C,P\}} \frac{\left(V_{j,t-1}-V_j^{NoShock}\right)}{\left(V_{j,t}-V_{j,t-1}\right)}, \; \text{(if shock period)}. \end{aligned}$$

Other revenue sources

Other revenue sources are 1) government revenue from compulsory and voluntary social contributions is given by equation (7.19):

$$\begin{aligned} TR_t^{SocCont} &= W_t \sum_{j\in\{C,P\}} q_t^{LG} L_{j,t}^D \\ &+ \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} r_{s,a,t}^{PEWq} k_t^{PEW} w_t^{PEW} Unemp_t^{Max} \\ &+ \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} r_{s,a,t}^{Unempq} k_t^{Unemp} w_t^{Unemp} Unemp_t^{Max} \\ &+ \sum_{a\in Ax0} N_{a,t}^{Adult} o_t^{H,G,Soc} + \sum_{a\in Ax0} N_{a,t}^{Adult} o_t^{H,G,Soc,Opt} + OR_t^{CS,Imp}, \end{aligned}$$

2) tax on bequests, eq. (7.20):

$$TR_t^{Beq} = \sum_{a\in Ax0pu} t_t^{Beq} \left(1+i_t^H\right) \frac{A_{t-1}^{H,Beq}}{(1+g_t)\left(1+g_t^P\right)} N_{a,t-1}^{Adult,Eq},$$

and finally 3) current and capital transfers given by equation (7.21) and (7.22):

$$\begin{aligned} OR_t^G &= OR_t^{EU,G} + OR_t^{F,G,Res} + \sum_{a\in Ax0} N_{a,t}^{Adult} o_t^{H,G}, \\ TR_t^{Ocap} &= OR_t^{F,G,Cap} + \sum_{a\in Ax0} N_{a,t}^{Adult} o_t^{H,G,Cap}. \end{aligned}$$

7.6.2 Government Expenditure

Like government revenue, total government expenditure are dividen into a number of subcategories:

$$Exp_t^G = P_t^{C,G} C_t^G + Exp_t^{I,G} + SR_t + OR_t + OR_t^{G,H,Cap} + \sum_{a\in Ax0} N_{a,t}^{Adult} o_t^{G,H,LumpExp}.$$

Government Consumption

Total government consumption can be divided into individual- and collective government consumption, eq. (7.23):

$$C_t^G = C_t^{G,Ind} + C_t^{G,Coll}.$$

The government minimizes its costs, which leads to the following demand functions and price index, eq. (7.26) , (7.27), (7.28) and (7.29):

$$
\begin{aligned}
C_{k,t}^{G,1} &= \mu_k^{C,G,1} \left(\frac{P_t^{C,G}}{P_{k,t}^{C,G,1}} \right)^{\sigma^{C,G}} C_t^G && , k \in \{C, P, G\}, \\
P_t^{C,G} &= \left[\sum_{k \in \{C,P,G\}} \mu_k^{C,G,1} \left(P_{k,t}^{C,G,1} \right)^{1-\sigma^{C,G}} \right]^{\frac{1}{1-\sigma^{C,G}}} , \\
C_{k,c,t}^{G,2} &= \mu_{k,c}^{C,G,2} \left(\frac{P_{k,t}^{C,G,1}}{P_{k,c,t}^{C,G,2}} \right)^{\sigma^{C,G1}} C_{k,t}^{G,1} && , k \in \{C, P, G\}, \\
P_{k,t}^{C,G,1} &= \left[\sum_{c \in \{C,D\}} \mu_{k,c}^{C,G,2} \left(P_{k,c,t}^{C,G,2} \right)^{1-\sigma_k^{C,G,1}} \right]^{\frac{1}{1-\sigma_k^{C,G,1}}} && , k \in \{C, P, G\}.
\end{aligned}
$$

In the computer code, equation $(7.30a)$ and $(7.30b)$ together form one equation

$$
\begin{aligned}
P_{k,c,t}^{C,G,2} &= \left(1 - s_t^{G,G,Dwe} + t_t^{G,Reg} + t_t^{G,VAT} + t_t^{G,DutyV} + t_{k,c,t}^{G,DutyQ} - s_t^{G,G,Spe} - s_t^{G,EU,Spe}\right) P_{k,t}^{Y} \\
, c &\in \{D\}, k \in \{C, P, G\},
\end{aligned}
$$

$$
\begin{aligned}
P_{k,c,t}^{C,G,2} &= \left(1 - s_t^{G,G,Dwe} + t_t^{G,Reg} + t_t^{G,VAT} + t_t^{G,DutyV} + t_{k,c,t}^{G,DutyQ} - s_t^{G,G,Spe} - s_t^{G,EU,Spe}\right) \\
&\quad \times \left(1 + t_t^{G,Cus}\right) P_t^F \\
, c &\in \{F\}, k \in \{C, P, G\}.
\end{aligned}
$$

Investment Expenditure

Investment expenditure are given by equation (7.31):

$$
Exp_t^{I,G} = \left(1 + k_t^{G,I}\right) \left(\sum_{j \in \{G\}} P_{j,t}^{I,P,M} I_{j,t}^{P,M} + \sum_{j \in \{G\}} P_{j,t}^{I,P,B} I_{j,t}^{P,B} \right).
$$

Subsidies

Subsidies are given by equation (7.32):

$$
\begin{aligned}
SR_t \;=\; & \sum_{j\in\{C,P\}} \left(s_{j,t}^{EU,P,SetAside} + s_{j,t}^{EU,P,Rural} \right) \\
& + \sum_{j\in\{C,P,G\}} \Bigg[\left(s_{j,t}^{G,P,Dwe} + s_{j,t}^{G,P,Res} + s_{j,t}^{EU,P,Res} + s_{j,t}^{G,P,Spe} + s_{j,t}^{EU,P,Spe} \right) \\
& \quad \times \left(\sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} \left(1 + t_{j,t}^{M,Cus}\right) P_t^F M_{j,k,c,t}^2 + \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} P_{k,t}^Y M_{j,k,c,t}^2 \right) \Bigg] \\
& + \left(s_t^{G,G,Dwe} + s_t^{G,G,Spe} + s_t^{EU,G,Spe} \right) \\
& \quad \times \left(\sum_{k\in\{C,P,G\}} \sum_{c\in\{F\}} \left(1 + t_{k,t}^{G,Cus}\right) P_t^F C_{k,c,t}^{G,2} + \sum_{k\in\{C,P,G\}} \sum_{c\in\{D\}} P_{k,t}^Y C_{k,c,t}^{G,2} \right) \\
& + \left(s_t^{G,X,Spe} + s_t^{EU,X,Exp} + s_t^{EU,X,Spe} \right) \sum_{k\in\{C,P,G\}} P_{k,t}^Y X_{k,t} \\
& + \sum_{e\in\{D,R,G,P\}} \sum_{k\in\{C,P,G\}} \Bigg[\left(s_{e,t}^{G,H,Dwe} + s_{e,t}^{G,H,Spe} + s_{e,t}^{EU,H,Spe} \right) \\
& \quad \times \left(\sum_{c\in\{F\}} \left(1 + t_{d,t}^{H,Cus}\right) P_t^F C_{d,k,c,t}^{H,2} + \sum_{c\in\{D\}} P_{k,t}^Y C_{d,k,c,t}^{H,2} \right) \Bigg] \\
& + \sum_{j\in\{C,P,G\}} \Bigg[\left(s_{j,t}^{G,I,M,Spe} + s_{j,t}^{EU,I,M,Spe} \right) \\
& \quad \times \left(\sum_{k\in\{P\}} \sum_{c\in\{F\}} \left(1 + t_{j,t}^{I,M,Cus}\right) P_t^F I_{j,k,c,t}^{P,M,2} + \sum_{k\in\{P\}} \sum_{c\in\{D\}} P_{k,t}^Y I_{j,k,c,t}^{P,M,2} \right) \Bigg] \\
& + \sum_{j\in\{C,P,D,G\}} \Bigg[\left(s_{j,t}^{G,I,B,Dwe} + s_{j,t}^{G,I,B,Spe} + s_{j,t}^{EU,I,B,Spe} \right) \\
& \quad \times \left(\sum_{k\in\{C,P\}} \sum_{c\in\{F\}} \left(1 + t_{j,t}^{I,B,Cus}\right) P_t^F I_{j,k,c,t}^{P,B,2} + \sum_{k\in\{C,P\}} \sum_{c\in\{D\}} P_{k,t}^Y I_{j,k,c,t}^{P,B,2} \right) \Bigg] \\
& - SR_t^{EU,G}.
\end{aligned}
$$

Transfers

Transfers are given by 1) total current transfers from equation (7.33):

$$
\begin{aligned}
OR_t \quad = \quad & OR_t^{IncomeRepl} \\
& + \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{s,a,t}^{Able} o_{a,t}^{G,H,CS} \\
& + \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} \left(o_{s,a,t}^{G,H,AgeDepNoTax} + o_{s,a,t}^{G,H,AgeDepTax} + o_t^{G,H,NonAgeDep} \right) \\
& + OR_t^{G,EU,GNI} + OR_t^{G,EU,Res} + OR_t^{G,EU,VAT} \\
& + \sum_{a\in Ax0} N_{a,t}^{Adult} o_t^{G,H} \\
& + OR_t^{G,F,Res} + OR_t^{G,FI} + OR_t^{G,Gr},
\end{aligned}
$$

2) income-replacing transfers, eq. (7.34):

$$
\begin{aligned}
OR_t^{IncomeRepl} \quad = \quad & o_t^{G,H,S} \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} \left(r_{o,s,a,t}^{S} + r_{o,s,a,t}^{LabS} \right) \\
& + o_t^{G,H,Pew} \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} r_{o,s,a,t}^{Pew} \\
& + o_t^{G,H,LA} \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} r_{o,s,a,t}^{LA} \\
& + o_t^{G,H,MB} \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} r_{o,s,a,t}^{MB} \\
& + o_t^{G,H,SB} \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} \left(r_{o,s,a,t}^{SB} + r_{o,s,a,t}^{LabSB} \right) \\
& + o_t^{G,H,BB} \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} r_{o,s,a,t}^{BB} \\
& + o_t^{G,H,AP} \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} \left(r_{o,s,a,t}^{AP} + r_{o,s,a,t}^{LabAP} \right) \\
& + \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} \left(r_{o,s,a,t}^{OAP} + r_{o,s,a,t}^{LabOAP} \right) o_{s,a,t}^{G,H,OAP} \\
& + o_t^{G,H,CA} \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} r_{o,s,a,t}^{CA} \\
& + o^{G,H,AB} \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} r_{o,s,a,t}^{AB} \\
& + o_t^{G,H,IB} \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} N_{o,s,a,t}^{Ind} r_{o,s,a,t}^{IB} \\
& + \sum_{o\in oLab} \sum_{s\in\{m,f\}} \sum_{a\in Ax0} o_{o,s,a,t}^{G,H,Unemp} N_{o,s,a,t}^{Ind} adj_t^{Hours} r_{o,s,a,t}^{LabFull} \left(L_{o,s,a,t}^{Max} - \left(1 + adj_t^{LS}\right) L_{o,s,a,t}^{S} \right),
\end{aligned}
$$

and finally, 4) capital transfers of equation (7.37):

$$OR_t^{G,H,Cap} = OR_t^{G,F,Cap} + \sum_{a \in Ax0} N_{a,t}^{Adult} o_t^{G,H,Cap} + \sum_{j \in \{C,P\}} o_{j,t}^{G,P,Cap}.$$

Other transfers

Other transfers (which is not a part of Exp_t^G) is taxable age-dependent transfers, eq. (7.35) and non-taxable transfers, (7.36):

$$\begin{aligned} o_{s,a,t}^{G,H,AgeDepNoTax} &= \sum_{b \notin bTax} o_{b,s,a,t}^{G,H,AgeDep}, \\ o_{s,a,t}^{G,H,AgeDepTax} &= \sum_{b \in bTax} o_{b,s,a,t}^{G,H,AgeDep}, \end{aligned}$$

7.6.3 The primary budget and government debt

The government primary budget balance is equal to total revenue minus total expenditure minus the lump-sum payment paid to all adults if sustainability is ensured by the use of lump-sum taxes , eq. (7.38):

$$PrimBudg_t = Rev_t^G - Exp_t^G - \sum_{a \in Ax0} N_{a,t}^{Adult} o_t^{G,H,LumpSustain}.$$

Government debt in each period is equal to government debt from last period plus its interest minus the primary surplus, eq. (7.39):

$$D_t^G = \frac{D_{t-1}^G}{(1+g_t)\left(1+g_t^P\right)} - PrimBudg_t + \left(i_t + i_t^{G,add}\right) \frac{D_{t-1}^G}{(1+g_t)\left(1+g_t^P\right)}.$$

7.6.4 Projection of government sector variables

Tax freeze

For vehicle execise duties on households and firm the equations for periods in which the tax freeze is active are (7.40) and (7.41):

$$
\begin{aligned}
t_t^{H,Weight} &= t_{t-1}^{H,Weight} \frac{P_{C,t-1}^{C,H}}{(1+g_t)\, P_{C,t}^{C,H}}, \\
t_{j,t}^{P,Weight} &= t_{j,t-1}^{P,Weight} \frac{1}{(1+g_t^P)} \qquad , j \in \{P, C, G\}.
\end{aligned}
$$

and for quantity taxes, the equations for periods in which the tax freeze is active are (7.42), (7.43), (7.44), (7.45), (7.46), (7.47), (7.48) and (7.49):

$$
\begin{aligned}
t_{k,c,t}^{G,DutyQ} &= t_{k,c,t-1}^{G,DutyQ} \frac{P_{k,t-1}^{Y}}{(1+g_t^P)\, P_{k,t}^{Y}} \qquad , c = D,\ k \in \{C, P, G\}, \\
t_{k,c,t}^{G,DutyQ} &= t_{k,c,t-1}^{G,DutyQ} \frac{1}{(1+g_t^P)} \qquad , c = F,\ k \in \{C, P, G\}, \\
t_{d,k,c,t}^{H,DutyQ} &= t_{d,k,c,t-1}^{H,DutyQ} \frac{P_{k,t-1}^{Y}}{(1+g_t^P)\, P_{k,t}^{Y}} \qquad , c = D, d \in \{D, R, G, P\},\ k \in \{C, P, G\}, \\
t_{k,c,t}^{H,DutyQ} &= t_{k,c,t-1}^{H,DutyQ} \frac{1}{(1+g_t^P)} \qquad , c = F, d \in \{D, R, G, P\},\ k \in \{C, P, G\}, \\
t_{j,k,c,t}^{I,B,DutyQ} &= t_{j,k,c,t-1}^{I,B,DutyQ} \frac{P_{k,t-1}^{Y}}{(1+g_t^P)\, P_{k,t}^{Y}} \qquad , c = D, j \in \{C, P, D, G\}, k \in \{C, P\}, \\
t_{k,c,t}^{I,B,DutyQ} &= t_{k,c,t-1}^{I,B,DutyQ} \frac{1}{(1+g_t^P)} \qquad , c = F, j \in \{C, P, D, G\}, k \in \{C, P\}, \\
t_{j,k,c,t}^{I,M,DutyQ} &= t_{j,k,c,t-1}^{I,M,DutyQ} \frac{P_{k,t-1}^{Y}}{(1+g_t^P)\, P_{k,t}^{Y}} \qquad , c = D, j \in \{C, P, D, G\}, k \in \{P\}, \\
t_{k,c,t}^{I,M,DutyQ} &= t_{k,c,t-1}^{I,M,DutyQ} \frac{1}{(1+g_t^P)} \qquad , c = F, j \in \{C, P, D, G\}, k \in \{P\}, \\
t_{j,k,c,t}^{M,DutyQ} &= t_{j,k,c,t-1}^{M,DutyQ} \frac{P_{k,t-1}^{Y}}{(1+g_t^P)\, P_{k,t}^{Y}} \qquad , c = D, j \in \{C, P, D, G\}, k \in \{C, P, G\}, \\
t_{k,c,t}^{M,DutyQ} &= t_{k,c,t-1}^{M,DutyQ} \frac{1}{(1+g_t^P)} \qquad , c = F, j \in \{C, P, D, G\}, k \in \{C, P, G\}, \\
t_{k,t}^{X,DutyQ} &= t_{k,t-1}^{X,DutyQ} \frac{P_{k,t-1}^{Y}}{(1+g_t^P)\, P_{k,t}^{Y}}, \\
t_{j,c,t}^{I,I,DutyQ} &= t_{j,c,t-1}^{I,I,DutyQ} \sum_{k \in \{C,P,D,G\}} \frac{P_{k,t-1}^{Y}}{(1+g_t^P)\, P_{k,t}^{Y}} \qquad , c = D, j \in \{C, P\}, \\
t_{j,c,t}^{I,I,DutyQ} &= t_{j,c,t-1}^{I,I,DutyQ} \frac{1}{(1+g_t^P)} \qquad , c = F, j \in \{C, P\}.
\end{aligned}
$$

Finally the tax on owner-occupied dwellings for periods where the tax freeze are active are given by equation (7.51):

$$t^{Dwe}_{t+1} = t^{Dwe}_{t} \times \frac{\sum_{j\in\{D\}}\sum_{a}\left(P^{K,H,B}_{j,tFreeze}K^{H,B}_{a-1,t} + P^{K,H,L}_{j,tFreeze}K^{H,L,Ind}_{a-1,t}\right)N^{AdultEq}_{a-1,t}}{\sum_{j\in\{D\}}\sum_{a}\left(P^{K,H,B}_{j,tFreeze}K^{H,B}_{a-1,t-1} + P^{K,H,L}_{j,tFreeze}K^{H,L,Ind}_{a-1,t-1}N^{AdultEq}_{a-t,t-1}\right)}$$
$$\times \frac{\sum_{j\in\{D\}}\sum_{a}\left(P^{K,H,B}_{j,t-1}K^{H,B}_{a-1,t-1} + P^{K,H,L}_{j,t-1}K^{H,L,Ind}_{a-1,t-1}\right)N^{AdultEq}_{a-1,t-1}\ /\ (1+g_t)(1+g^p_t)}{\sum_{j\in\{D\}}\sum_{a}\left(P^{K,H,B}_{j,t}K^{H,B}_{a-1,t} + P^{K,H,L}_{j,t}K^{H,L,Ind}_{a-1,t}\right)N^{AdultEq}_{a-1,t}}$$

For periods in which the tax freeze is not active, the tax rates of the equations in this subsection are simply constant, for example (7.51) becomes

$$t^{Dwe}_{t+1} = t^{Dwe}_{t},$$

etc.

Indexation of government consumption

The development of individual government consumption can be indexed so that age-, gender- and origin-specific per capita expenses follow either the exogenous productivity growth and foreign inflation rates or so that per capita expenses follow GDP, equation (7.54):

$$C^{G,Ind}_{t} = \frac{C^{G,IndExo}_{t}}{C^{G,IndExo}_{t-1}}\left(1 + d^{CGInd}_{t}\left(\frac{\frac{Y^{GDP}_{t}}{P^{C,G}_{t}}}{\frac{Y^{GDP}_{t-1}}{P^{C,G}_{t-1}}} - 1\right)\right)C^{G,Ind}_{t-1}adj^{C,G}_{t}.$$

Correspondingly, collective government consumption can be represented either as a constant percentage of GDP or be indexed to total population, eq. (7.57):

$$C^{G,Coll}_{t} = \left(\left(1 - d^{CGColl}_{t}\right)\frac{N^{Tot}_{t}}{N^{Tot}_{t-1}} + d^{CGColl}_{t}\frac{\frac{Y^{GDP}_{t}}{P^{C,G}_{t}}}{\frac{Y^{GDP}_{t-1}}{P^{C,G}_{t-1}}}\right)C^{G,Coll}_{t-1}adj^{C,G}_{t}.$$

Indexation according to wage regulation

The wage indexation variable is given by equation (7.58):

$$W_t^{Reg} = \frac{\dfrac{\sum\limits_{o\in oLab}\sum\limits_{s\in\{m,f\}}\sum\limits_{a\in Ax0}\left(1-t_t^{Payroll}\right)adj_t^{Hours}r_{o,s,a,t}^{LabFull}\left(1+adj_t^{LS}\right)L_{o,s,a,t}^S\left(\rho_{o,s,a,t}W_t\left(1-q_{o,s,a,t}^{Z,F}\right)-q_{a,t}^{ATP}\right)N_{o,s,a,t}^{Ind}}{\sum\limits_{o\in oLab}\sum\limits_{s\in\{m,f\}}\sum\limits_{a\in Ax0}r_{o,s,a,t}^{LabFull}\left(1+adj_t^{LS}\right)L_{o,s,a,t}^S N_{o,s,a,t}^{Ind}}}{\dfrac{\sum\limits_{o\in oLab}\sum\limits_{s\in\{m,f\}}\sum\limits_{a\in Ax0}\left(1-t_{t-1}^{Payroll}\right)adj_{t-1}^{Hours}r_{o,s,a,t-1}^{LabFull}\left(1+adj_{t-1}^{LS}\right)L_{o,s,a,t-1}^S\left(\rho_{o,s,a,t-1}W_{t-1}\left(1-q_{o,s,a,t-1}^{Z,F}\right)-q_{a,t-1}^{ATP}\right)N_{o,s,a,t-1}^{Ind}}{\sum\limits_{o\in oLab}\sum\limits_{s\in\{m,f\}}\sum\limits_{a\in Ax0}r_{o,s,a,t-1}^{LabFull}\left(1+adj_{t-1}^{LS}\right)L_{o,s,a,t-1}^S N_{o,s,a,t-1}^{Ind}}},$$

(7.59):

$$\begin{aligned} o_{b,s,a,t}^{G,H,AgeDep} &= (1+adj_{b,s,a,t}^{OAPAge})\left(W_t^{Reg}d_{b,t}^{WReg}+\frac{P_{C,t}^{C,H}}{\frac{P_{C,t-1}^{C,H}}{(1+g_t)}}(1-d_{b,t}^{WReg})-adj_t^{WReg}\right) \\ &\quad\times\frac{o_{b,s,a,t}^{G,H,AgeDepExo}}{o_{b,s,a,t-1}^{G,H,AgeDepExo}}o_{b,s,a,t-1}^{G,H,AgeDep}. \end{aligned}$$

The growth rate in the majority of income-replacing transfers is simply equal to W_t^{Reg} minus an exogenous variable adj_t^{WReg}. As equation (7.60) we for a number of income-replacing transfers have:

$$\begin{aligned}
\frac{o_t^{G,H,S}}{o_{t-1}^{G,H,S}} &= W_t^{Reg} - adj_t^{WReg}, \\
\frac{o_t^{G,H,AP}}{o_{t-1}^{G,H,AP}} &= W_t^{Reg} - adj_t^{WReg}, \\
\frac{o_t^{G,H,PEW}}{o_{t-1}^{G,H,PEW}} &= W_t^{Reg} - adj_t^{WReg}, \\
\frac{o_t^{G,H,BB}}{o_{t-1}^{G,H,BB}} &= W_t^{Reg} - adj_t^{WReg}, \\
\frac{o_t^{G,H,LA}}{o_{t-1}^{G,H,LA}} &= W_t^{Reg} - adj_t^{WReg}, \\
\frac{o_t^{G,H,MB}}{o_{t-1}^{G,H,MB}} &= W_t^{Reg} - adj_t^{WReg}, \\
\frac{o_t^{G,H,SB}}{o_{t-1}^{G,H,SB}} &= W_t^{Reg} - adj_t^{WReg}, \\
\frac{o_t^{G,H,CA}}{o_{t-1}^{G,H,CA}} &= W_t^{Reg} - adj_t^{WReg}, \\
\frac{o_t^{G,H,AB}}{o_{t-1}^{G,H,AB}} &= W_t^{Reg} - adj_t^{WReg}, \\
\frac{o_t^{G,H,IB}}{o_{t-1}^{G,H,IB}} &= W_t^{Reg} - adj_t^{WReg}, \\
\frac{o_{o,s,a,t}^{G,H,Unemp}}{o_{o,s,a,t-1}^{G,H,Unemp}} &= W_t^{Reg} - adj_t^{WReg}, \\
\frac{o_t^{G,H,NonAgeDep}}{o_{t-1}^{G,H,NonAgeDep}} &= W_t^{Reg} - adj_t^{WReg}, \\
\frac{k_t^{Source}}{k_{t-1}^{Source}} &= W_t^{Reg} - adj_t^{WReg}, \\
\frac{allow_t^{Pers}}{allow_{t-1}^{Pers}} &= W_t^{Reg} - adj_t^{WReg}, \\
\frac{allow_t^{Assess}}{allow_{t-1}^{Assess}} &= W_t^{Reg} - adj_t^{WReg}.
\end{aligned}$$

In other case there are special rules: Old-age pensions are devided in basis pension benefit and supplementary pensions benefit, asgiven in equation,(7.61), (7.62) and (7.63):

$$
\begin{aligned}
o^{G,H,OAP}_{s,a,t} &= o^{G,H,OAP,Base}_{s,a,t} + o^{G,H,OAP,Add}_{s,a,t}, \\
\frac{o^{G,H,OAP,Base}_{s,a,t}}{o^{G,H,OAP,Base}_{s,a,t-1}} &= W^{Reg}_t - adj^{WReg}_t, \\
\frac{o^{G,H,OAP,Add}_{s,a,t}}{o^{G,H,OAP,Add}_{s,a,t-1}} &= \left(1 - adj^{OAP}_{s,a,t}\right)\left(W^{Reg}_t - adj^{WReg}_t\right).
\end{aligned}
$$

Pensions for civil servants is also a special case, eq. (7.64):

$$o^{G,H,CS}_{a,t} = o^{G,H,CSExo}_{a,t} W_t.$$

Finally also contributions to unemployment funds are indexed to the wages, eq. (7.65):

$$\frac{Unemp^{Max}_t}{Unemp^{Max}_{t-1}} = W^{Reg}_t - adj^{WReg}_t.$$

Indexation of current and capital transfers following GDP

Indexation to GDP is used like in equation (7.66) for a number of transfers:

$$
\begin{aligned}
OR_t^{G,EU,Res} &= OR_{t-1}^{G,EU,Res} \frac{Y_t^{GDP}}{Y_{t-1}^{GDP}}, \\
OR_t^{G,F,Res} &= OR_{t-1}^{G,F,Res} \frac{Y_t^{GDP}}{Y_{t-1}^{GDP}}, \\
OR_t^{G,F,Cap} &= OR_{t-1}^{G,F,Cap} \frac{Y_t^{GDP}}{Y_{t-1}^{GDP}}, \\
OR_t^{G,Gr} &= OR_{t-1}^{G,Gr} \frac{Y_t^{GDP}}{Y_{t-1}^{GDP}}, \\
OR_t^{G,FI} &= OR_{t-1}^{G,FI} \frac{Y_t^{GDP}}{Y_{t-1}^{GDP}}, \\
o_t^{G,P,Cap} &= o_{t-1}^{G,P,Cap} \frac{Y_t^{GDP}}{Y_{t-1}^{GDP}}, \\
OR_t^{EU,G} &= OR_{t-1}^{EU,G} \frac{Y_t^{GDP}}{Y_{t-1}^{GDP}}, \\
OR_t^{F,G,Res} &= \left(1 + adj^{OR,F,G,Res}\right) OR_{t-1}^{F,G,Res} \frac{Y_t^{GDP}}{Y_{t-1}^{GDP}}, \\
OR_t^{F,G,Cap} &= OR_{t-1}^{F,G,Cap} \frac{Y_t^{GDP}}{Y_{t-1}^{GDP}}, \\
o_t^{P,G,Land,Rent} &= o_{t-1}^{P,G,Land,Rent} \frac{Y_t^{GDP}}{Y_{t-1}^{GDP}}, \\
o_t^{P,G,Quasi} &= o_{t-1}^{P,G,Quasi} \frac{Y_t^{GDP}}{Y_{t-1}^{GDP}}.
\end{aligned}
$$

Indexation to GDP per adult is used like in equation (7.67) for a number of transfers:

$$
\begin{aligned}
\sum_{a \in Ax0} N_{a,t}^{Adult} o_t^{G,H} &= \sum_{a \in Ax0} N_{a,t-1}^{Adult} o_{t-1}^{G,H} \frac{Y_t^{GDP}}{Y_{t-1}^{GDP}} \\
\sum_{a \in Ax0} N_{a,t}^{Adult} o_t^{G,H,Cap} &= \sum_{a \in Ax0} N_{a,t-1}^{Adult} o_{t-1}^{G,H,Cap} \frac{Y_t^{GDP}}{Y_{t-1}^{GDP}} \\
\sum_{a \in Ax0} N_{a,t}^{Adult} o_t^{H,G} &= \sum_{a \in Ax0} N_{a,t-1}^{Adult} o_{t-1}^{H,G} \frac{Y_t^{GDP}}{Y_{t-1}^{GDP}} \\
\sum_{a \in Ax0} N_{a,t}^{Adult} o_t^{H,G,Cap} &= \sum_{a \in Ax0} N_{a,t-1}^{Adult} o_{t-1}^{H,G,Cap} \frac{Y_t^{GDP}}{Y_{t-1}^{GDP}} \\
\sum_{a \in Ax0} N_{a,t}^{Adult} o_t^{H,G,Soc} &= \sum_{a \in Ax0} N_{a,t-1}^{Adult} o_{t-1}^{H,G,Soc} \frac{Y_t^{GDP}}{Y_{t-1}^{GDP}} \\
\sum_{a \in Ax0} N_{a,t}^{Adult} o_t^{H,G,SocOpt} &= \sum_{a \in Ax0} N_{a,t-1}^{Adult} o_{t-1}^{H,G,SocOpt} \frac{Y_t^{GDP}}{Y_{t-1}^{GDP}}
\end{aligned}
$$

Lump-sum transfers resulting from calibration process

There exist eight different lump-sum transfers which are results of the calibration process. Of these are to already treated above and i this section we look at the rest.

Lump-sum transfers from the payroll tax payments and from the tax on owner-occupied dwellings are given in equation (7.68) and (7.69):

$$\begin{aligned} o^{H,G,LumpPayroll}_{o,s,a,t} &= k^{Payroll}_t t^{Payroll}_t N^{Ind}_{o,s,a,t} adj^{Hours}_t r^{LabFull}_{o,s,a,t} \left(1 + adj^{LS}_t\right) L^S_{o,s,a,t}(\rho_{o,s,a,t} w_t - q^{ATP}_{a,t}) \\ o^{H,G,LumpDwe}_{a,t} &= k^{Dwe}_t t^{Dwe}_t \sum_{j \in \{D\}} \left(P^{K,H,B}_{j,t-1} K^{H,B}_{a-1,t-1} + P^{K,H,L}_{j,t-1} K^{H,L,Ind}_{a-1,t-1}\right) N^{AdultEq}_{a-1,t-1} \frac{1}{(1+g_t)\left(1+g^P_t\right)} \end{aligned}$$

Identity transfers from household to government because of error in kildeskat revenue is given by equation (7.70):

$$\sum_{a \in Ax0} N^{Adult}_{a,t} o^{H,G,LumpInt}_t = \sum_{a \in Ax0} N^{Adult}_{a,1} o^{H,G,LumpInt}_1 \frac{\sum\limits_{j \in \{C,P\}} K^{P,W}_{j,t}}{\sum\limits_{j \in \{C,P\}} K^{P,W}_{j,1}}$$

Transfers because of capital income and investmenst are given by equation (7.71) and (7.72):

$$\begin{aligned} o^{H,G,LumpGrOS}_t &= \frac{1}{\sum\limits_{a \in Ax0} N^{Adult}_{a,t}} \left[k^{GrOS}_t \sum_{j \in \{G\}} \left(\left(1 + k^{Depr}_{j,t}\right)\left(P^{I,P,M}_{j,t} \delta^{P,M}_j \frac{K^{P,M}_{j,t-1}}{1+g_t} + P^{I,P,B}_{j,t} \delta^{P,B}_j \frac{K^{P,B}_{j,t-1}}{1+g_t}\right)\right)\right] \\ o^{H,G,LumpGI}_t &= \frac{1}{\sum\limits_{a \in Ax0} N^{Adult}_{a,t}} \left[k^{GI}_t \sum_{j \in \{G\}} \left(P^{I,P,M}_{j,t} I^{P,M}_{j,t} + P^{I,P,B}_{j,t} I^{P,B}_{j,t}\right)\right] \end{aligned}$$

Lump-sum transfers for the SP fund, eq. (7.73):

$$o^{H,SP,LumpSP}_{s,a,t} = k^{SP}_t \sum_{o \in oLab} N^{Ind}_{o,s,a,t} q^{SP}_{a,t} adj^{Hours}_t r^{LabFull}_{o,s,a,t} \left(1 + adj^{LS}_t\right) L^S_{o,s,a,t} \left(\rho_{o,s,a,t} W_t \left(1 - q^{ZF}_{a,t}\right) - q^{ATP}_{a,t}\right).$$

Finally identity transfers from firms to government because of the K factor on corporate tax, equation (7.74):

$$
\begin{aligned}
o_{j,t}^{P,G,LumpCor} = \; & k_t^{Cor} t_t^{Cor} \cdot P_{j,t}^{Y} \left(Y_{j,t} + Y_{j,t}^{NorthSea} \right) - P_{j,t}^{M} M_{j,t} \\
& - \left(1 + t_{j,t}^{Emp} + t_{j,t}^{W} + q_t^{LG} \right) W_t LD_{j,t} \\
& - \frac{\delta_{j,t}^{PM,Book} K_{j,t-1}^{PM,Book} + \delta_{j,t}^{PB,Book} k_{j,t-1}^{PB,Book}}{(1+g_t)\left(1+g_t^P\right)} \\
& - \frac{i_t \; D_{j,t-1}^{P}}{(1+g_t)\left(1+g_t^P\right)} \\
& - \frac{t_{j,t}^{P,Weight} K_{j,t-1}^{PM}}{(1+g_t)} \\
& - \frac{t_{j,t}^{P,Land} P_{j,t-1}^{IPB} K_{j,t-1}^{PB}}{(1+g_t)\left(1+g_t^P\right)} \\
& + s_{j,t}^{EU,P,SetAside} + s_{j,t}^{EU,P,Rural} + o_{j,t}^{G,P,Cap}.
\end{aligned}
$$