Design of fiscal consolidation packages and model-based fiscal multipliers in Croatia*

Milan Deskar-Škrbić, Darjan Milutinović

https://doi.org/10.3326/pse.45.1.1 | **Published online:** March 2, 2021

Equation/Identity	Variable label	Variable name	Description/definition	Variable source
Behavioural equations				CBS
Consumption	C_t	Private consumption	Consumption of households and NPISH, National accounts, constant prices (2015=100)	CBS
	Y_t^D	Real disposable income	See below (identity)	CBS
	W_t	Real wealth	Zagreb stock market exchange (ZSE) index CROBEX. deflated by CPI	ZSE, CBS
Private investments	IP_t	Private investments	Gross capital formation (GCF), National accounts – Gross capital formation of the government (ESA 2010, sectoral government accounts), deflated by investments deflator	CBS
	ID_t	Investment demand	See below	CBS
	FDI_t	Foreign direct investment	Balance of Payments, Financial account, Direct investment (liabilities) (converted from EUR to HRK)	CNB
	$COST_t$	Private investment cost	See below (identity)	
	$SUBS_t$	Subsidies	Sectoral government accounts (ESA 2010)	CBS
Imports	M_t	Imports	Imports of goods and services (GS), National accounts, constant prices (2015=100)	CBS
	MD_t	Import demand	See below (identity)	
	$\overline{TOT_t}$	Terms of trade	Ratio between deflator of exports and deflator of imports, National accounts	CBS
Private employment	$EMPPRIV_t$	Private employment	Number of employed persons in all sectors except O, P, Q activities according to NKD 2007, in thousands	CHIF
	IT_t	Total investment	Gross capital formation, National accounts, constant prices (2015=100)	CBS

	C_t	Private consumption	Consumption of households and NPISH, National accounts, constant prices (2015=100)	
Prices	CPI_t	Consumer price index	Consumer price index, 2015=100	CNB
	$WTOTAL_t$	Total wage bill	See below	
	MP_t	Imports deflator	(Imports of GS in current prices)/(imports of GS in constant prices, 2015=100)*100	CBS
	OIL_t	OIL prices	Brent oil price in US dollars (converted to HRK)	Fred
	$\overline{IMPL\_IND_t}$	Implicit indirect tax rate	$\overline{IMPL\_IND_t} = \frac{IND\_TAX_t}{C_t^{nominal}}$	
Interest rate	IIR_t	Implicit interest rate	$IIR_t = \frac{INT_t^{annual}}{DEBT_{t-4}}$	
	$DEBT_t$	Public debt	General government debt (ESA 2010), millions of HRK	CNB
Unemployment benefits	$UNEMP\_B_t$	Unemployment benefits	Unemployment benefits (COFOG 10.5.0, ESA 2010)	Eurostat
	$EMPTOT_t$	Total employment	Total number of employed persons, in thousands	CHIF
Identities (macro)				
Real GDP	GDP_t	Gross domestic product (GDP)	$GDP_t = C_t + \overline{G_t} + IT_t + \overline{X_t} - M_t$	
	C_t	Private consumption	Consumption of households and NPISH, National accounts, constant prices (2015=100)	CBS
	IT_t	Total investment	Gross capital formation (GCF), National accounts, constant prices (2015=100)	CBS
	$\overline{G_t}$	Government consumption	General government (GG) consumption, National accounts, constant prices (2015=100)	CBS
	$\overline{X_t}$	Exports	Exports of goods and services (GS), National accounts, constant prices (2015=100)	CBS
	M_t	Imports	Imports of goods and services (GS), National accounts, constant prices (2015=100)	CBS
Nominal GDP	GDP_t^{nom}	Nominal GDP	$GDP_t^{nom} = GDP_t * (GDP\_DEF_t) * 100$	
	GDP_DEF_t	GDP deflator	(GDP in current prices)/(GDP in constant prices, 2015=100)*100	CBS

Nominal consumption	C_t^{nom}	Nominal private consumption	$CN_t = C_t * (CPI_t) * 100$	
	C_t	Private consumption	Consumption of households and NPISH, National accounts, constant prices (2015=100)	CBS
	CPI_t	Consumer price index	Consumer price index, 2015=100	CNB
Real G	$\overline{G_t}$	Government consumption	$\overline{G_t} = (\overline{\overline{G_t^{nom}}}/\overline{G\_DEF_t}) * 100$	CBS
	$\overline{G_t^{nom}}$	Nominal government consumption	See below.	
	$\overline{G\_DEF_t}$	Government consumption deflator	(GG consumption in current prices)/(GG consumption in constant prices, 2015=100)*100	CBS
Real GDP annual	$GDPY_t$	Annual GDP	$GDPY_t = GDP_t + GDP_{t-1} \mp GDP_{t-2} + GDP_{t-3}$	
Total investment	IT_t	Total investment	$IT_t = IP_t + \overline{IG_t}$	
	IP_t	Private investments	Gross capital formation (GCF), National accounts – Gross capital formation of the government (ESA 2010, sectoral government accounts), constant prices (2015=100)	CBS
	$\overline{IG_t}$	Government investment	See below.	
Private investment costs	$ICOST_t$	Private investment costs	$ICOST_t = (WPRIV_{t-1} + CIT_{t-1})/IP_{t-1}$	
	$WPRIV_t$	Private wage bill	See below.	
	CIT_t	Corporate income tax	Direct taxes by corporations (sectoral accounts of S.11+S.12, ESA 2010)	Eurostat
Investment demand	ID_t	Investment demand	$ID_t = C_t + \overline{G_t} + \overline{X_t} + \overline{IG_t}$	
	C_t	Private consumption	Consumption of households and NPISH, National accounts, constant prices (2015=100)	CBS
	$\overline{G_t}$	Government consumption	See above.	CBS
	$\overline{X_t}$	Exports	Exports of goods and services (GS), National accounts, constant prices (2015=100)	CBS

	$\overline{IG_t}$	Government investment	See below (identity)	
Real government investment	$\overline{IG_t}$	Government investment	$\overline{IG_t} = (\overline{IG_t}^{nom}/\overline{IG\_DEF_t})$*100	
	$\overline{IG_t}^{nom}$	Nominal government investment	Gross fixed capital formation (ESA 2010, sectoral government accounts)	CBS
	$\overline{IG\_DEF_t}$	Government investment deflator	$\overline{IG\_DEF_t} = (\overline{IG_t}^{nom}/\overline{IG_t})$*100	CBS
	$\overline{IG_t}$	Government investment	Government investment in constant prices, 2015=100	CBS
Imports demand	MD_t	Import demand	$MD_t = C_t + IP_t + \overline{G_t} + (\overline{G_t} - WPUB_t) + \overline{X_t}$	
	C_t	Private consumption	Consumption of households and NPISH, National accounts, constant prices (2015=100)	CBS
	IP_t	Private investment	Gross capital formation (GCF), National accounts – Gross capital formation of the government (ESA 2010, sectoral government accounts), deflated by investments deflator	
	$\overline{IG_t}$	Public investment	$\overline{IG_t} = (\overline{IGN_t}/\overline{IG\_DEF_t})$*100	
	$\overline{G_t}$	Government consumption	See above.	
	$WPUB_t$	Public wage bill	See below.	CHIF
	$\overline{X_t}$	Exports	Exports of goods and services (GS), National accounts, constant prices (2015=100)	CBS
Private wage bill	$WPRIV_t$	Private wage bill	$WPRIV_t = \left(W_{NET_{PRIV}t} + PIT_t{}^{Private}{}_{emp} + SC_{H}{}_t{}^{Private}{}_{emp} + SC_{P}{}_t{}^{Private}{}_{emp} \right) * EMPPRIV_t$	
	$W\_NET\_PRIV_t$	Net private wages	Average net wage in all activities except O, P, Q according to NKD 2007, adjusted	CBS
	$PIT_t{}^{Private}{}_{emp}$	Personal income tax paid by private sector per empl.	$PIT_t{}^{Private}{}_{emp} = \frac{PIT_t - PIT_{PUB}{}_t}{EMPPRIV_t}$	

	$SC\_H_t{}^{Private}{}_{emp}$	Healthcare social contribution paid by private sector employers	$SC\_H^{Private}{}_{t_{emp}} = \frac{SC\_H_t - SC\_H_{PUB_t}}{EMPPRIV_t}$	
	$SC\_P_t{}^{Private}{}_{emp}$	Pension social contribution paid by private sector employees	$SC\_P^{Private}{}_{t_{emp}} = \frac{SC\_P_t - SC\_P_{PUB_t}}{EMPPRIV_t}$	
	$EMPPRIV_t$	Private employment	Number of employed persons in all activities except O, P, Q according to NKD 2007, in thousands	CHIF
Public wage bill	$WPUB_t$	Public wage bill	$WPUB_t = \left(W_{NET_{PUB_t}} + PIT_t{}^{Public}{}_{emp} + SC_{H_t}{}^{Public}{}_{emp} + SC_{P_t}{}^{Public}{}_{emp} \right) * EMPPUB_t$	
	$W\_NET\_PUB_t$	Net public wages	Average net wage in O, P, Q activities according to NKD 2007, adjusted	CBS
	$PIT_t{}^{Public}{}_{emp}$	Personal income tax paid by public sector employees	$PIT_t{}^{Public}{}_{emp} = \frac{PIT_t}{EMPTOT_t} * \frac{W\_NET\_PUB_t}{W\_NET_t}$	
	$SC\_H_t{}^{Public}{}_{emp}$	Healthcare social contribution paid by public employers	$SC\_H_t{}^{Public}{}_{emp} = \frac{SC\_H_t}{EMPTOT_t} * \frac{W\_NET\_PUB_t}{W\_NET_t}$	
	$SC\_P_t{}^{Public}{}_{emp}$	Pension social contribution paid by public employees	$SC\_P_t{}^{Public}{}_{emp} = \frac{SC\_P_t}{EMPTOT_t} * \frac{W\_NET\_PUB_t}{W\_NET_t}$	
	$EMPPUB_t$	Public employment	Number of employed persons in O, P, Q activities according to NKD 2007, in millions	CHIF
Disposable income	NY_t^D	Nominal disposable income	$NY_t^D = (WPUB_t + WPRIV_t + SB_T + REM_t) - (SC\_P_t + SC\_H_t + PIT_t)$	
	$WPUB_t$	Public wage bill	See above.	

	$WPRIV_t$	Private wage bill	See above.	
	SB_T	Social benefits	Social benefits other than social transfers in kind (ESA 2010).	CBS
	REM_t	Remittances	Balance of Payments, Secondary income, Other sectors, Revenues (converted from EUR to HRK)	CNB
	SC_P_t	Social security contributions for pensions	Households' actual social contributions (ESA 2010).	
	SC_H_t	Social security contributions for healthcare	Employers' actual social contributions (ESA 2010).	CBS
	PIT_t	Personal income tax	Direct taxes by households (sectoral accounts of S.14+S.15, ESA 2010)	CBS
Real disposable income	Y_t^D	Real disposable income	$Y_t^D = (NY_t^D / CPI_t)$*100	
	NY_t^D	Nominal disposable income	$NY_t^D = (WPUB_t + WPRIV_t + SB_T + REM_t) - (SC\_P_t + SC\_H_t + PIT_t)$	
	CPI_t	Consumer price index	Consumer price index, 2015=100	CNB
Identities (fiscal)				
Fiscal Balance	FB_t	General government fiscal balance	$FB_t = \mathrm{TR}_t - \mathrm{TE}_t$	
General government revenues	TR_t	Total general government revenues	$TR_t = IND\_TAX_t + INCOME\_TAX_t + SC\_H_t + SC\_P_t + \overline{SALES_t} + \overline{REV\_OTHER_t}$	
	IND_TAX_t	Indirect taxes	$IND\_TAX_t = \overline{IMPL\_IND_t} * C_t^{nom}$	
	$\overline{IMPL\_IND_t}$	Implicit indirect tax rate	$\overline{IMPL\_IND_t} = \frac{\overline{IND\_TAX}_t}{C_t^{nom}}$	
	$\overline{IND\_TAX}_t$	Indirect taxes	Taxes on production and imports (ESA 2010)	Eurostat
	C_t^{nom}	Private consumption	Consumption of households and NPISH, National accounts, current prices	CBS

$INCOME\_TAX_t$	Personal and profit income taxes	$INCOME\_TAX_t = CIT_t + PIT_t$	
$CIT_{\ t}$	Corporate income tax	$CIT_{\ t} = \overline{IMPL\_CIT_t} * IP_t$	
$\overline{IMPL\_CIT_t}$	Implicit direct tax rate	$\overline{IMPL\_CIT_t} = \frac{\overline{CIT_t}}{IP_T}$	
$\overline{CIT_T}$	Corporate income tax	Direct taxes by corporations (sectoral accounts of S.11+S.12) (ESA 2010)	Eurostat
IP_t	Private investments	Gross capital formation (GCF), National accounts – Gross capital formation of the government (ESA 2010, sectoral government accounts), deflated by investments deflator	CBS, Eurostat
PIT_t	Personal income tax	$PIT_t = PIT_t^{Private} + PIT_t^{Public}$	
$PIT_t^{Private}$	Personal income tax paid by private sector employees	$PIT_t^{Private} = \overline{IMPL\_PIT_t}^{Private} * WPRIV_t$	
$\overline{IMPL\_PIT_t}^{Private}$	Implicit personal income tax rate for private sector employees	$\overline{IMPL\_PIT_t} = \frac{\overline{PIT_t}^{Private}}{WPRIV_t}$	
$\overline{PIT_t}^{Private}$	Personal income tax paid by private sector employees	$\overline{PIT_t}^{Private} = PIT_t{}^{Private}{}_{emp} * EMPPRIV_t$	
$PIT_t{}^{Private}{}_{emp}$	Personal income tax paid by private sector employees per employee	See above.	
$EMPPRIV_t$	Private sector employment	See above.	
$WPRIV_t$	Private wage bill	See above.	

PIT_t^{Public}	Personal income tax paid by public sector employees	$PIT_t^{Public} = \overline{IMPL\_PIT_t}^{Public} * \overline{WPUB_t}$
$\overline{IMPL\_PIT_t}^{Public}$	Implicit personal income tax rate for private sector employees	$\overline{IMPL\_PIT_t} = \frac{\overline{PIT_t}^{Public}}{WPUB_t}$
$\overline{PIT_t}^{Public}$	Personal income tax paid by private sector employees	$\overline{PIT_t}^{Public} = PIT_t{}^{Public}{}_{emp} * EMPPUB_t$
$PIT_t{}^{Public}{}_{emp}$	Personal income tax paid by public sector employees per employee	See above.
$EMPPUB_t$	Private sector employment	See above.
$WPRIV_t$	Public wage bill	See above.
SC_P_t	Social contributions for pension insurance	$SC\_P_t = SC\_P_t^{Private} + SC\_P_t^{Public}$
$SC\_P_t^{Private}$	Social contributions for pension insurance paid by the private sector employees	$SC\_P_t^{Private} = \overline{IMPL\_SC\_P_t}^{Private} * WPRIV_t$
$\overline{IMPL\_PIT_t}^{Private}$	Implicit personal income tax rate	$\overline{IMPL\_SC\_P_t}^{Private} = \frac{\overline{SC\_P_t^{Private}}}{WPRIV_t}$

	for private sector employees	
$\overline{SC\_P_t^{Private}}$	Social contributions for pension insurance paid by the private sector employees	$\overline{SC\_P_t^{Private}} = SC\_P_t{}^{Private}{}_{emp} * EMPPRIV_t$
$SC\_P_t^{Public}$	Social contributions for pension insurance paid by the public sector employees	$SC\_P_t^{Public} = \overline{IMPL\_SC\_P_t}^{Public} * WPRIV_t$
$\overline{IMPL\_SC\_P_t}^{Public}$	Implicit personal pension contribution rate for public sector employees	$\overline{IMPL\_SC\_P_t}^{Public} = \frac{\overline{SC\_P_t^{Public}}}{WPRIV_t}$
$\overline{SC\_P_t^{Public}}$	Social contributions for pension insurance paid by the public sector employees	$\overline{SC\_P_t^{Public}} = SC\_P_t{}^{Private}{}_{emp} * EMPPRIV_t$
SC_H_t	Social contributions for health insurance	$SC\_H_t = SC\_H_t{}^{Private} + SC\_H_t{}^{Public}$
$SC\_H_t{}^{Private}$	Social contributions for pension	$SC\_H_t{}^{Private} = \overline{IMPL\_SC\_H_t}^{Private} * WPRIV_t$

	insurance paid by the private sector employers		
$\overline{IMPL\_SC\_H_t}^{Private}$	Implicit health contribution rate for private sector employers	$\overline{IMPL\_SC\_H_t}^{Private} = \frac{\overline{SC\_H_t}^{Private}}{WPRIV_t}$	
$\overline{SC\_H_t}^{Private}$	Social contributions for pension insurance paid by the private sector employers	$\overline{SC\_H_t}^{Private} = SC\_H_t{}^{Private}{}_{emp} * EMPPRIV_t$	
$SC\_H_t{}^{Public}$	Social contributions for pension insurance paid by the public sector employers	$SC\_P_t{}^{Public} = \overline{IMPL\_SC\_P_t}^{Public} * WPRIV_t$	
$\overline{IMPL\_SC\_H_t}^{Public}$	Implicit health contribution rate for public sector employers	$\overline{IMPL\_SC\_P_t}^{Public} = \frac{\overline{SC\_P_t}^{Public}}{WPRIV_t}$	
$\overline{SC\_H_t}^{Public}$	Social contributions for pension insurance paid by the public sector employers	$\overline{SC\_P_t}^{Public} = SC\_P_t{}^{Private}{}_{emp} * EMPPRIV_t$	
$\overline{SALES_t}$	Government sales	Sales (ESA 2010)	Eurostat
$\overline{REV\_OTHER_t}$	Other revenues	Residual of total general government revenues after deduction of all abovementioned revenue categories.	

General government expenditures	TE_t	Total general government expenditures	$TE_t = \overline{G_t}^{nom} + \left(\overline{SB_t^{cash}} - UNEMP\_B_t\right) + UNEMP\_B_t + INT_t + \overline{IG_t} + \overline{SUBSIDIES_t} + \overline{OTHER\_TRANS} + \overline{CAP\_TRANS} - \overline{CAP\_C} + \overline{SALES_t}.$	
	$\overline{G_t}^{nom}$	Nominal government consumption	$\overline{G_t}^{nom} = WPUB_t + \overline{SB_t^{kind}} + \overline{INT\_C_t} + \overline{CAP\_C} - \overline{SALES_t}$	
	$WPUB_t$	Public wage bill	See above.	
	$\overline{SB_t^{kind}}$	Social benefits in kind	Social transfers in kind - purchased market production (ESA 2010)	Eurostat
	$\overline{INT\_C_t}$	Intermediate consumption	Intermediate consumption (ESA 2010)	Eurostat
	$\overline{CAP\_C}$	Consumption of fixed capital	Consumption of fixed capital (ESA 2010)	Eurostat
	$\overline{SALES_t}$	Government sales	See above.	
	$\overline{SB_t^{cash}}$	Social benefits other than social transfers in kind and unemployment benefits	$\overline{SB_t^{cash}} = SB_T - UNEMP\_B_t$	
	$UNEMP\_B_t$	Unemployment benefits	Unemployment benefits (COFOG 10.5.0, ESA 2010)	Eurostat
	INT_t	Interest expenditure	$INT_t{}^{annual} = IIR_t * DEBT_{t-4}$	
	IIR_t	Implicit interest rate	$IIR_t = \frac{\overline{INT_t}}{\overline{DEBT}_{t-4}}$	
	$\overline{INT_t}$	Interest expenditure	Interest payable (ESA 2010)	Eurostat
	$DEBT_t$	Public debt	General government debt (ESA 2010), millions of HRK	CNB
	$\overline{IG_t}$	Public investments	Gross capital formation of the public sector (ESA 2010, sectoral government accounts)	Eurostat
	$\overline{SUBSIDIES_t}$	Subsidies	Subsidies payable (ESA 2010)	Eurostat

	$\overline{OTHER\_TRANS}$	Other current expenditure	Other current expenditure (ESA 2010)	Eurostat
	$\overline{CAP\_TRANS}$	Capital transfers	Capital transfers payable (ESA 2010)	Eurostat
Public debt	$\frac{DEBT_t}{GDP_t^{nom}}$	Public debt, % of GDP	$\frac{DEBT_t}{GDP_t^{nom}} = \frac{(1+IIR_t)}{(1+(GDP_t^{nom}\ growth))} * \frac{DEBT_{t-1}}{GDP_{t-1}^{nom}} - \frac{FB_t^{prim}}{GDP_t^{nom}}$	
	$DEBT_t$	Public debt	General government debt (ESA 2010), millions of HRK	CNB
	GDP_t^{nom}	Nominal GDP	$GDP_t^{nom} = GDP_t * (GDP\_DEF_t) * 100$	
	IIR_t	Implicit interest rate	See above.	
	$GDP_t^{nom}\ growth$	Growth rate of nominal GDP	$GDP_t^{nom}\ growth = \frac{GDP_t^{nom} - GDP_{t-1}^{nom}}{GDP_{t-1}^{nom}}$	
Primary fiscal balance	FB_t^{prim}	Primary fiscal balance	$FB_t^{prim} = \mathrm{TR}_t - \mathrm{TE}_t - \ INT_t$	