Is a Double Dividend Possible for the Irish Carbon Tax?

Kelly C. de Bruin
kelly.debruin@esri.ie

Aykut Mert Yakut
mert.yakut@esri.ie

FSR Climate Annual Conference

November 29, 2019
Florence, Italy

Ireland will miss its legally-binding non-ETS emissions reduction targets for 2020 and 2030 (EPA).

Carbon taxation is the primary policy tool of the Irish government for the sectors not covered by the EU-ETS (72% of the total emissions).

The carbon tax was firstly imposed on liquid fossil fuels and natural gas in 2010, and on solid fuels in 2013. Its level was equalised for all commodities at €20 per tonne-eq of CO_2 in 2014. In 2020, its level will be €26.

However, due to the Brexit uncertainties, the government did not change its policy: there will be no revenue recycling in 2020.

This paper analyses the economic and environmental impacts of an increase in the carbon tax under different revenue recycling schemes.

As the first fully dynamic general equilibrium model for the Irish economy, the Ireland Environment, Energy and Economy (I3E) model provides a comprehensive analysis of the interactions between the environment, energy use, and the economy. Moreover, it distinguishes between ETS and non-ETS emissions of firms. It constitutes

- 32 representative firms, of which 27 have dynamic investment decision
- 39 commodities
- 4 factors of production: capital and low-, medium-, and high-skilled labours (SILC & LFS)
- 10 (5 urban & 5 rural) utility maximising representative Ramsey type households (HBS)

Maximising the presented discounted value of utility by choosing the (composite) consumption subject to the intertemporal budget constraint

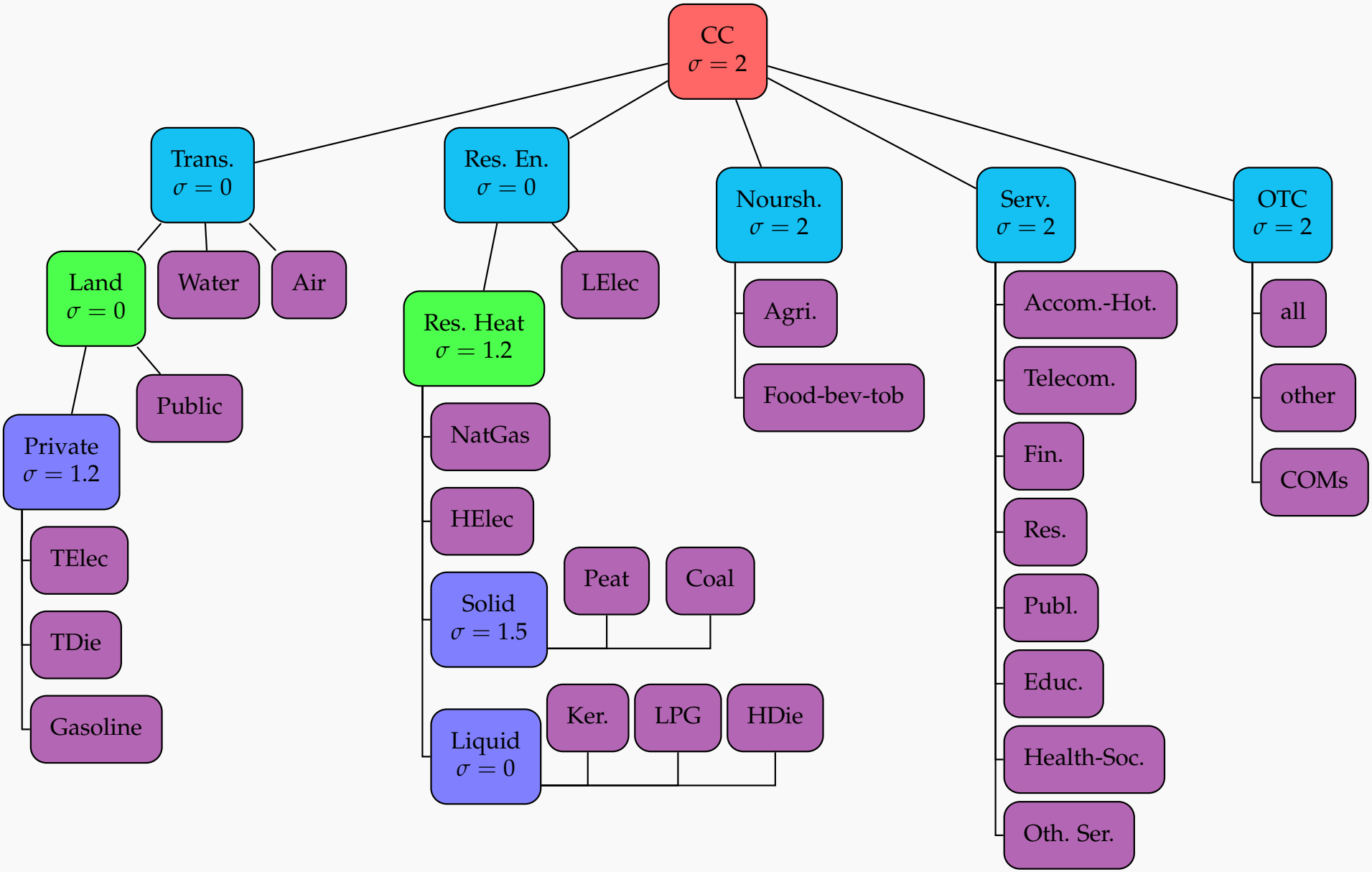
$$\max_{CC_{hh,t}} \sum_{t=1}^{\infty} \left(\frac{1+grw_t}{1+\rho_{hh}} \right)^t \frac{(CC_{hh,t})^{1-\theta_{hh}}}{1-\theta_{hh}}$$

$$s.t$$

$$SAV_{hh,t} + PCC_{hh,t}\, CC_{hh,t} \leq WINC_{hh,t} + CINC_{hh,t} + TR_{hh,t} + PEN_{hh,t} + \overline{NFI}_{hh,t}\, ER_t + RCI_{hh,t}\, RCHH_t$$

FOC: Euler equation

$$\frac{CC_{hh,t+1}}{CC_{hh,t}} = \left[(1+grw_t) \frac{1+r_{t+1}}{1+\rho_{hh}} \frac{PCC_{hh,t}}{PCC_{hh,t+1}} \right]^{\frac{1}{\theta_{hh}}}$$


CC
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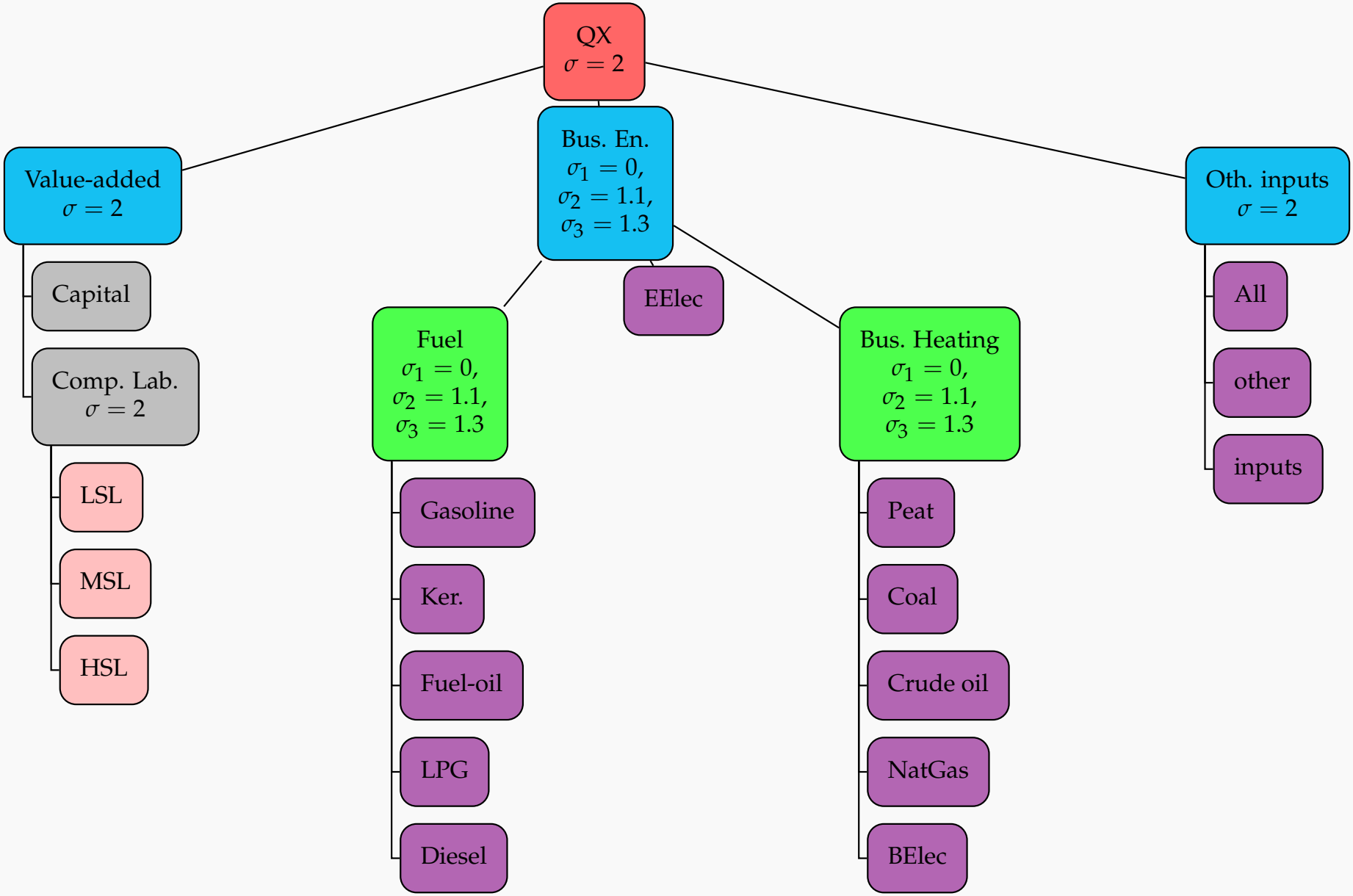
Trans.
$\sigma = 0$
Land
$\sigma = 0$
Water
Air
Public
Private
$\sigma = 1.2$
TElec
TDie
Gasoline
Res. En.
$\sigma = 0$
Res. Heat
$\sigma = 1.2$
LElec
NatGas
HElec
Solid
$\sigma = 1.5$
Peat
Coal
Liquid
$\sigma = 0$
Ker.
LPG
HDie
Noursh.
$\sigma = 2$
Agri.
Food-bev-tob
Serv.
$\sigma = 2$
Accom.-Hot.
Telecom.
Fin.
Res.
Publ.
Educ.
Health-Soc.
Oth. Ser.
OTC
$\sigma = 2$
all
other
COMs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Value-added
$\sigma = 2$
Capital
Comp. Lab.
$\sigma = 2$
LSL
MSL
HSL
Bus. En.
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$\sigma_2 = 1.1$,
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EElec
Fuel
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Fuel-oil
LPG
Diesel
Bus. Heating
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$\sigma_2 = 1.1$,
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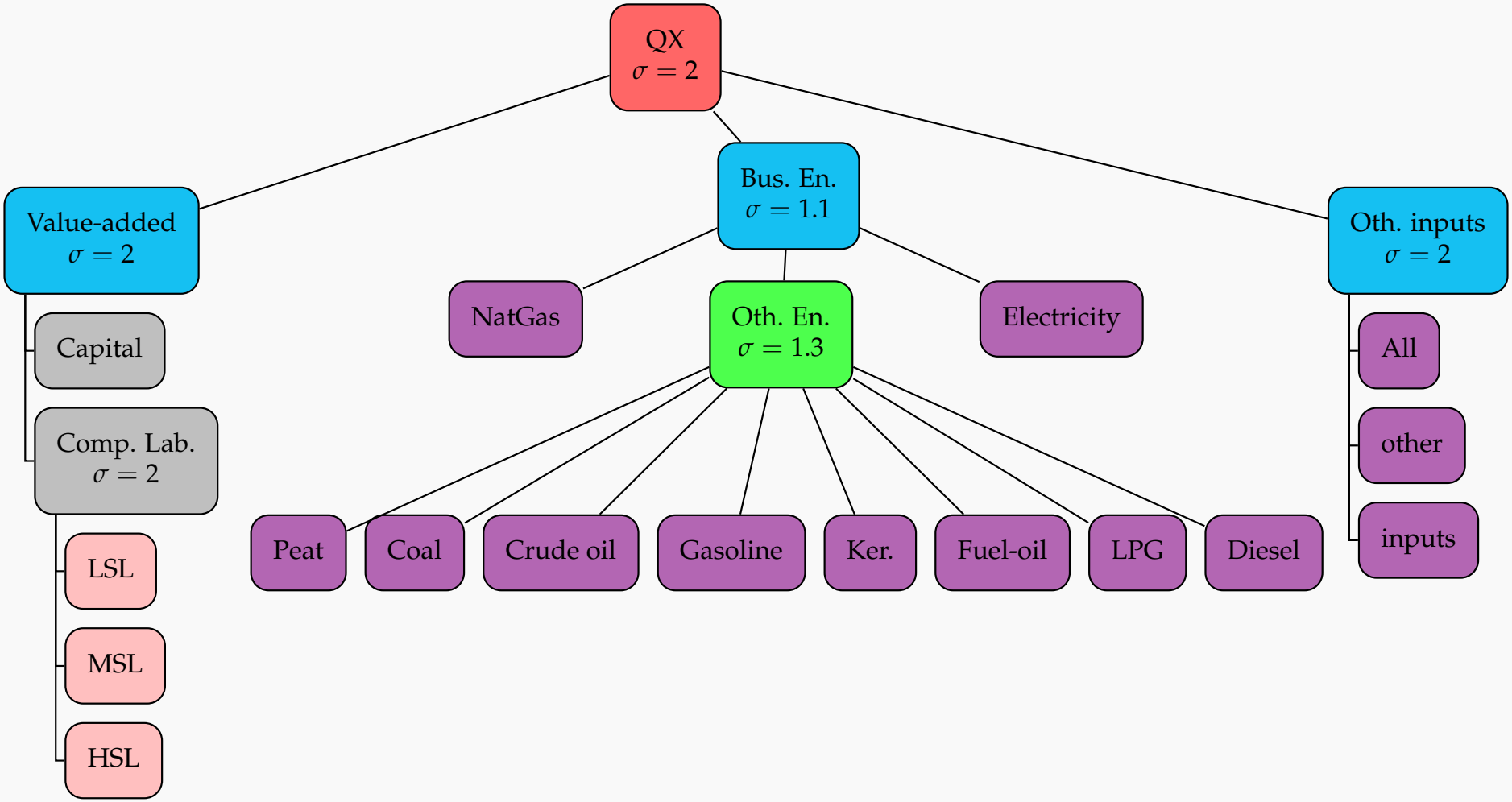
Peat
Coal
Crude oil
NatGas
BElec
Oth. inputs
$\sigma = 2$
All
other
inputs



Electricity Production

Firms' intermediate input decision is based on the *perceived* unit cost of commodity c for activity a such that

$$PQD_c + \overline{PETS}\ ETStoE_a\ (1 - AtoT_a)\ carcon_c$$

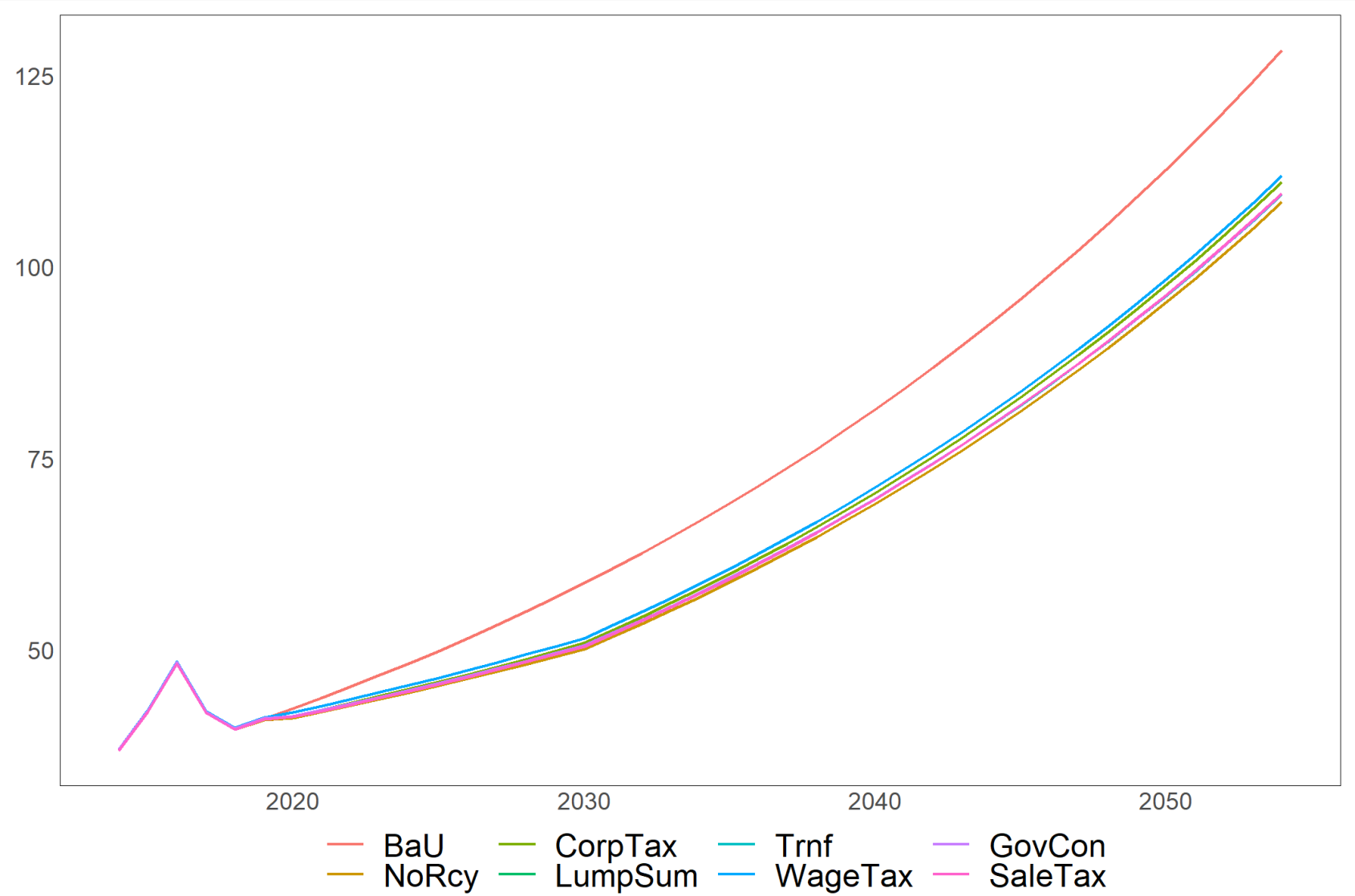
where PQD_c is purchaser price of commodity c, $\overline{PETS}$ is the EU-ETS price of a per ton emission allowance, $ETStoE_a$ is the ratio of ETS emissions to total emissions and $AtoT_a$ is the ratio of ETS allowance to ETS emissions of activity a, and finally $carcon_c$ is the carbon content of commodity c.

The I3E incorporates some significant changes, which occurred between 2014 (base year) and 2018:

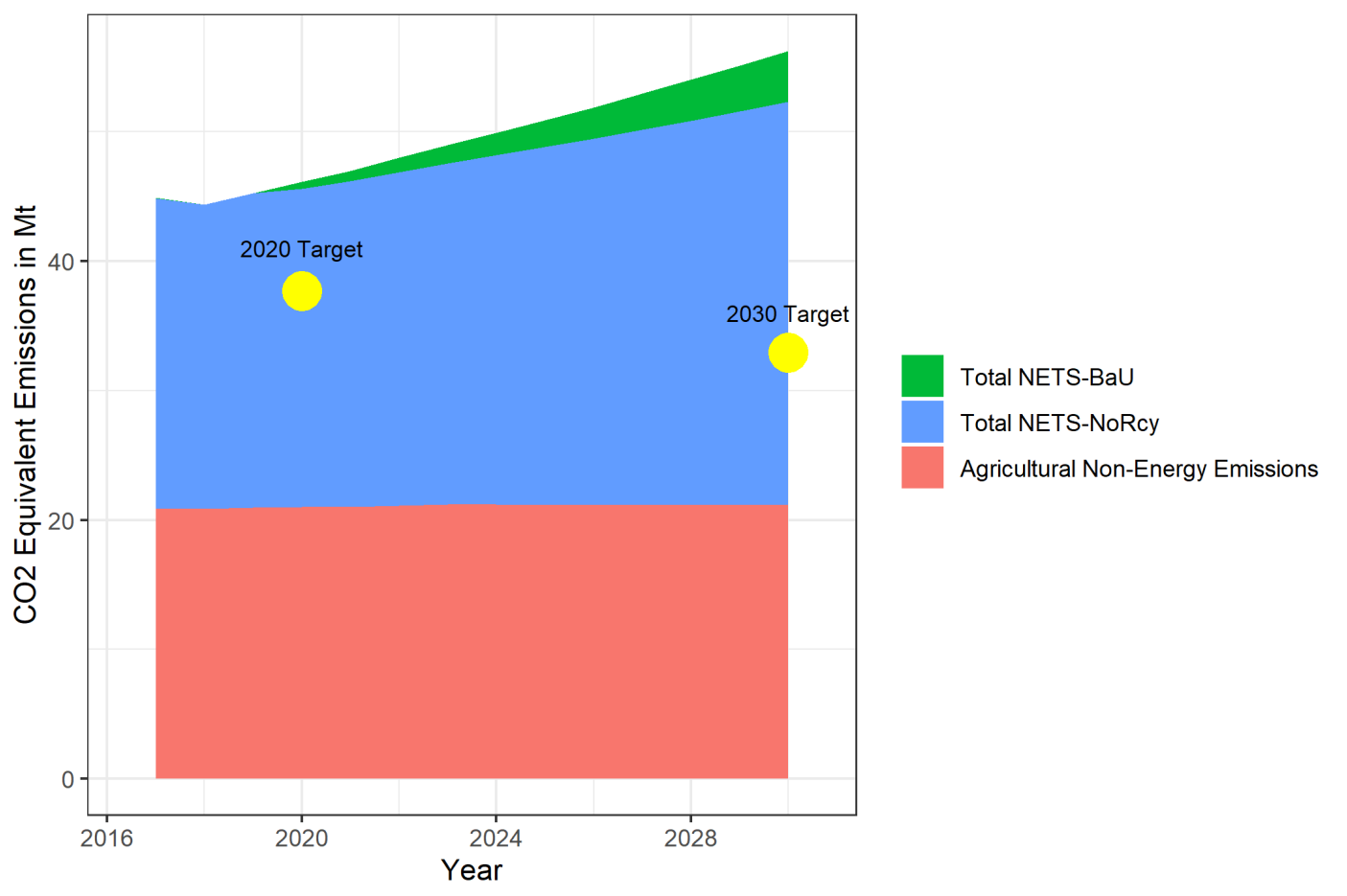
- U-shaped pattern of energy commodity prices.
- Declining peat consumption.
- Changes in the fuel composition in electricity production: a decline in peat and coal, an increase in natural gas.
- The allocated ETS allowances; with a stable trend in the 2014-2020 period and decreasing on an annual basis until 2030. Moreover, the ETS price has a positive trend.

Carbon tax increases from €20 to €30 in 2020, and then increases by €5 annually until 2030. In 2030, it reaches €80 and then stays constant at this level. In all scenarios, the entire carbon tax collection is used in the recycling scheme.

Scenario	**Definition**
BaU	Business as usual - no policy change
NoRcy	No recycling - debt reduction
CorpTax	Reduction in corporate tax rate
LumpSum	Lump sum transfers to households on a per capita basis
Trnf	Transfers to households on social welfare transfer basis
WageTax	Reduction in wage tax rates
GovCon	Increasing government demand for commodities
SaleTax	Reduction in sales tax rates of non-energy and FBT commodities

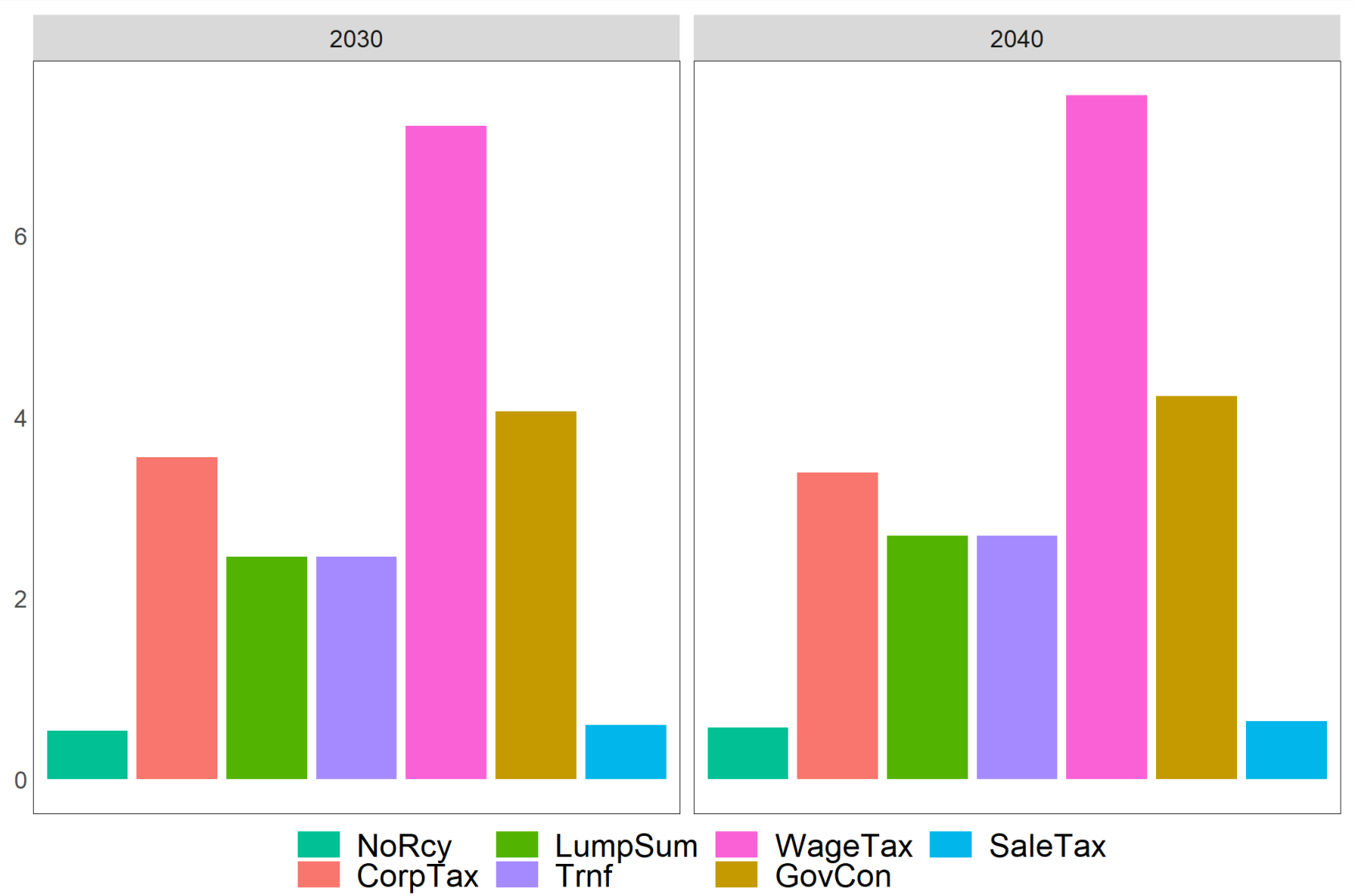


Economy-wide CO_2 Emissions, million ton

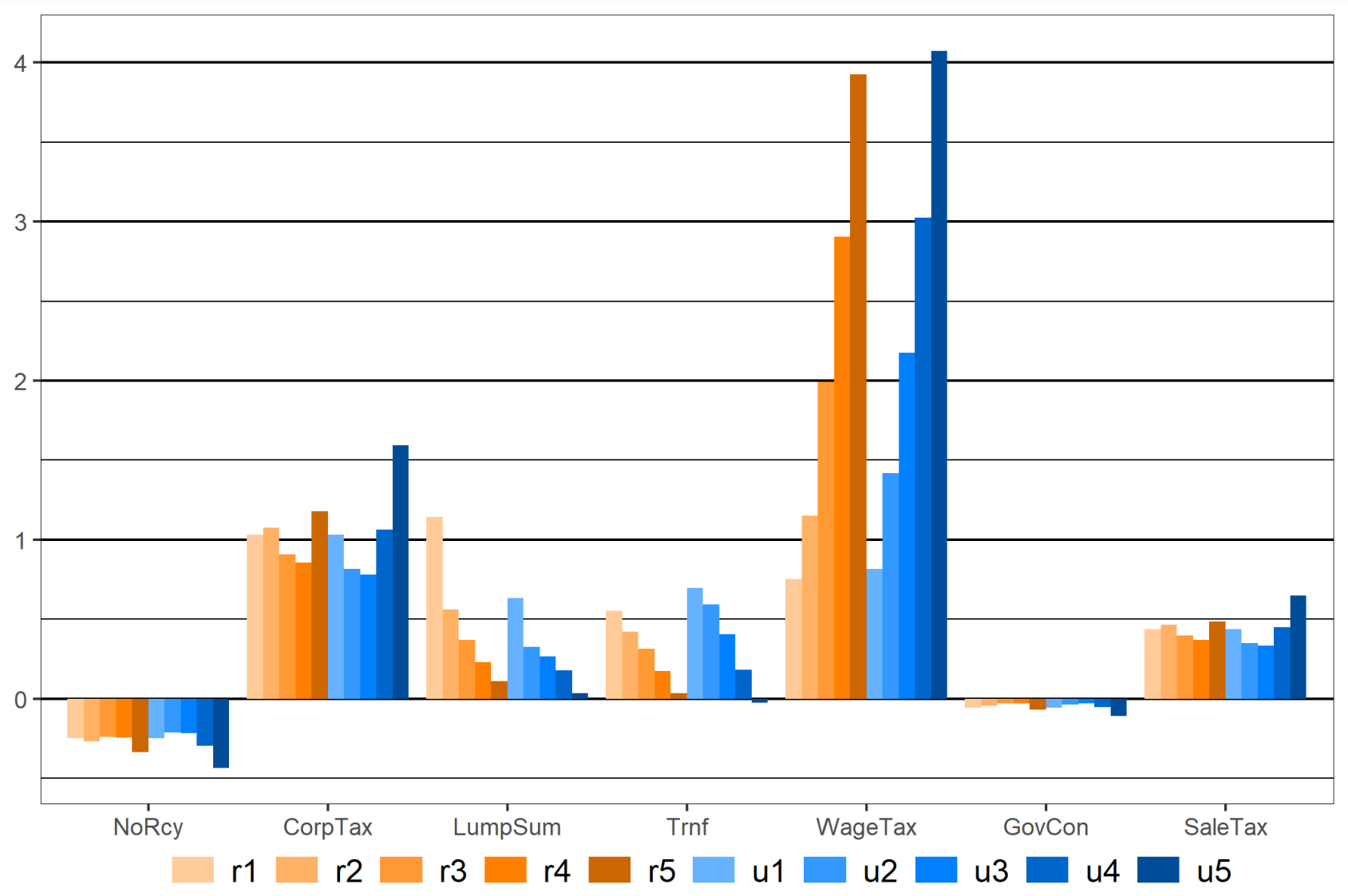


Non-ETS CO_2 Emissions, million ton

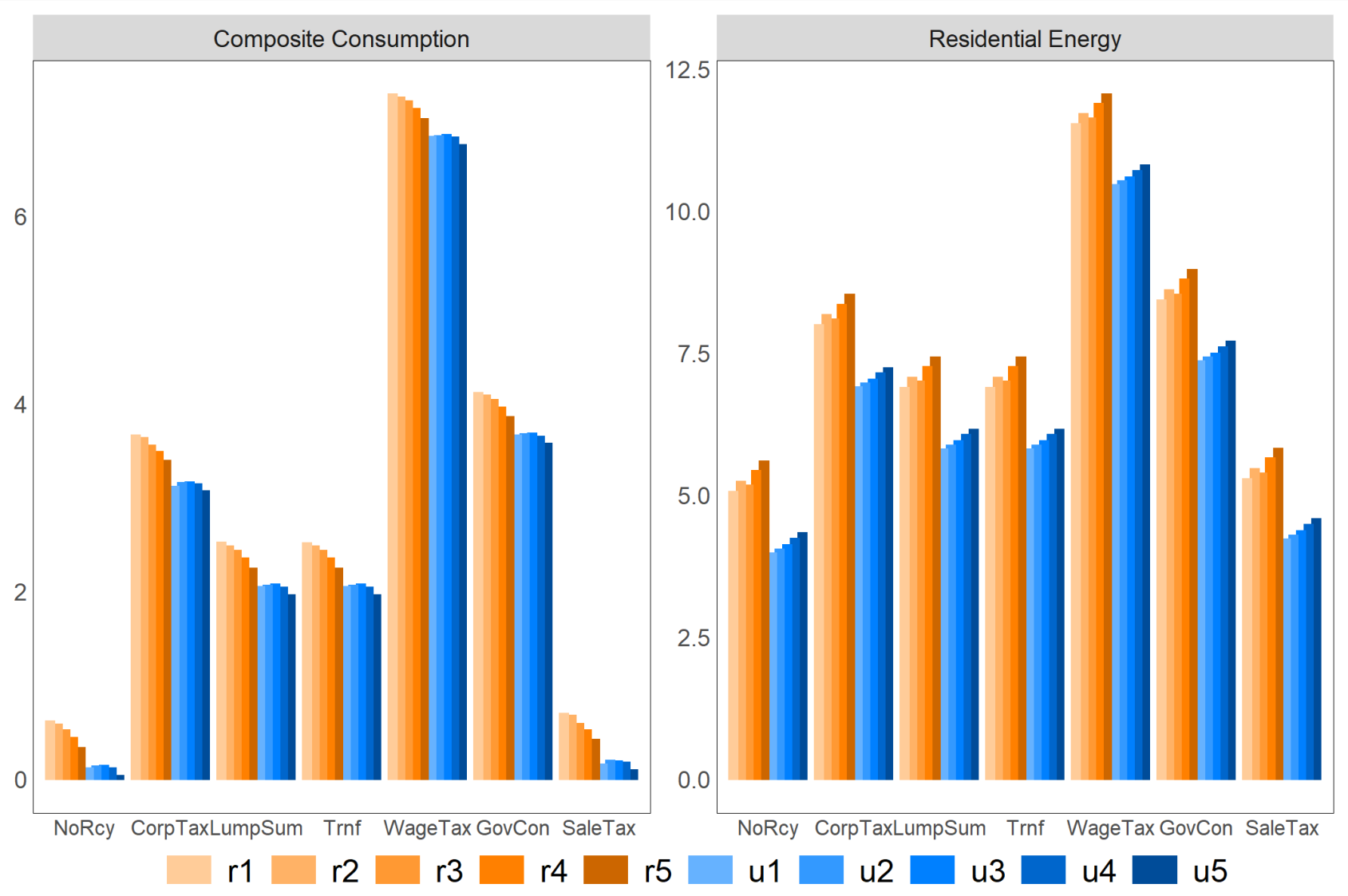
Real GDP, % change w.r.t BaU



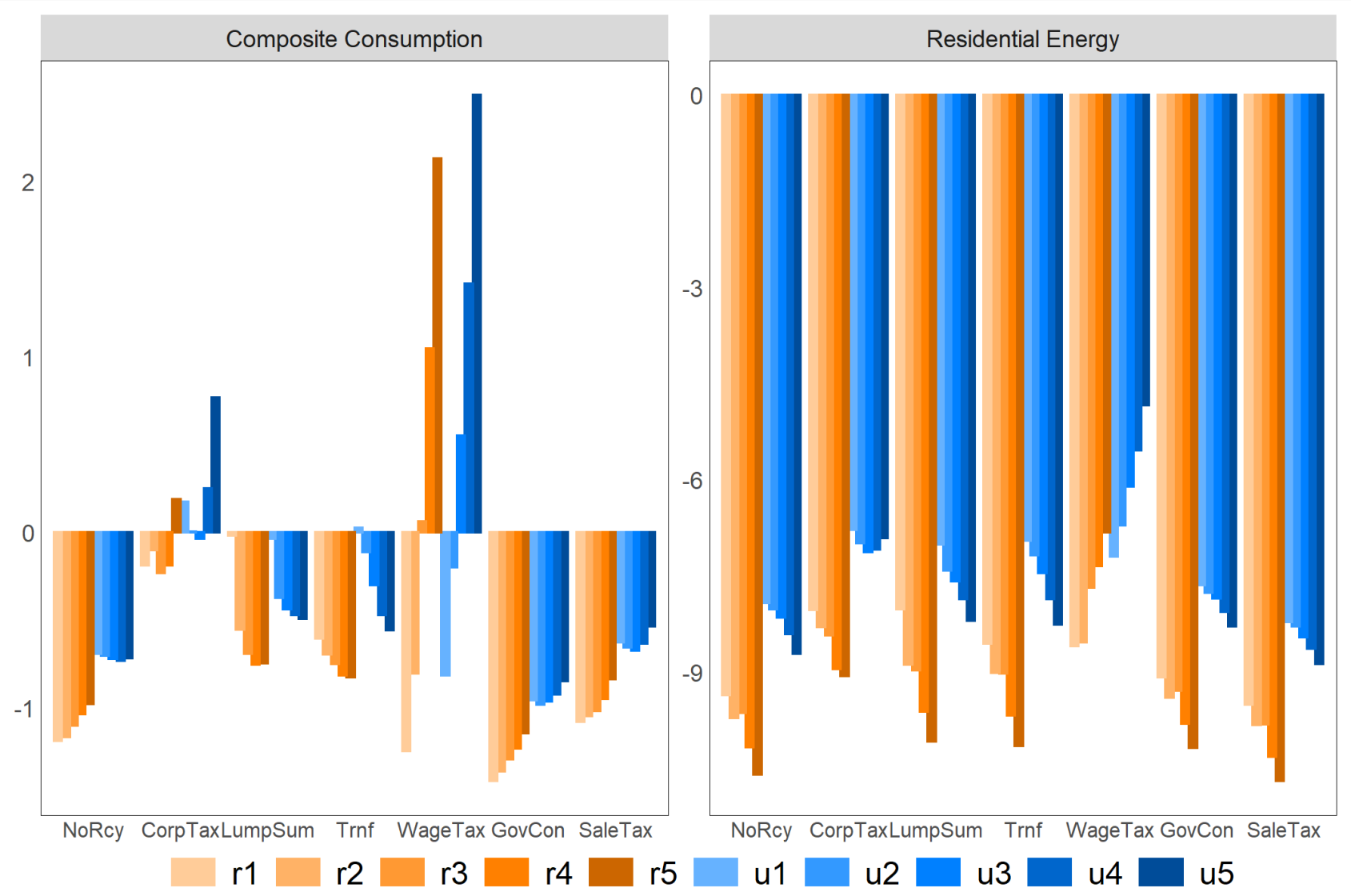
Consumer Price Index, % change w.r.t BaU



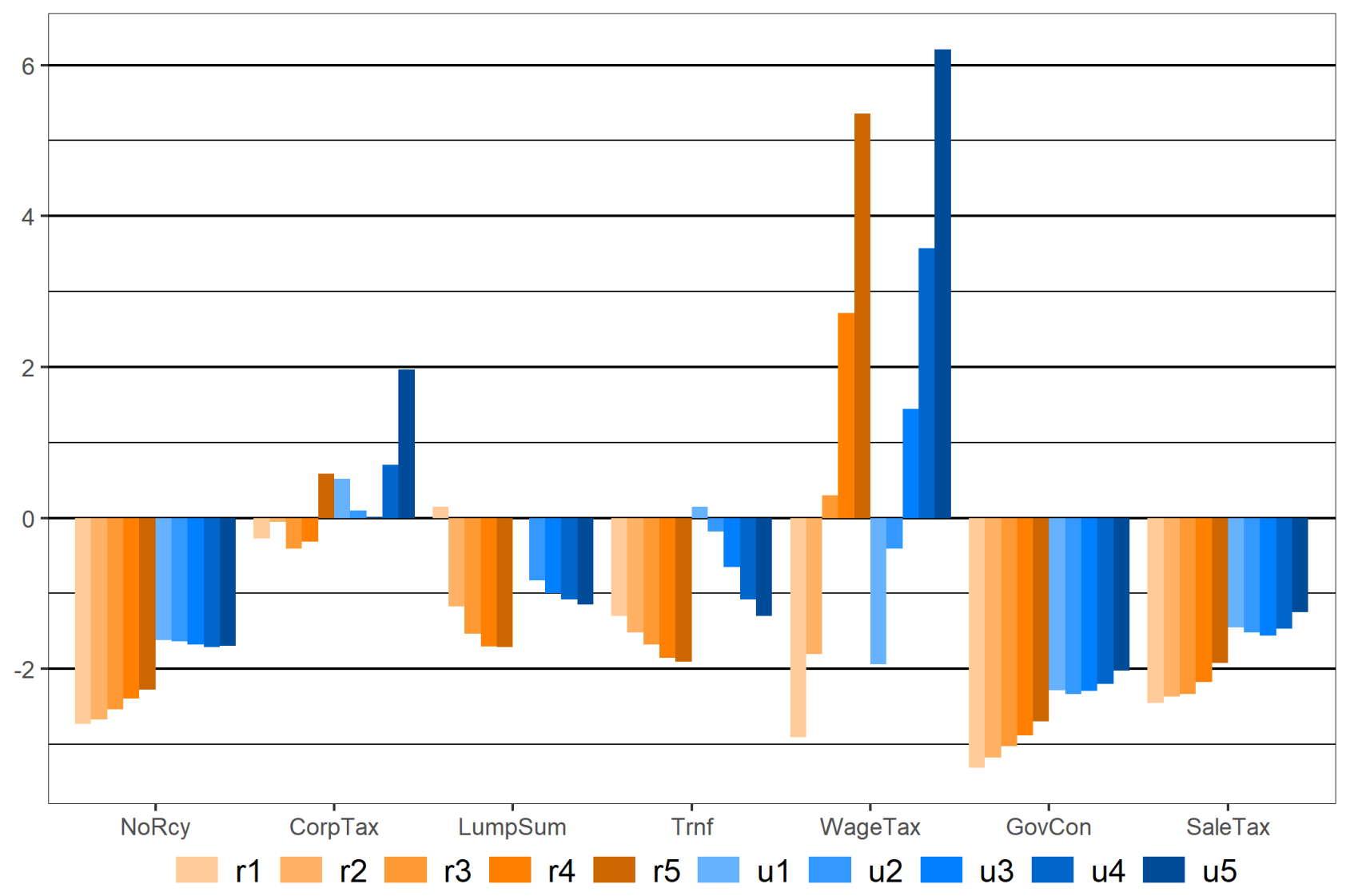
Real Disposable Income in 2030, % change w.r.t BaU



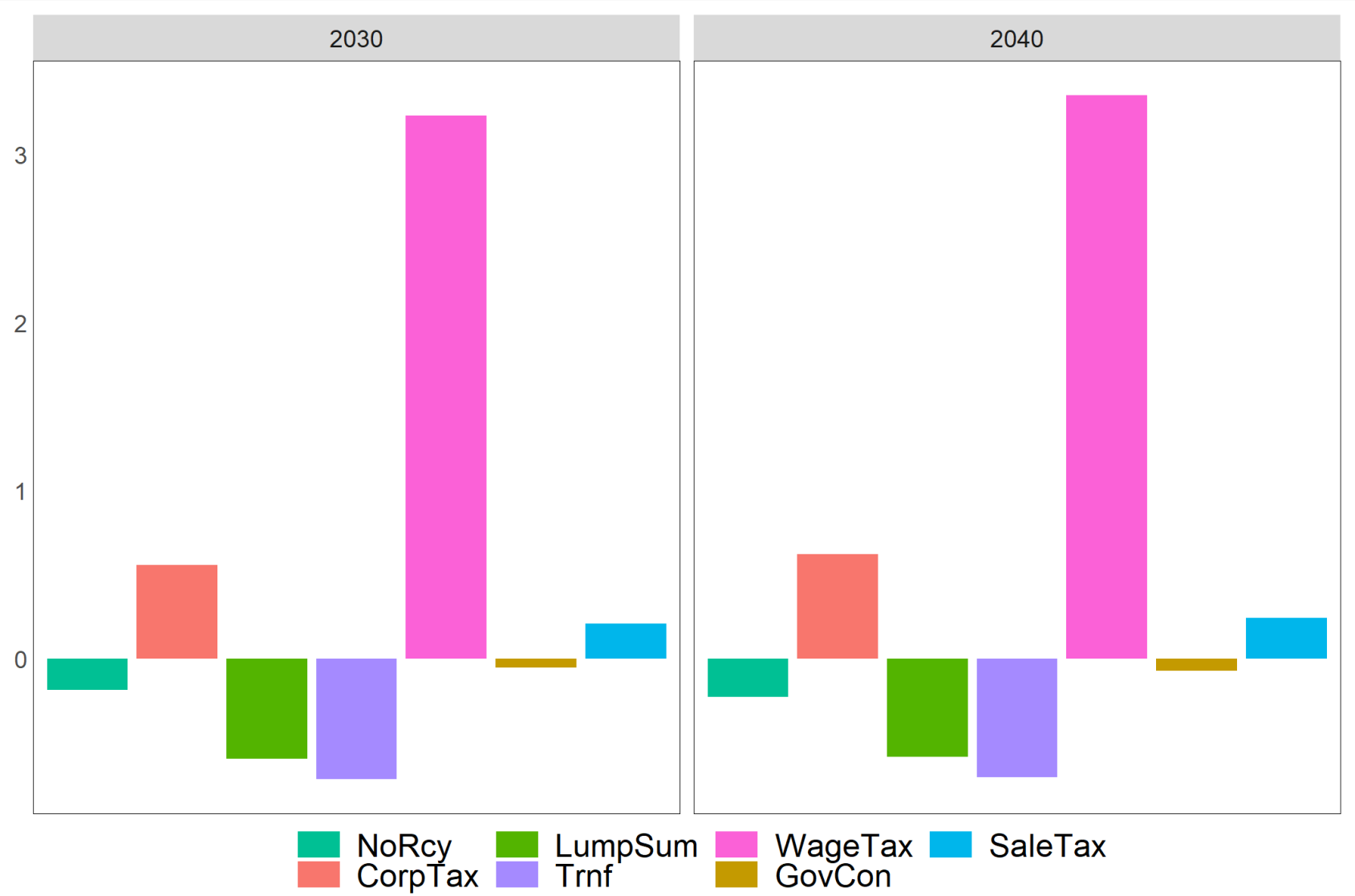
Price of Composite Commodities in 2030, % change w.r.t BaU



Composite Consumption in 2030, % change w.r.t BaU



Equivalent Variation in 2030, % change w.r.t BaU



u5-to-u1 Real Income Ratio, % change w.r.t BaU

r5-to-r1 Real Income Ratio, % change w.r.t BaU

- The level of total CO_2 emission reaches 50 million in 2030. This figure is 14.7% lower than the BaU, and 4.2% higher than its 2005 level.
- No revenue recycling scheme seems the best option to reduce emissions but it leads to an erosion in household welfare.
- Reducing the wage tax rate generates the highest increase in the disposable income at the expense of distorting the size distribution of income.
- Reducing the corporate tax has smaller impacts on consumption and welfare but it also distorts the size distribution of income.
- Recycling of income to households reduces the negative effect of the higher carbon tax on economic activity and has progressive impacts on real disposable income and welfare of the households.

Introduction of

- the carbon tax exemptions of the ETS sectors (in progress)
- renewable energy production
- other pollutants
- climate change module

- Government
  1. Rev.: indirect taxes on domestic sales (VAT), carbon tax, production tax, and export tax (only electricity), direct taxes on corporate profits and wage income of households, and the half of the cost of ETS.
  2. Exp.: Public demand, transfers to HH and ENT, and interest payment over outstanding debt stock
- Enterprises, the owner of all firms
  1. Rev.: Profits of all firms and transfer from the GOV
  2. Exp.: Fixed fraction of net-of-tax profits is saved. Pays corporate tax, and the remaining funds are paid to households as dividend
- Rest of the World
  1. Rev.: Exports, net factor income of HH, and foreign saving (current account balance)
  2. Exp.: Imports, the half of the cost of ETS, interest payments of the GOV

$$TWTAXS_t = \sum_l WTAXS_{l,t} + TCTAXS_t\, RCWT_t$$

$$wtax_{l,t} = wtax_{l,0}\, WTADJ_t - WTADJ\_P_t\, WT01_{l,t}$$

where $TWTAXS_t$ is the total wage income tax collection, $WTAXS_{c,t}$ is the wage tax paid by labour type l, $TCTAXS_t$ is the total carbon tax collection, $RCWT_t$ is a policy switching parameter, $wtax_{c,t}$ is wage income tax rate of labour l and $wtax_{l,0}$ is its calibrated value, $WTADJ_t$ and $WTADJ\_P_t$ are full and partial tax rate adjuster variables, and $WT01_{l,t}$ is a binary parameter for each type of labour. Along the *BaU*, $RCWT_t$ and $WTADJ\_P_t$ are equal to 0, $WTADJ_t$ is equal to 1, $WT01_{l,t}$ is 0 for all labour types.