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Efficiency and Equity in Green Transitions

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XXIII Bank of Italy Public Finance Workshop – 4 September 2025

Presentation Outline

Motivation & Research Question
The IAM Model
Climate Scenarios & Simulation Results
Conclusions

Motivation & Research Question

Motivation & Research Question

Climate change poses severe risks to human health and economic & financial stability and **climate policy design** faces a challenge: **balancing environmental goals with economic fairness**.

Standard policy assessments often focus on aggregate economic impacts, potentially overlooking **critical distributional and inter-generational effects**.

Our research question

→ **What are the economic costs and inter-generational welfare effects associated with the transition to a low-carbon economy?**

We assess the economic impact of different climate policies, with a specific focus on the **generational inequality** implications, and on the potential **political support** for these policies.

Our approach

We develop a novel Integrated Assessment Model (IAM) to analyse the efficiency-equity trade-off of various policy mixes during the transition to a Paris Agreement aligned economy.

- → Our IAM is composed by a large-scale (85 generations) **Overlapping Generations Model** (OLG), connected to a **sectoral Computable General Equilibrium model** (CGE) and a **climate module**.
- → Our set up allows to assess, in a common framework, the long-run implications of the evolution of **demographics**, **human capital**, and **climate change**.
- → We build NGFS-like climate scenarios to assess the **chronic physical risks** due to climate change and the **transition risk** embodied in emission reduction paths, with different policies applied.

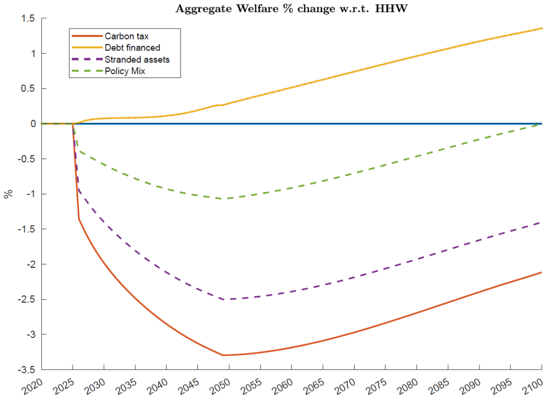
CAVEAT: we do not consider **acute physical risks**, which can be a relevant part of climate risks.

Main Findings (in brief)

→ Ambitious carbon pricing is the most efficient policy to meet climate goals but entails significant equity and political support challenges, as it might worsen welfare.

→ Green subsidies & public green investments improve the effectiveness of the transition, yet do not fully offset welfare losses from a severe carbon tax.

→ Public debt financed policies and a lower carbon tax improve the welfare effects of the transition.



Related Literature - the main strands References

Climate macroeconomics and policy design: *Catalano and Forni (2021)* study how fiscal tools (carbon taxes, green investments) can support climate mitigation while preserving macroeconomic stability.

→ Our contribution: we build an IAM-OLG framework to assess how such policies affect long-run growth, fiscal sustainability, and long-term inequality.

Carbon pricing and policy mixes: *Acemoglu et al. (2016)* and *Barrage (2020)* explore optimal carbon pricing and the welfare gains from combining taxes with clean R&D support.

→ Our contribution: we take instead a positive approach and we embed heterogeneous agents, evaluating distributional trade-off across policies.

Distributional effects and inequality: *Kotlikoff et al. (2024)*, *Caprioli & Caracciolo (2024)* analyse how climate policy affects inequality across and within generations.

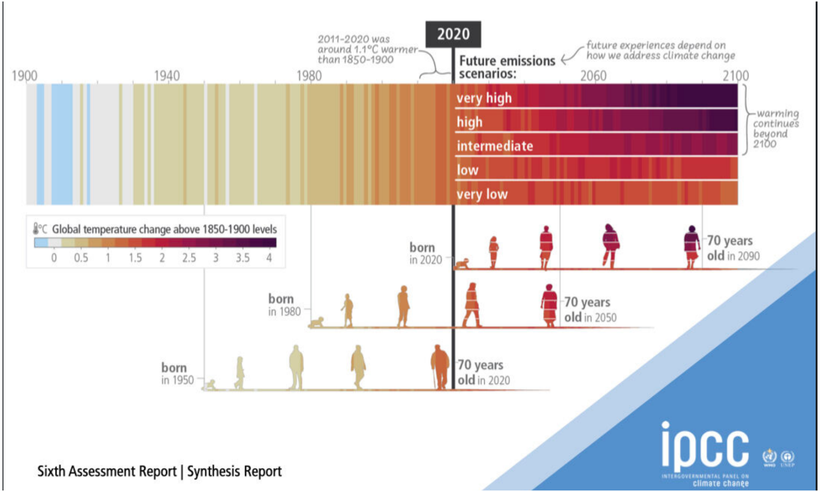
→ Our contribution: we quantify both inter-generational inequality in response to climate policies, highlighting trade-off and potential complementarity with economic policies.

The IAM Model

The IAM Model in a nutshell

1. **Macro module**: Overlapping Generation Model (OLG)
   - → **Regions:** Italy and the Rest of the World (in all simulations, the two regions coordinate policies)
   - → **Agent types:** Households, Firms, Government
   - → **Climate policies**: carbon tax, stranded assets, green public debt, green subsidies, public green investments + various carbon revenues *recycling* policies (**transition risk**)
2. **Sectoral module**: Computable General Equilibrium Model (CGE)
   - → **5 energy sectors:** Brown (Oil, Gas, Coal) & Green (Renewables, Negative Emissions (BECCS))
   - → **5 final production sectors:** Agriculture, Manufacturing, Services, Transports and Building
3. **Climate module**: FUND (Anthoff & Tol, 2014)
   - → Global average temperatures & Radiative forcing as outputs
   - → Climate damage to the GDP (**chronic physical risk**)

The OLG Model rationale: capturing inter-generational inter-dependencies



The OLG model's main feature

Timing

→ The time-horizon: 1850-2250 (yearly frequency). Years 1950-2100 considered as **transition period**.

Demographics

→ Each cohort is born at 15 years old and lives up to 100 years old (working & retired).

→ Every period 85 different cohorts are alive and cohort sizes is time varying in transition, following historical data & (scenario dependent) projections from the United Nations.

Human capital

→ The share of educated agents varies over time according to historical data & (scenario dependent) projections from the Wittgenstein Centre for Demography and Global Human Capital.

Technology

→ Endogenous GDP growth (human capital accumulation) + Exogenous GDP growth (Solow residual).

The households sector

Households. The households of each cohort s maximize their life-time utility,

$$\max_{c^s_{t+s,s},1-l_{t+s}} \sum_{s=1}^{T} \beta^{t-1}\pi_{t+s,s}\frac{\left((c^s_{t+s,s}+\psi)(1-l^s_{t+s,s})^{\gamma}\right)^{1-\sigma}}{1-\sigma}$$

choosing consumption, c_t, and labour supply, l_t subject to the inter-temporal budget constraint:

$$a_{t+1} = \begin{cases} \frac{(1+r_t)a^s_t}{surv^s_t} + (1-\tau^w_t)w^s_t H^s_t l^s_t - p_{c,t}c^s_t, & \textit{if} \quad s = 1,\dots,T^W \quad (\textbf{workers}) \\ \\ \frac{(1+r_t)a^s_t}{surv^s_t} + pen^s_t - p_{c,t}c^s_t, & \textit{if} \quad s = T^W+1,\dots,T^W+T^R \quad (\textbf{retirees}) \end{cases}$$

where H^s_t and $\pi_{t+s,s} = \prod_{k=0} surv_{t+k,k}$ are respectively the human capital level and unconditional survival probability of cohort s at time t. We assume a *perfect annuity* regime for the involuntary bequests.

The production sector

Firms. Production sector is characterized by a representative firm which uses capital and effective-labour:

$$Y_t = TFP_{exo} Z_t K_t^{\beta} (HL)_t^{1-\beta}, \quad Z_t = (1 - D_t) TFP_t$$

where H is human capital and Z is endogenous TFP_t net of the **climate damage** **à la Nordhaus**.

Endogenous growth is modelled linking physical capital per worker & human capital **à la Romer (1990)**:

$$TFP_t = \left(\frac{K_t}{L_t} \right)^g H_t^z$$

Human capital index, H, is based on a Tornqvist index for education levels, as in Catalano et al. (2020).

The Sectoral CGE Model

The Energy Sector

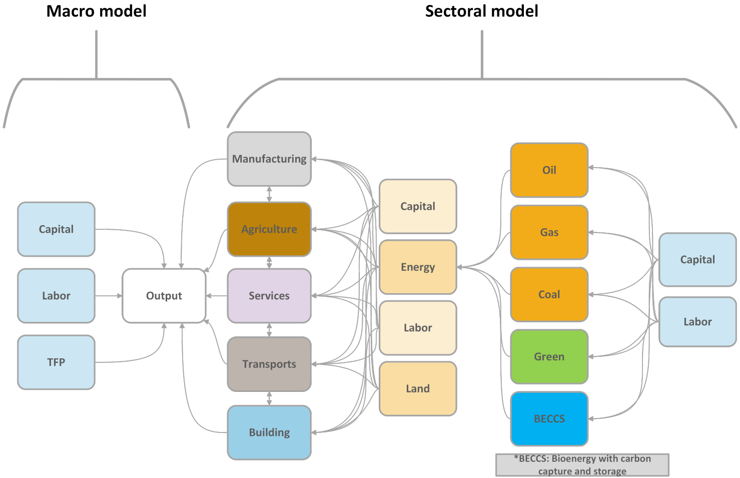
→ Energies (dirty, clean) are produced with *capital* & *labour*.

The Final Sectors

→ Final sectors use a Leontieff production, with primary inputs capital, labour, land & energies.

The Aggregate Demand

→ Aggregate demand is computed using a Cobb-Douglas utility.



The government sector (1/2)

Government. The budget of the government is balanced in each period.

In absence of climate policies:

$\rightarrow$ The government raises funds issuing **public debt**, B_t and through endogenous **taxes on labour**, τ_t^w.

$\rightarrow$ Collected resources are used to finance **public PAYG pensions** $PEN_t = pen_t T^R$. Individual pensions are $pen_t = \theta(1 - \tau_t^w) w_t H_t \bar{l}$, where θ is the replacement rate.

When climate policies are active:

$\rightarrow$ The government can raise funds also issuing **green public debt**, B_t^{green} and via **carbon taxes** on energy-specific CO2 emissions, τ_t^e, which provide carbon revenues $CAR_t = \sum_i \sum_e \tau_e E_{e,i} q_{E_e}$.

The government sector (2/2)

Aggregation Equilibrium

The green public debt and the revenues from carbon taxes can be **recycled** for:

→ **Direct green policies** Details

1. Green energy subsidies applied to green energy prices (GES_t)
2. Public investments to increase the efficiency of green energy production (PGI_t)

→ **Redistributive & Economy-Sustaining Policies** Details

3. Lump-sum transfers to households ($LUMP_t$), to sustain consumptions and investments
4. Labour tax reduction (TR_t), to reduce labour supply distortion
5. Public debt reduction (PDR_t), to increase firms' capital resources

The government budget constraint reads:

$$\Delta B_t + \Delta B_t^{green} = r_t B_t + r_t B_t^{green} + PEN_t - REV_t + \mathbf{Green\ expenditure}_t - \mathbf{CAR}_t$$

where $Greenexpenditure = GES_t + PGI_t - PDR_t + TR_t + LUMP_t$.

The Climate Model

Details   Solution algorithm

- → The climate module is based on the FUND model by Anthoff and Tol. [2014].
- → It uses, as input, the OLG estimate of economic growth rate and sectoral emissions.
- → Total GHG emissions are defined according to the *Kaya identity* that calculates the total emissions.
- → The model determines the global temperature deviation from pre-industrial level.
- → The **climate damage à la Nordhaus** reads

$$D_t = 1 - \frac{1}{1 + \pi_1 T_t^A + \pi_2 (T_t^A)^2}$$

with π_1 and π_2 being the coefficients of the quadratic polynomial of damage function representing the change, since 1900, in global mean surface temperature, T_t^A, measured in Celsius.

Model Calibration: sources

Calib. details

Macroeconomic module

- → Demographics: history & projection of population and cohorts' sizes from United Nation, 2024.
- → Human capital: education attainment by cohort from Lutz, Goujon, Stonawski and Stilianakis (2018)
- → GDP growth: historical data from Penn World Table, World Bank and OECD.
- → Public debt: historical data from International Monetary Fund

Sectoral module

- → Sectoral inter-dependencies/shares: OECD, Input-Output Tables (IOTs) 2021 ed.
- → Emission multipliers: IPCC, Guidelines for National Greenhouse Gas Inventories (2006)
- → Energy intensity by sector: our elaborations based on Kotlikoff et al. 2021

Climate module

- → Climate related parameters: based on FUND calibration from Anthoff et al. 2014

Climate Scenarios & Simulation Results

The Climate Scenarios

Hot House World (HHW): limited active and coordinated climate policies (*status quo*).

→ Significant chronic physical risk and no transition risk.

Net Zero 2050 (NZ): carbon neutrality reached by 2050 using globally coordinated climate policies.

→ Temperature rise is contained to about 1.5 degree Celsius.

→ Climate damage is significantly reduced.

→ High transition risk and low chronic physical risk.

We compare the HHW scenario with alternative NZ scenarios obtained via different policy instruments, but each including all five recycling options.

Each policy instrument and recycling option has different implications for the **effectiveness of the green transition** and for **the inter-generations and economic fairness**.

The alternative Net Zero scenarios
Scenarios' details

NZ 1. Carbon Tax: Price-based instrument

→ Generates an increase in brown energy prices and is a source of revenues for the government.

→ There is an inflationary effect transmitted through the production chain.

NZ 2. Debt-Financed green investments and subsidies: Fiscal instrument

→ Public debt used for green energy subsidies & for green energy production productivity.

→ The policy has a deflationary effect, reducing prices and marginal cost of green energies.

NZ 3. Mandatory Green Capital Conversion: Regulatory instrument Details

→ Forces shift from brown to green capital, creating stranded assets in brown energy sectors.

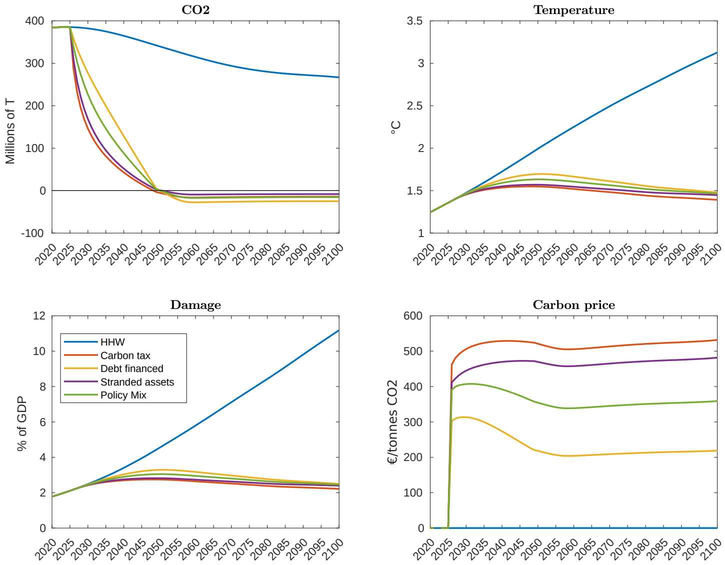
NZ 4. All policy instruments: Mix of instruments

→ Limited stranded assets + limited carbon tax + partially public debt financed green subsidies and investments.

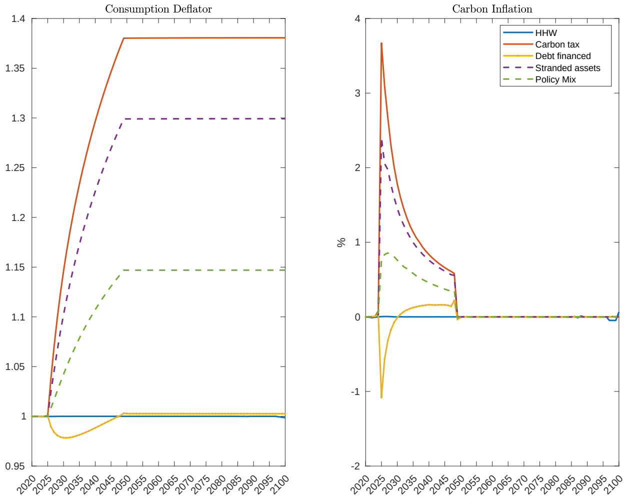
Note: also in NZ 2 and NZ 3 a limited carbon tax is included to reach the NZ target by 2050. See Appendix for details.

Climate Impacts

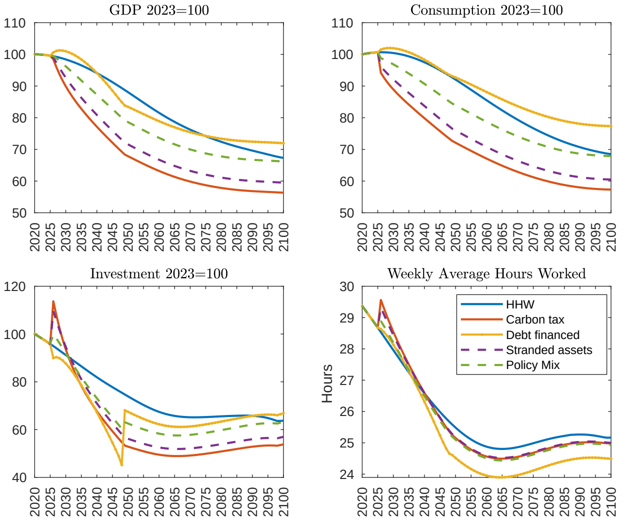
Carbon taxes



Carbon inflation & carbon deflator

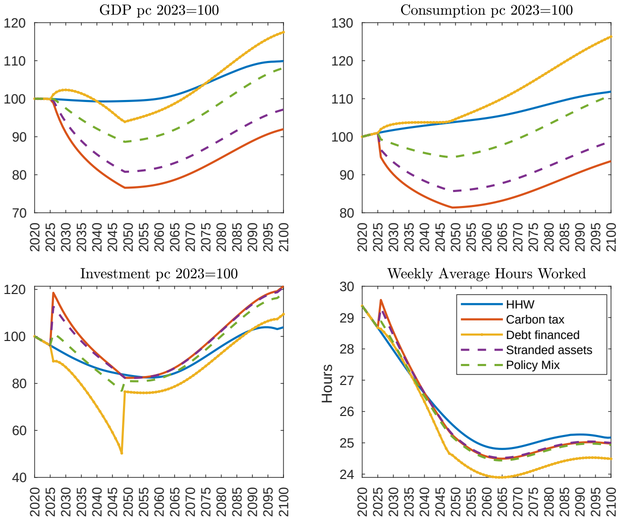


Macroeconomic Impacts



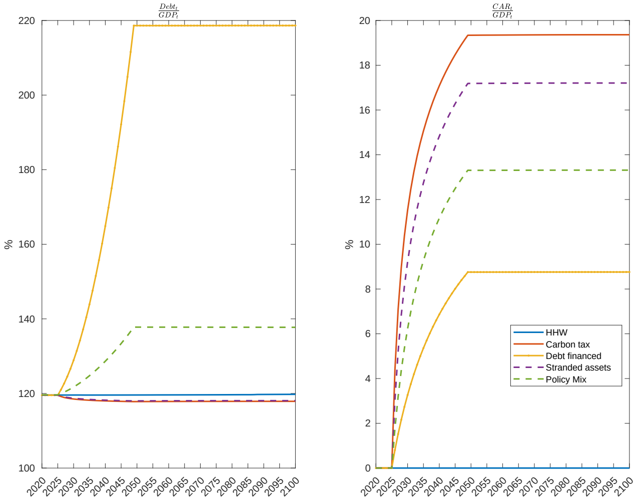
Macroeconomic Impacts, per capita

Nominal per-capita

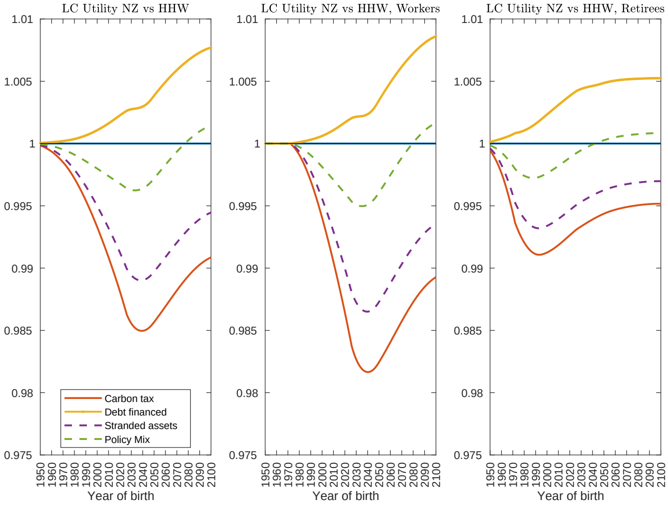


Public debt and carbon revenues as % of GDP

Disposable income Interest rate Stranded assets and green productivity

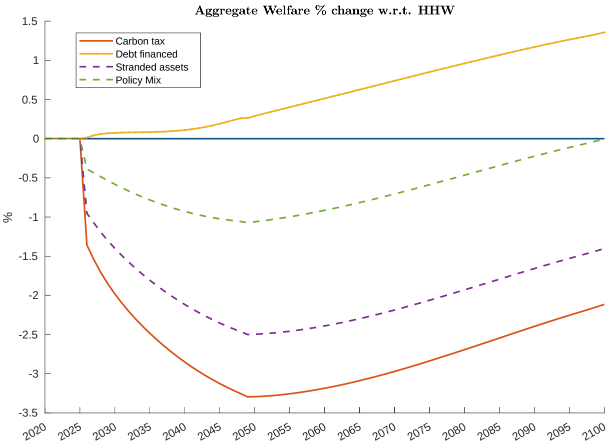


Welfare analysis, life-cycle



Welfare analysis, aggregate

Definition



Conclusions

Conclusions

We develop a novel Integrated Assessment Model with an OLG block to investigate the potential efficiency-inter-generational equity trade-off of transition to a carbon neutral economy.

We find that:

→ Relying solely on carbon taxes & standard green policies can lead to efficiency-equity trade-off, particularly across generations, due to the inflationary effect.

→ The impact of climate policies on individual and aggregate welfare is heterogeneous across generations, leading to a potential lack of political support for the climate transition.

→ Public debt financed green policies can deliver a Pareto improving climate transition, at the cost of a less efficient transition and postponing the reduction of public debt.

→ Our results might be a lower bound for economic & welfare gains since we ignore the negative effects of acute physical risks and the positive non-economic externalities of carbon neutrality.

Thanks for your attention!

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Appendix

References (*limited to this presentation*) Back

1. Acemoglu, Daron, Ufuk Akcigit, Douglas Hanley, and William Kerr. 2016. “Transition to Clean Technology.” American Economic Review 106 (1): 52–104.
2. Barrage, Lint. 2020. “Optimal Dynamic Carbon Taxes in a Climate–Economy Model with Distortionary Fiscal Policy.” Review of Economic Studies 87 (1): 1–39.
3. Catalano, Michele and Forni,Lorenzo, 2021. "Fiscal Policies for a Sustainable Recovery and a Green Transformation," Policy Research Working Paper Series 9799, The World Bank.
4. Caprioli, Francesco, and Giacomo Caracciolo. 2024. “The Distributional Effects of Carbon Taxation in Italy.” Banca d’Italia Temi di Discussione (Working Papers) No. 1463.
5. Kotlikoff, Laurence J., Felix Kübler, Andrey Polbin, and Simon Scheidegger. 2021. “Can Today’s and Tomorrow’s World Uniformly Gain from Carbon Taxation?” European Economic Review 137: 103816

Aggregation and closing of the OLG model Back

For each period t, the total aggregate financial wealth A_t is equal to:

$$A_t = \sum_{s=1}^{T} a_{t+s} N_{t+s} \tag{1}$$

where N_{t+s} is the population aged s in year. t, L_t is labour supply and C_t is consumption:

$$L_t = \sum_{s=1}^{T^w} l_{t+s} N_{t+s}, \qquad C_t = \sum_{s=1}^{T} c_{t+s} N_{t+s} \tag{2}$$

We define aggregate capital stock and capital investment as:

$$K_t = A_t - B_t, \qquad I_t = K_{t+1} - (1+\delta) K_t \tag{3}$$

while the following accounting identity must be satisfied:

$$Y_t = p_{Y_{olg}} C_t + I_t \tag{4}$$

The Equilibrium definition

Back

Equilibrium. Given the exogenous demographic development, the equilibrium for this closed and perfectly competitive economy is a sequence of prices $\{w_t, r_t\}_{t=1}^{401}$, policies $\{\tau_w\}_{t=1}^{401}$, pensions $\{pen_t\}_{t=1}^{401}$, quantities: $c_{t+s,s}$, $a_{t+s,s}$ and K_t, L_t, Y_t, C_t, I_t for $s = 0, 1, \ldots, T$ and $t = 1, 2, \ldots, 401$, such that:

1. Households solve their optimization problem;
2. Firms maximize profits given the production function;
3. The fiscal authority sets the tax rates $\tau_{w,t}$ and $\tau_{g,t}$ such that its budget is balanced in each period given the individual pension transfer pen_t and interests on public debt r_t, B_t;
4. Factor markets and the goods market clear satisfying the law of motion of capital, with aggregate consumption.

The Energy & Final Sectors

Back

Each energy type is produced using capital and labor, through a Cobb-Douglas production technology:

$$E_e = A \cdot K_e^{\psi_e^k} \cdot L_e^{\psi_e^l}, \qquad e = \{oil, gas, coal, renewables, BECCS\}$$

The final sectors maximize aggregate demand subject to an economy-wide constraint:

$$\max_{X_i} \prod_i X_i^{\xi_i}, \quad s.t. \quad p_{Y_{olg}} \cdot Y_{olg} = \sum p_i X_i$$

Total output is produced with intermediate inputs X_{ij} and primary inputs with Leontieff technology:

$$Y_i = \min \left\{ \frac{L_i^{\beta_i^l} K_i^{\beta_i^k} Land_i^{\beta_i^{land}} Eoil_i^{\beta_i^{oil}} Egas_i^{\beta_i^{gas}} Ecoal_i^{\beta_i^{coal}} Ern_i^{\beta_i^{rn}} Ebeccs_i^{\beta_i^{beccs}}}{a_{0i}}, \frac{X_{ii}}{a_{ii}}, \frac{X_{ji}}{a_{ji}} \right\}$$

Given the prices & the quantity for each sector, we can compute the price deflator: $p_{Y_{olg}} = \prod_i \left(\frac{q_i}{\xi_i}\right)^{\xi_i}$

Computing CO2 emissions and defining a CO2 emissions limit Back

→ CO2 emissions are estimated from the sectoral demand for energies E_i of each sector:

$$CO2 = \sum_i \chi_{oil} Eoil_i + \chi_{gas} Egas_i + \chi_{coal} Ecoal_i + \chi_{rnw} Erenewables_i - \chi_{beccs} Ebeccs_i$$

where χ_j represent the coefficients of transformation between energy consumption & CO2 emission.

→ To implement the exogenous emission dynamic constraint on total actual emissions:

$$\overline{CO2} = \sum_i \chi_{oil} \overline{Eoil}_i + \chi_{gas} \overline{Egas}_i + \chi_{coal} \overline{Ecoal}_i$$

→ From $\overline{CO2}$ we can identify a path for the carbon tax τ_e on each dirty energy price.

→ The total carbon revenues, CAR equals to:

$$CAR = \sum_i \sum_e \tau_{e,i} \cdot E_{e,i} \cdot q_{E_e}$$

The FUND Model

Back

Total CO2 and GHGs emissions in the FUND climate module are defined according to the Kaya identity that calculates the total emission as the product of four factors:

$$M_{r,t} = \frac{M_{r,t}}{E_{r,t}} \frac{E_{r,t}}{Y_{r,t}} \frac{Y_{r,t}}{P_{r,t}} P_{r,t} \tag{5}$$

where M denotes emissions, E denote energy use, Y denotes GDP and P denotes population; t is the index for time, r for region.

GHGs concentrations in the atmosphere are defined according to:

$$C_{t,j} = C_{t-1,j} + \gamma M_t - \zeta(C_{t-1} - C_{pre}) \tag{6}$$

where C denotes concentration and *pre* denotes *pre-industrial* levels.

The Solution Algorithm

Back

1. Assumptions and exogenous data about population cohorts, human capital and parametrization is provided.
2. An initial guess for consumption price deflator, capital and labor supply is provided in the form of time series.
3. A **Gauss-Seidel algorithm** starts at the first iteration computing the interest and wage rates.
4. Each year a new cohort born, and given the known future profile of interest and wage rates, it computes the saving and labor supply decision for the entire life-cycle. It consist in backwardly solving 85 non-linear simultaneous equations formulated as in given terminal conditions on wealth (nil).
5. Aggregation of saving and labor supply permits computation of GDP for the whole time-frame.
6. Given aggregate capital and labor supply, the CGE computes sectoral prices, productions, input intermediate factors demand, emissions, in a top-down procedure, therefore not requesting particular computational burden. If an emission ceiling is provided, than we calculate carbon price as a shadow price.
7. The CGE model provides the deflator and the total emissions.
8. The climatic module provides temperature and the damage function is updated.
9. A new iteration starts as at point 3, given new level of capital, labor supply and deflator.
10. The external Gauss-Seidel Algorithm stops at convergence and stabilization given a certain tolerance calculated on the whole time-frame.

Model calibration details (1/2)

Back

Table: OLG Model Parameters

		Italy	Rest of the World
β	Time impatience rate	0.99	0.96
σ	Inter-temporal elasticity of substitution	2.00	2.00
γ	Dis-utility of labor	1.95	2.00
α	Share of capital in production	0.36	0.36
δ	Depreciation rate of capital	0.05	0.045
θ	Replacement rate of PAYG pension system	0.39	0.21
g	Capital spillover in TFP	0.055	0.03
z	Human capital spillover in TFP	0.28	0.10

Model calibration details (2/2) Back

Table: Sectoral Model: energy & final sectors parameters

		Oil	Gas	Coal	Renewables	BECCS
ψ^k	Energy elasticity of capital	0.449	0.430	0.467	0.421	0.421
ψ^l	Energy elasticities of labour	0.551	0.526	0.573	0.514	0.514

		Agriculture	Manufacturing	Services	Transport	Building
β^k	Output elasticity of capital	0.3812	0.3618	0.3572	0.4175	0.4031
β^l	Output elasticity of labor	0.2035	0.1506	0.1421	0.1512	0.1590
β^{la}	Output elasticity of land	0.3032	0.2489	0.2451	0.2884	0.2922
β^{oil}	Output elasticity of oil	0.0412	0.0461	0.0759	0.0568	0.0446
β^{gas}	Output elasticity of gas	0.0344	0.0594	0.0670	0.0429	0.0114
β^{coal}	Output elasticity of coal	0.0276	0.0773	0.0299	0.0232	0.0516
β^{rn}	Output elasticity of renewables	0.0080	0.0475	0.0730	0.0174	0.0323
β^{beccs}	Output elasticity of beccs	0.0010	0.0085	0.0098	0.0026	0.0059

Climate Policies' calibration details

Back

Table: Policy mix

parameter	Carbon tax	Debt financed	Stranded assets	Policy mix
Stranded assets	0.0	0.0	1.2	0.37
Debt financed subsidies	0.0	8.5	0.0	2.8
Debt financed investments	0.0	0.9	0.0	0.3
Carbon tax intensity	6.8	1	4.3	2.3

Table: Recycling of carbon revenues

% CAR	**Green subsidy**	**Green public investments**	Labor tax reduction	Public debt reduction	Lump sum transfer
All recycling policies	0.25	0.25	0.0833	0.0834	0.0833

Modelling Stranded Assets Policy

Back

A mandatory regulation forces firms to discard brown capital in favour of green capital. This is obtained by introducing a wedge on the return of brown capital, which directly hit the brown energy production.

For energy brown sectors $e = \{oil, gas, coal\}$, the energy production and energy prices now take the following form:

$$q_{E_e} = \frac{1}{A}\left(\frac{r_{olg}(1+\tau_t^{SA})}{\psi_e^k}\right)^{\psi_e^k} \cdot \left(\frac{w_{olg}}{\psi_e^l}\right)^{\psi_e^l}$$

The stranded asset burdens the price of brown energy, reducing the final quantity produced.

In this framework, τ_t^{SA} assumes the role of an extra depreciation factor δ_e^{SA}, as shown by the following identity equation:

$$R_{brown} = r_{olg} + r_{olg}\tau_t^{SA} + \delta_e, \quad where \quad \delta_e^{SA} = r_{olg}\tau_t^{SA}$$

Direct green policies Back

Green Energy Subsidies

→ The subsidy rate, τ_g is applied as follows: $\frac{q_{E_e}}{(1+\tau_g)}$, *where* $e = \{renewables, BECCS\}$

→ The total amount of green subsidy bestowed to the economy equals:

$$Subsidies\ expenditure = \tau_g(q_{E_{rn}} E_{rn} + q_{E_{beccs}} E_{beccs})$$

Public Green Investments

→ Public green investments improve production efficiency of clean energies (renewable and BECCS):

$$E_e = \boldsymbol{A_{t,e}} \cdot K_e^{\psi_e^k} \cdot L_e^{\psi_e^l},$$

→ $A_{t,e}$ is a function of government support to R&D in green technologies: $\boldsymbol{A_t} = 1 + \psi(PGI)^{\xi}$

→ This policy impacts positively quantities and negatively prices of renewable and BECCS.

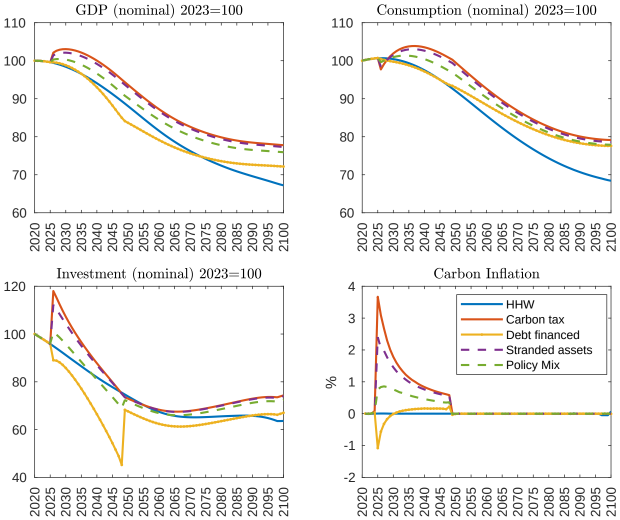
Redistributive & Economy-Sustaining Policies

Back

- → In order to mitigate negative effects on agents' welfare and consumption, the government can use part of the carbon revenues to provide lump-sum transfers to households.
- → Green transfers, denoted as $LUMP_t$, are distributed equally between cohorts in each period t.
- → The government can also finance a labour tax reduction (TR_t), which enters in the endogenous labour tax $\tau_{w,t}$.
- → Finally, the government can use part of the carbon revenues to reduce public debt and reduce the wedge between households' savings and capital available to firms fo r production.

Macroeconomic Impacts (nominal)

Back



Macroeconomic Impacts, per capita (nominal)

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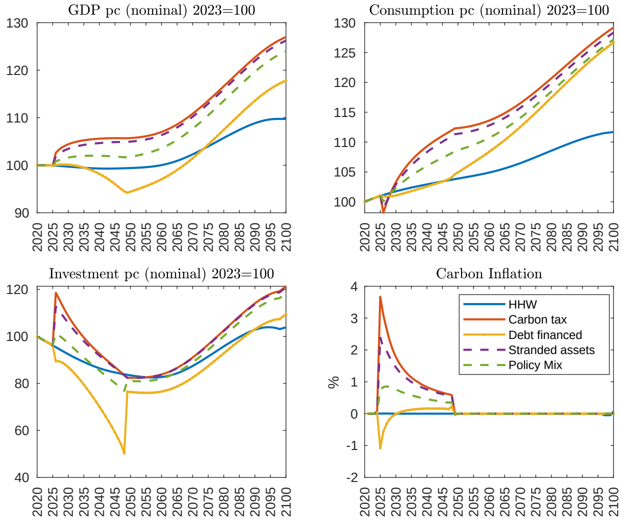

Disposable incomes, policy comparison

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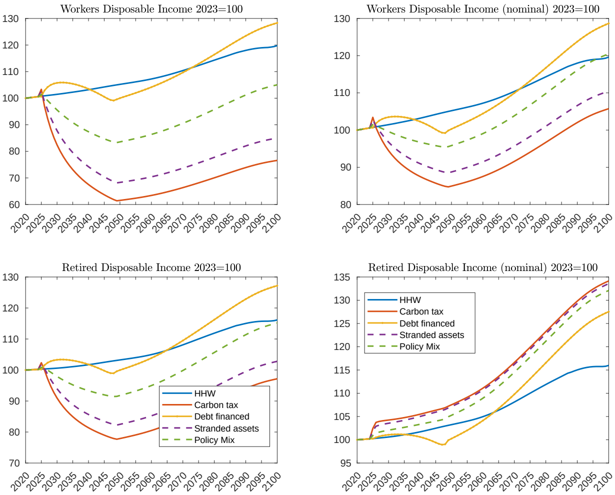

Real Interest Rate and Wages

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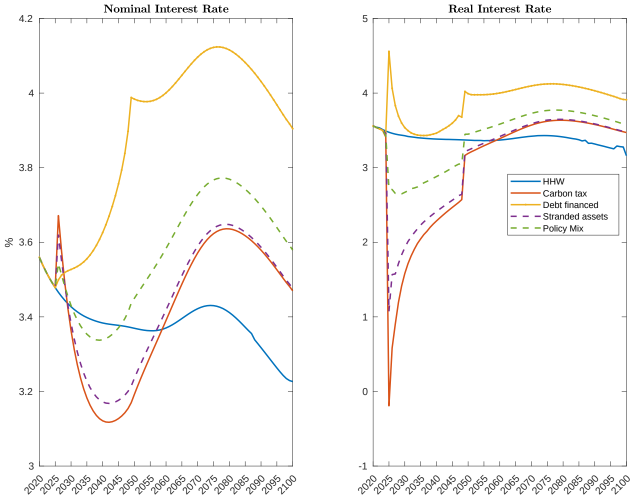

Carbon taxes % green subsidies

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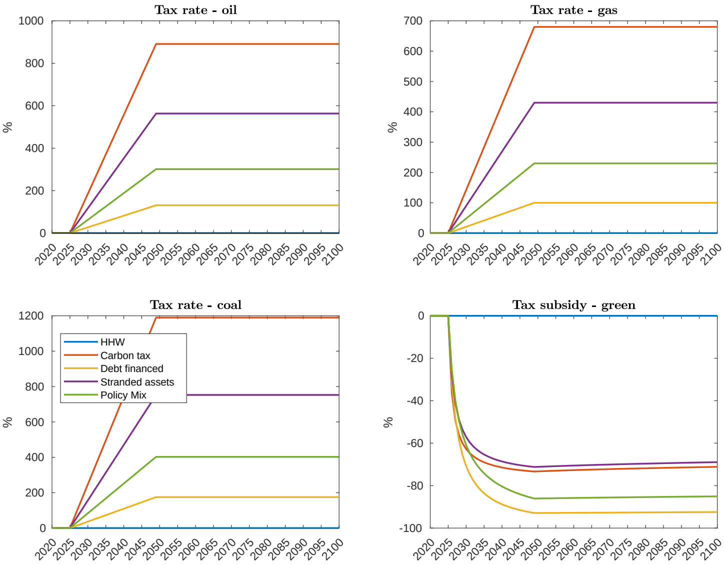

Stranded assets & green productivity

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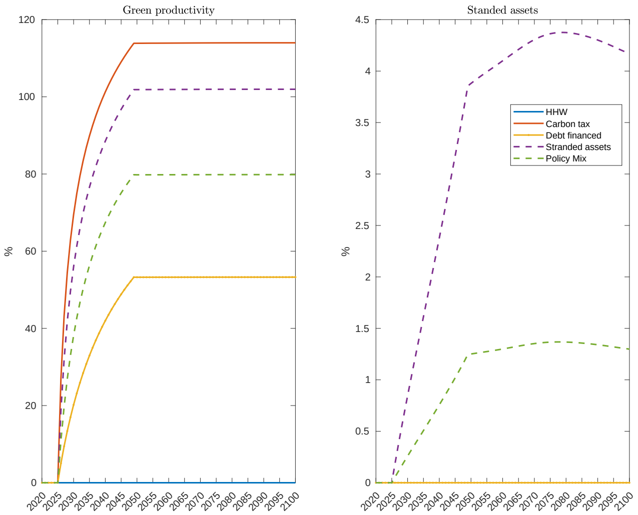

Welfare definition

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Life-cycle welfare, by cohort, is defined as follows:

$$W_s = \sum_{s=1}^{T} \beta^{t-1} \pi_{t+s,s} \frac{\left((c^s_{t+s,s} + \psi)(1 - l^s_{t+s,s})^{\gamma}\right)^{1-\sigma}}{1-\sigma}$$

Aggregate welfare, by year, is defined as follows:

$$W_t = \sum_{s=1}^{T} \frac{\left((c^s_{t+s,s} + \psi)(1 - l^s_{t+s,s})^{\gamma}\right)^{1-\sigma}}{1-\sigma}$$

Energy Quantities

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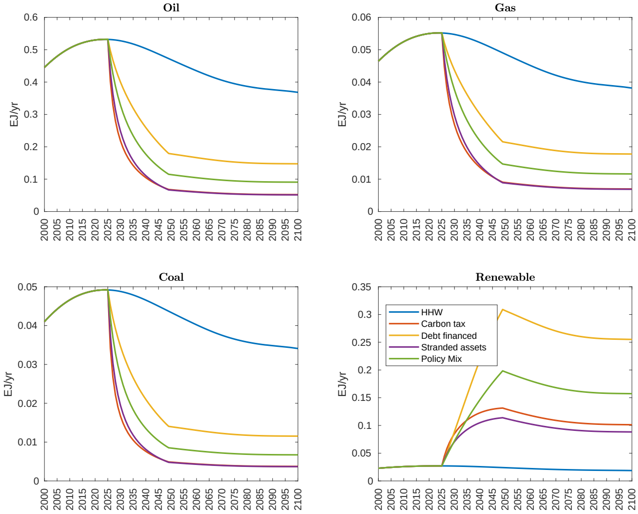

Energy Prices

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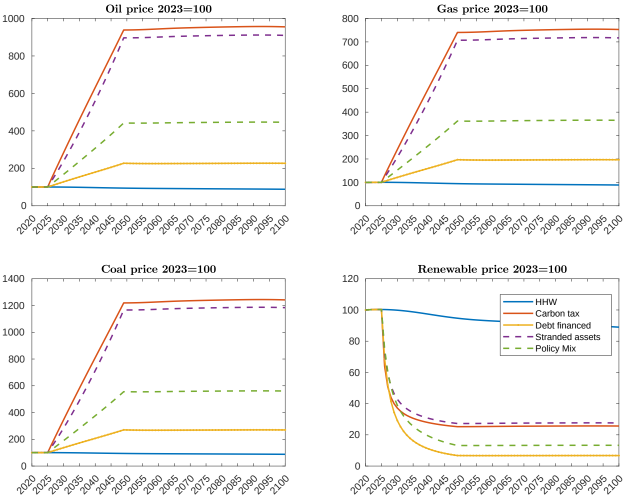

Final Sectors Quantities

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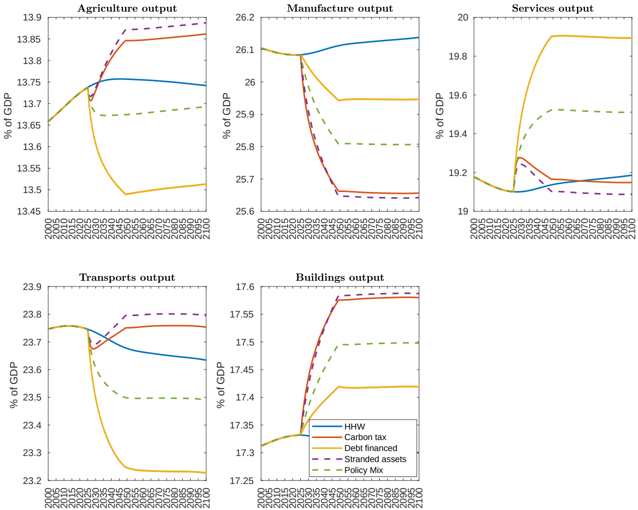

Final Sectors Prices

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