An Empirically Calibrated Prototype IO-SFC Model of the Italian Economy

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- Since then, several ECO-SFC models have been developed.

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- They are widely used to:
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  - Analyse economy-environment feedbacks.
- Main limitation: high aggregation, little inter-industry detail.

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- Refer to: Hardt and O'Neill (2017); Fevereiro et al. (2025).

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- The reason: methodological complexity in integrating IO and SFC frameworks.
- Yet this integration is crucial to study economy-ecosystem interactions in a coherent way.

Reclass. Balance-Sheet of Italy in 2021

	Workers	Rentiers	Firms	Government	Banks	Central bank	Foreign	Total
Cash and reserves	130.44	70.24	0.00	0.00	10.82	-211.5	0.00	0.00
Deposits	1656.88	1355.62	0.00	0.00	-3012.50	0.00	0.00	0.00
Loans	-572.61	-190.87	-871.9	0.00	1635.39	0.00	0.00	0.00
Advances	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-bills	34.99	198.27	0.00	-2678.4	1366.29	211.5	867.34	0.00
Domestic securities	686.26	6041.83	-6728.1	0.00	0.00	0.00	0.00	0.00
Foreign securities	0.00	867.34	0.00	0.00	0.00	0.00	-867.34	0.00
Capital stock	0.00	0.00	7600.00	0.00	0.00	0.00	0.00	7600.00
Net financial wealth	-1935.96	-8342.43	0.00	2678.4	0.00	0.00	0.00	-7600.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Reclass. Transactions-Flow Matrix in 2021

	Workers	Rentiers	Firms		Government	Banks	Central bank	Foreign	Total
			Current	*Capital*					
Consumption	-407.94	-622.18	1030.12	0.00	0.00	0.00	0.00	0.00	0.00
Investment	0.00	0.00	357.21	-357.21	0.00	0.00	0.00	0.00	0.00
Government spending	0.00	0.00	394.72	0.00	-394.72	0.00	0.00	0.00	0.00
Export	0.00	0.00	582.19	0.00	0.00	0.00	0.00	-582.19	0.00
Import	0.00	0.00	-582.19	0.00	0.00	0.00	0.00	582.19	0.00
[Value added]			[1782.05]						
Wages	624.62	32.88	-657.50	0.00	0.00	0.00	0.00	0.00	0.00
Deprec. / Amort.	0.00	0.00	-357.21	357.21	0.00	0.00	0.00	0.00	0.00
Firms profit	0.00	653.34	-653.34	0.00	0.00	0.00	0.00	0.00	0.00
Banks profit	0.00	38.19	0.00	0.00	0.00	-38.19	0.00	0.00	0.00
Tax revenue	-218.74	-200.65	0.00	0.00	419.39	0.00	0.00	0.00	0.00
Interests on reserves	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interests on deposits	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interests on loans	-8.59	-2.86	-13.08	0.00	0.00	24.53	0.00	0.00	0.00
Interests on advances	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interests on T-bills	0.35	1.98	0.00	0.00	-26.78	13.66	2.11	8.67	0.00
Interests on domestic sec.s	10.29	90.63	-100.92	0.00	0.00	0.00	0.00	0.00	0.00
Interests on foreign sec.s	0.00	8.67	0.00	0.00	0.00	0.00	0.00	-8.67	0.00
Seigniorage income	0.00	0.00	0.00	0.00	2.11	0.00	-2.11	0.00	0.00
Change in cash and reserves	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Change in deposits	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Change in loans	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Change in advances	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Change in T-bills	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Change in domestic sec.s	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Change in foreign sec.s	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Selected Technical Coefficients

	Ind_1	Ind_2	Ind_3	Ind_4	Ind_5	Ind_6	Ind_7	Ind_8	Ind_9	Ind_10	Ind_11	Ind_12
Ind_1	0.0368797	0.0000007	0.0000007	0.0000013	0.0000007	8.00e-07	0.0000000	6.00e-07	0.0140400	0.0326833	0.0158261	0.0027586
Ind_2	0.0000057	0.0693607	0.0000138	0.0000329	0.0000157	1.66e-05	0.0000521	1.13e-05	0.0121683	0.0023488	0.0002212	0.0012697
Ind_3	0.0000000	0.0000000	0.0148670	0.0000001	0.0000000	0.00e+00	0.0000000	1.00e-07	0.2234907	0.0207926	0.0250413	0.0018627
Ind_4	0.0000000	0.0000000	0.0000000	0.0204673	0.0000000	0.00e+00	0.0000001	0.00e+00	0.0002744	0.0005054	0.0003423	0.0009458
Ind_5	0.0000000	0.0000000	0.0000000	0.0000000	0.0188265	0.00e+00	0.0000000	0.00e+00	0.0000000	0.0000000	0.0000000	0.0000000
Ind_6	0.0000012	0.0000027	0.0000029	0.0000069	0.0000033	3.50e-06	0.0000109	2.30e-06	0.0000031	0.0000045	0.0000028	0.0000003
Ind_7	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.00e+00	0.0001791	0.00e+00	0.0000000	0.0000000	0.0000000	0.0000000
Ind_8	0.0000010	0.0000024	0.0000023	0.0000048	0.0031689	2.90e-06	0.0000011	9.86e-05	0.0012323	0.0004455	0.0003160	0.0000758
Ind_9	0.0000002	0.0000005	0.0000005	0.0000021	0.0000007	5.00e-07	0.0000027	6.00e-07	0.0000523	0.0001243	0.0000024	0.0000138
Ind_10	0.0000014	0.0000040	0.0000037	0.0000080	0.0000041	4.80e-06	0.0000017	3.50e-06	0.0000048	0.0000323	0.0000049	0.0000026
Ind_11	0.0000009	0.0000025	0.0000023	0.0000052	0.0000026	2.90e-06	0.0000013	2.20e-06	0.0000030	0.0000058	0.0000036	0.0000007
Ind_12	0.0000032	0.0000080	0.0000079	0.0000169	0.0000087	9.90e-06	0.0000107	6.90e-06	0.0002764	0.0001950	0.0000705	0.0000342

Note: Please refer to my **GitHub repository** for a detailed description of how to integrate IO accounting with SFC accounting.

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(3) GDP: $Y_n = \mathbf{p}^T \cdot (\mathbf{x} \cdot [\mathbf{I} - \mathbf{A}]) - \mathbf{p}_m^T \cdot \psi \cdot im$

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(12) Personal loans: $L_w = L_{w,-1} \cdot (1 - \delta_w) + \theta_w \cdot YD_w$

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  (24) Bank profits: $\Pi_b = PAYM_b^L + PAYM_b^H + PAYM_b^B + PAYM_b^R - PAYM_b^M$

The Labour Market

– Employment and Wages

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Interest Rates and Risk Premia

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(30) Interest payments: $PAYM_f^L = r_{l,-1} \cdot L_{f,-1}$

The Government

– Government Revenues and Expenditures

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(31) Net taxes paid by workers: $T_w = \tau_w^w \cdot WB \cdot (1 - \omega) + \tau_z \cdot PAYM_w^A + \tau_v \cdot V_{w,-1}$

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(34) Government debt accumulation: $B_s = B_{s,-1} + DEF$

The Central Bank

– Central Bank Operations

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Portfolio Equations

– Asset Allocation by Workers

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(39) Bank deposits as a buffer stock: $M_w = V_w + L_w - H_w - B_w - E_w$

Foreign Sector

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(40) Exports: $ln(ex) = \epsilon_0 - \epsilon_1 \cdot ln(\frac{p_x}{p_m}) + \epsilon_2 \cdot ln(y_f)$

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(45) Long-run exchange rate: $xr^* = xr^*_{-1} - \sigma^2_{xr} \cdot CAB$

Price Expectations

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(46) Expected inflation rate: $\pi^e_w = \pi_{w,-1} + \sigma_w \cdot (\bar{\pi} - \pi_{w,-1})$

(47) Expected price level (for working class): $p^e_w = p_{w,-1} \cdot (1 + \pi^e_w)$

Environmental Impact

– Emissions accounting

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(48) Sectoral emissions: $\mathbf{emis} = \boldsymbol{\epsilon} \odot \mathbf{x}$

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(48) Sectoral emissions: $\mathbf{emis} = \epsilon \odot \mathbf{x}$

(49) Total emissions: $EMIS = \epsilon^T \cdot \mathbf{x} = \sum_{j=1}^{163} \mathbf{emis}(j)$

Hidden Equation

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(36.B) Cash supply: $H_s = H_w + H_z + H_b$

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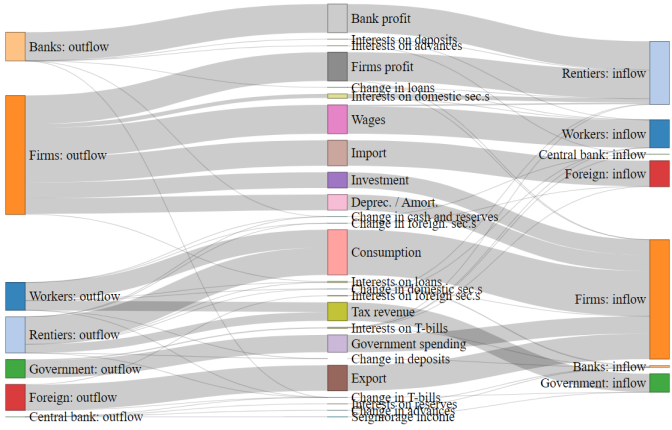
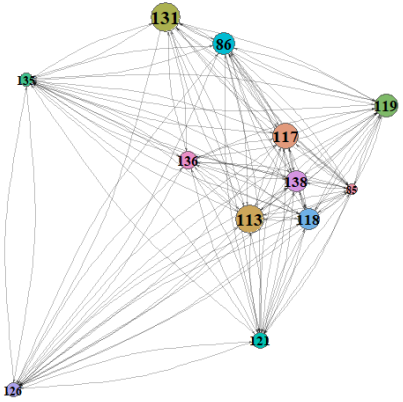
- Unit prices normalised to one in 2021.

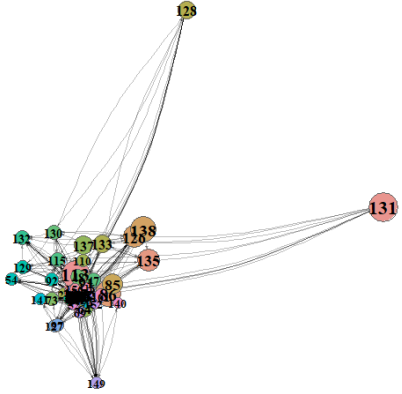
Cross-sector transactions in 2021



Cross-industry interdependencies in 2021



(a) Top 12



(b) Top 70

Baseline Assumptions and Shocks

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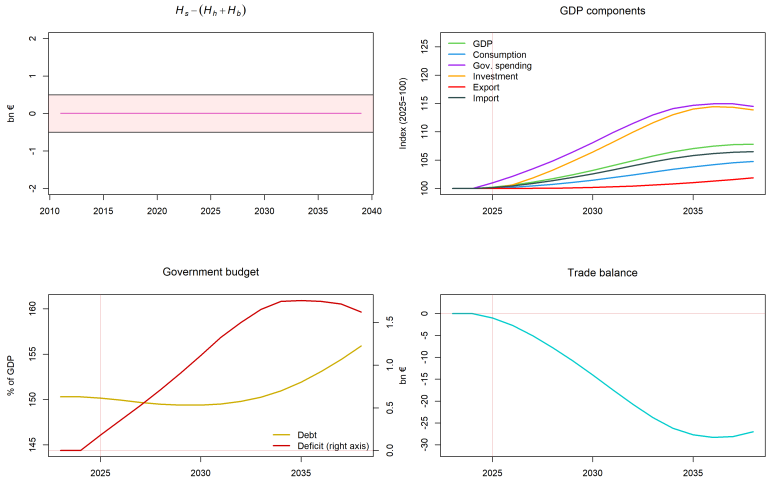
- Smooth adjustment of spending.

Selected variables after shock 1



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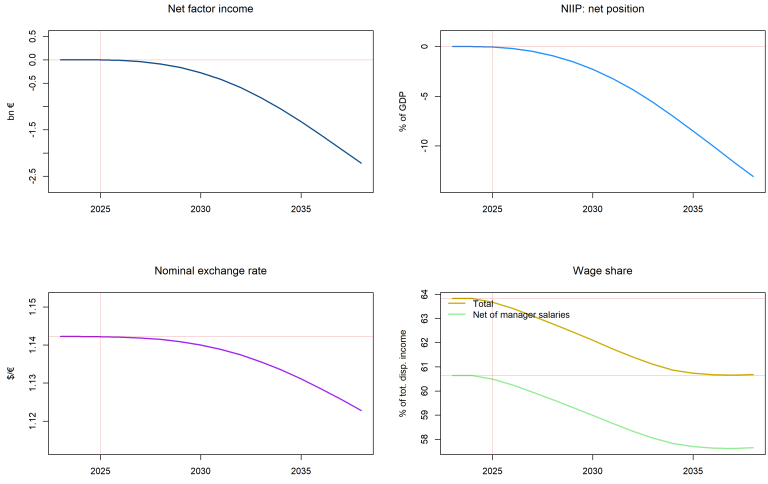

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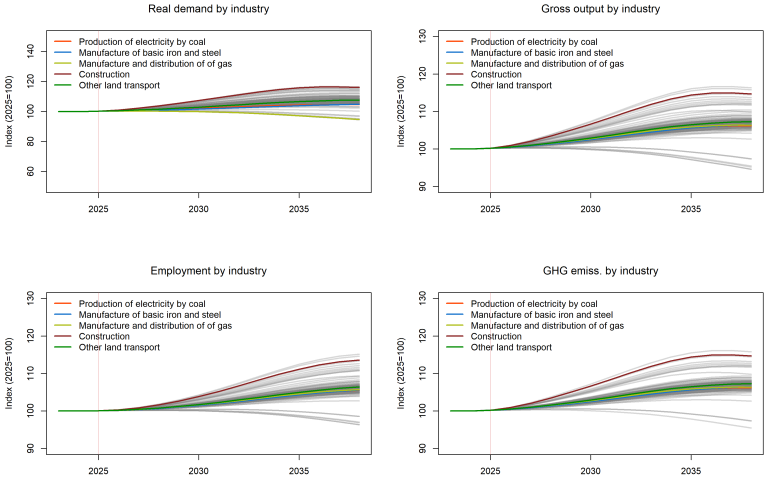

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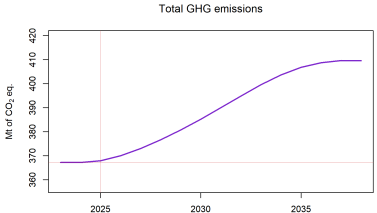

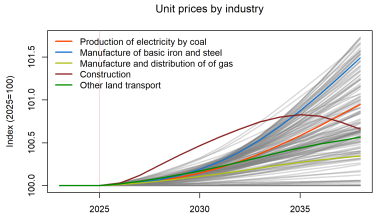

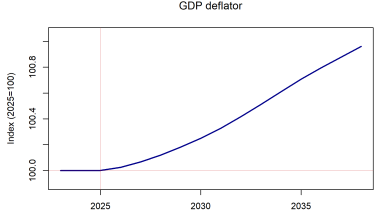

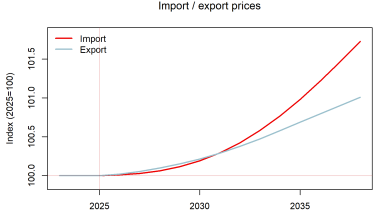

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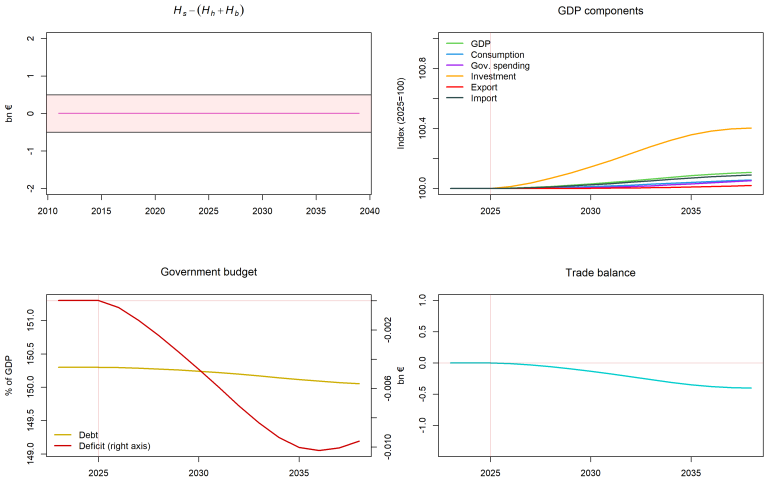
- However, to avoid negative disbursements, the size of the intervention is reduced to 1 billion euros.

Selected variables after shock 2



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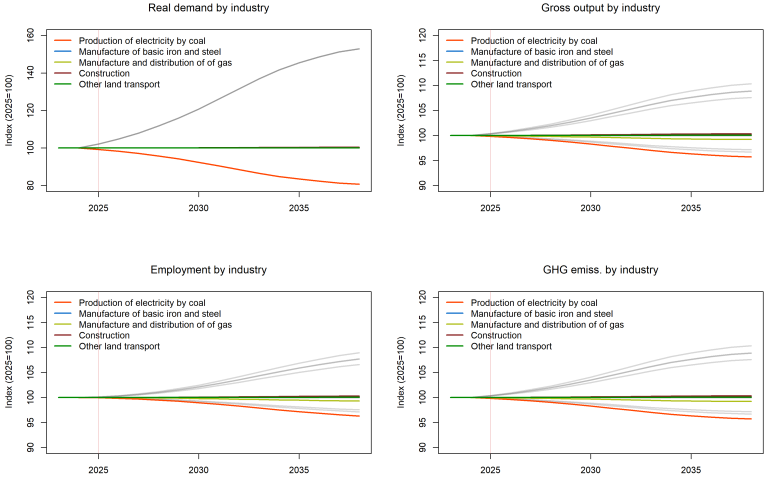

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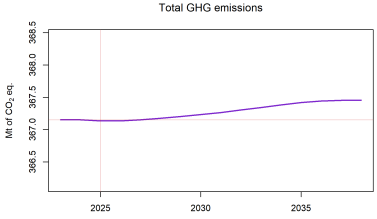

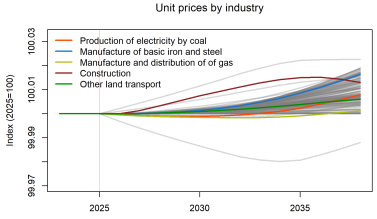

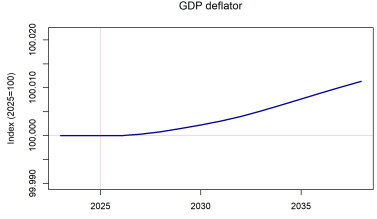

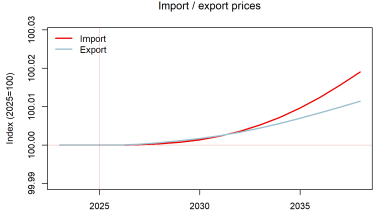

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- The model works smoothly and is watertight. However, IO relations must be carefully double-checked.
- Key message from early experiments: the transition takes time (rebound) and is likely to have uneven effects on different social groups.

Thank you

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