

Stock-flow consistent modelling and ecological macroeconomics - Lab

Yannis Dafermos¹ Maria Nikolaidi²

¹SOAS University of London

²University of Greenwich

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Outline

1 DEFINE-SIMPLE

2 DEFINE-GOV

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DEFINE-SIMPLE: balance sheet matrix

	Households	Firms	Commercial banks	Total
Deposits	$+D_t$		$-D_t$	0
Green loans		$-L_{Gt}$	$+L_{Gt}$	0
Conventional loans		$-L_{Ct}$	$+L_{Ct}$	0
Green capital		$+K_{Gt}$		$+K_{Gt}$
Conventional capital		$+K_{Ct}$		$+K_{Ct}$
Total (net worth)	$+D_t$	$+V_{Ft}$	0	$+K_t$

Source: Own illustration.

DEFINE-SIMPLE: transactions flow matrix

	Households	Firms		Commercial banks		Total
		Current	Capital	Current	Capital	
Consumption	$-CO_t$	$+CO_t$				0
Green investment		$+I_{Gt}$	$-I_{Gt}$			0
Conventional investment		$+I_{Ct}$	$-I_{Ct}$			0
Wages	$+W_t$	$-W_t$				0
Firms' profits	$+DP_t$	$-TP_t$	$+RP_t$			0
Banks' profits	$+BP_t$			$-BP_t$		0
Interest on deposits	$+int_D D_{t-1}$			$-int_D D_{t-1}$		0
Interest on green loans		$-int_G L_{Gt-1}$		$+int_G L_{Gt-1}$		0
Interest on conventional loans		$-int_C L_{Ct-1}$		$+int_C L_{Ct-1}$		0
Change in deposits	$-\Delta D_t$				$+\Delta D_t$	0
Change in green loans			$+\Delta L_{Gt}$		$-\Delta L_{Gt}$	0
Change in conventional loans			$+\Delta L_{Ct}$		$-\Delta L_{Ct}$	0
Total	0	0	0	0	0	0

Source: Own illustration.

Simulation exercise 1

Go to the simulation interface [here](#). In Step 3, run the following scenarios in which the identified shocks are implemented in period 5:

- 1 A ‘green investment shock’ scenario (Scenario 2) in which the interest rate on green loans (int_G) is reduced to 0.04, the interest rate on conventional loans (int_C) increases to 0.12, and the share of green investment ($beta_0$) increases to 0.36.
- 2 A ‘degrowth shock’ scenario (Scenario 3) in which the propensity to consume out of income (c_1) declines to 0.93 and the autonomous investment rate ($alpha_0$) declines to 0.015.

Explain the economic and environmental rationale of the effects of these shocks.

Simulation exercise 2

Go to the simulation interface [here](#). Include depreciation of capital (assuming that the depreciation of capital is the same for green and conventional capital stock) in the investment function and the capital stock. Make changes to Step 1 and Step 2 as described below. Then run the model.

- 1 Include depreciation of capital (*delta*) in the investment and green and conventional capital stock equations. To do so, in Step 1 'EQUATIONS', replace the equations for investment, green and conventional capital stock with the ones below:

$$I[t] = (\alpha_0 + \alpha_1 * r[t - 1]) * K[t - 1] + \textit{delta} * K[t - 1]$$

$$K_G[t] = K_G[t - 1] + I_G[t] - \textit{delta} * K_G[t - 1]$$

$$K_C[t] = K_C[t - 1] + I_C[t] - \textit{delta} * K_C[t - 1]$$

- 2 Include the description of the new parameter (*delta*). To do so, in Step 1 'PARAMETER DESCRIPTION', add the following:

delta #Depreciation of capital

- 3 Include the value for the new parameter. To do so, in Step 2, add the following:

delta=0.045 #Selected from a reasonable range of values

Check that the DEFINE-SIMPLE model remains at the steady state after this change.

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DEFINE-GOV: balance sheet matrix

	Households	Firms	Commercial banks	Government	Total
Deposits	$+D_t$		$-D_t$		0
Green loans		$-L_{Gt}$	$+L_{Gt}$		0
Conventional loans		$-L_{Ct}$	$+L_{Ct}$		0
Green capital		$+K_{Gt}$			$+K_{Gt}$
Conventional capital		$+K_{Ct}$			$+K_{Ct}$
Government securities	$+SEC_{Ht}$		$+SEC_{Bt}$	$-SEC_t$	0
Total (net worth)	$+V_{Ht}$	$+V_{Ft}$	0	$-SEC_t$	$+K_t$

Source: Own illustration.

DEFINE-GOV: transactions flow matrix

	Households	Firms		Commercial banks		Government	Total
		Current	Capital	Current	Capital		
Private consumption expenditures	$-CO_{PRI t}$	$+CO_{PRI t}$					0
Government consumption expenditures		$+CO_{GOV t}$				$-CO_{GOV t}$	0
Green investment		$+I_{G t}$	$-I_{G t}$				0
Conventional investment		$+I_{C t}$	$-I_{C t}$				0
Wages	$+W_t$	$-W_t$					0
Green subsidies		$+SUB_t$				$-SUB_t$	0
Taxes	$-TAX_{H t}$	$-TAX_{F t} - TAX_{C t}$				$+TAX_t$	0
Firms' profits	$+DP_t$	$-TP_t$	$+RP_t$				0
Banks' profits	$+BP_t$			$-BP_t$			0
Interest on deposits	$+int_D D_{t-1}$			$-int_D D_{t-1}$			0
Interest on green loans		$-int_G L_{G t-1}$		$+int_G L_{G t-1}$			0
Interest on conventional loans		$-int_C L_{C t-1}$		$+int_C L_{C t-1}$			0
Interest on government securities	$+int_S SEC_{H t-1}$			$+int_S SEC_{B t-1}$		$-int_S SEC_{t-1}$	0
Change in deposits	$-\Delta D_t$				$+\Delta D_t$		0
Change in green loans			$+\Delta L_{G t}$		$-\Delta L_{G t}$		0
Change in conventional loans			$+\Delta L_{C t}$		$-\Delta L_{C t}$		0
Change in government securities	$-\Delta SEC_{H t}$				$-\Delta SEC_{B t}$	$+\Delta SEC_t$	0
Total	0	0	0	0	0	0	0

Source: Own illustration.

Simulation exercise 3

Go to the simulation interface [here](#). In Step 3, run the following scenarios in which the identified shocks are implemented in period 5:

- ① A ‘carbon tax shock’ scenario (Scenario 2) in which the carbon tax (τ_C) increases to 0.05 USD per kg of CO_2 (or 50 USD per tonne of CO_2).
- ② A ‘subsidy shock’ scenario (Scenario 3) in which the subsidy rate (gov_SUB) increases to 0.15.

Explain the economic and environmental effects of these shocks.