EC7025 - SFC

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Welcome!

- Welcome and thanks for taking this module
- intended for students who have a good mathematical background and wish to expand their knowledge of advanced economic modelling, data calibration, and model simulation
- On completion of the module, the students will have a deep understanding of various modelling practices in economics and their relevance in policy making, as well as an in-depth knowledge of data calibration and model simulation

Aims

- introduce students to pluralistic modelling practices such as Stock-Flow-Consistent (SFC) modelling, Kaleckian growth models, Post-Keynesian and Marxian models of growth and debt cycles and Agent-Based Modeling (ABM)
- equip students with the necessary knowledge to build and simulate different small and medium scale models.
- equip students with an in-depth knowledge of data analysis and model simulation.
- introduce students to the basics of system dynamics approach

Logistics

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Outline

- Week 1-2: Understanding National Accounts
- Week 3-5: Stock-Flow Consistent Modelling
- Week 6-8: Heterodox Theories of Distribution and Growth
- Week 9-12: Growth and Debt Cycles
- Week 13-14: Modelling System Dynamics
- Week 15–16: Introduction to Agent - Based Modelling
- Week 17–22: Stock-Flow Consistent Agent Based Models

Assessment

- Thre research projects (Nov. 16, Feb. 15 and Apr. 7), each 25%
- One class test (Jan. 11), 25%

Week 1 to 5: SFC modelling and national accounts

- Get you fluent in ESA2010 language: what does S11, P3, MIO_NAC or EL stand for?
- Know your way around Eurostat and ONS database
- Introduction to R and relevant packages (pdfetch, PKSFC)
- Build and calibrate medium scale SFC model

National Accounts and Stock-Flow Consistent Modelling

- SFC models are based on a set of different tables that are more or less connected to real data and national accounts.
- Balance Sheets
- Transaction Flow Matrix
- Full Integration Matrix
- References: Godley and Lavoie Ch. 2, Caverzasi and Godin (2015), Eurostat and ONS Blue book

Stock-Flow Accounting

- Started with Copeland (1949) and his Social Accounting for moneyflows, picked up by Denizet (1969) and many others...
- Highlights the importance to incorporate monetary and financial processes into national accounts such as NIPA.
- Very close to Keynes's idea to integrate financial and income accounting.
- Idea is to be able to answer Copeland questions:
  - when total purchases of our national product increase, where does the money come from to finance them?
  - when purchases of our national product decline, what becomes of the money that is not spent?

Balance Sheets

- Balance sheets display the assets, liabilities and the balancing item net worth.
- Most of you are familiar with basic balance sheets such as the households balance sheet for the households at the end of 2015 in the United Kingdom (source eurostat).

	As	sets Lia	bilities
Produced non-financial asset	5238911	0	
Non-produced non financial assets	2507	0	
Currency and deposits	1412172	0	
Securities other than shares	91487	2226	
Loans	18745	1563594	
Shares and other equity	777956	0	
Insurance technical reserves	3708339	69232	
Other accounts receivable/payable	6847	2842	
Net Worth	0	9738640	

Non-financial corporations

	Assets	Liabilities
Produced non-financial asset	2097113	0
Non-produced non financial assets	0	0
Currency and deposits	546337	0
Securities other than shares	65083	384631
Loans	262326	965308
Shares and other equity	837888	2475658
Insurance technical reserves	4029	1056253
Other accounts receivable/payable	29976	50912
Net Worth	0	-1146126

- note negative net worth due to market value of equity
- capital stock are at market value (replacement cost) and not historical costs

Financial corporations

	Assets	Liabilities
Produced non-financial asset	162277	0
Non-produced non financial assets	0	0
Currency and deposits	3129884	5141459
Securities other than shares	3520842	1829957
Loans	3418831	1553526
Shares and other equity	2986514	2046996
Insurance technical reserves	1296602	3844915
Other accounts receivable/payable	6069641	6031487
Net Worth	0	64149

- Central Banks are in the financial corporations

Goverment

	Assets	Liabilities
Produced non-financial asset	2097113	0
Non-produced non financial assets	0	0
Currency and deposits	546337	0
Securities other than shares	65083	384631
Loans	262326	965308
Shares and other equity	837888	2475658
Insurance technical reserves	4029	1056253
Other accounts receivable/payable	29976	50912
Net Worth	0	-1146126

Balance Sheets in SFC

- When you are constructing the balance sheets of your model, you should first consider which assets you will include in your model.
  - Real assets: Capital stock, housing etc.
  - Financial assets/liabilities: cash, deposits, bills, bonds, loans, equities, derivatives, bank reserves, monetary gold, SDR etc.
- These assets will contain the economic wealth accumulated by economic agents. So your balance sheet matrix must contain the assets you decide to include in your model, and it should clearly identify which sectors in your economy hold which assets and which liabilities. As usual, the difference between assets and liabilities will yield net worth.

Example

	HHs	Firms	Gov.	Banks	C. B.	Sum
Capital	+Kh	+Kf				+K
Money	+Hh			+Hb	-H	0
Bills	+Bh		-Bs	+Bb	+Bcb	0
Loans	-Lh	-Lf	+L	0	0	0
Equities	+Ef	-Ef	0	0	0	0
Equities	+Eb	0	-Eb	0	0	0
Net worth	-NWh	-NWf	-NWb	-NWg	0	-K
Sum	0	0	0	0	0	0

Sectorial accounts (from Eurostat)

- Sector accounts record every transaction between sector and the change in financial assets and liabilities.
- Transactions are grouped in categories having a distinct economic meaning. Each non-financial transaction is recorded as an increase in the "resources" of a sector and an increase in the "uses" of another.
- Shown in a sequence of accounts, each of which covers a specific economic process.
- Two main categories: current accounts and accumulation accounts
  - *Current accounts* record transactions that do not involve the purchase or sale of financial or non-financial assets. Final balancing item is saving
  - *Accumulation accounts* record net acquisition of non-financial and financial assets, and the net incurrence of liabilities. Also show other changes in balance sheets, such as revaluations and write-offs of bad debts
  - The accumulation accounts explain all the changes in the (non-financial and financial) balance sheets

Example for households in the UK in 2014

	Households
Total Income	9851688
Taxes	-1442130
Social Contributions	-2425244
Social Benefits	2635931
Other transfers	109116
[Gross Disposable Income	8729361]
Consumption	-8012603
Adjustments in Pensions	201553
[Gross Savings	918310]
Gross Capital Formation	-716849
Capital Transfer	14213
Net Non-Produced NF Assets	6360
Net Lending Position	222034

Transaction flow matrix

1. The transactions flow matrix consists of three separate parts.
   - On the top rows of the matrix, you will have output expressed as expenditures, which by definition is given by $Y = C + I + G(+X - M)$
   - The matrix should clearly identify the consumption and investment by the sectors in your model.
2. The second part of the transactions flow matrix outlines output using an income approach.
   - Depending on how disaggregated your model is and how many assets you have included in your model, this part may include various sources of income for your sectors

Assume a closed economy,

- Households work for firms in exchange for wages, consume, invest in housing and hold cash, equities of firms and banks, government bills and deposits as financial assets. Government taxes households, firms and banks and spends, and issues bills to finance its deficit.
- Firms employ households to produce goods and invest in productive capital stock. They use undistributed profits to finance investment and borrow from banks/issue new equity to finance any shortfall. -Banks lend to households and firms, hold bills, accept deposits from households and distribute part of their profits to households. They do not invest in tangible capital.
- Central bank holds government bills and transfers its profits to the government

Example of Transaction Flow Matrix

	Households	Production firms		Banks		Government	Central Bank		
	(1)	Current (2)	Capital (3)	Current (4)	Capital (5)	(6)	Current (7)	Capital (8)	Σ
Consumption	$-C$	$+C$							0
Investment	$-I_h$	$+I$	$-I_f$						0
Govt. exp.		$+G$				$-G$			0
Wages	$+WB$	$-WB$							0
Profits, firms	$+FD_f$	$-F_f$	$+FU_f$						0
Profits, banks	$+FD_b$			$-F_b$	$+FU_b$				0
Profit, central Bk						$+F_{cb}$	$-F_{cb}$		0
Loan interests	$-r_{l(-1)} \cdot L_{h(-1)}$	$-r_{l(-1)} \cdot L_{f(-1)}$		$+r_{l(-1)} \cdot L_{(-1)}$					0
Deposit interests	$+r_{m(-1)} \cdot M_{h(-1)}$			$-r_{m(-1)} \cdot M_{(-1)}$					0
Bill interests	$+r_{b(-1)} \cdot B_{h(-1)}$			$+r_{b(-1)} \cdot B_{b(-1)}$		$-r_{b(-1)} \cdot B_{(-1)}$	$+r_{b(-1)} \cdot B_{cb(-1)}$		0
Taxes – transfers	$-T_h$	$-T_f$		$-T_b$		$+T$			0
Change in loans	$+\Delta L_h$		$+\Delta L_f$		$-\Delta L$				0
Change in cash	$-\Delta H_h$				$-\Delta H_b$			$+\Delta H$	0
Change, deposits	$-\Delta M_h$				$+\Delta M$				0
Change in bills	$-\Delta B_h$				$-\Delta B_h$	$+\Delta B$		$-\Delta B_{cb}$	0
Change, equities	$-(\Delta e_f \cdot p_{ef} + \Delta e_b \cdot p_{eb})$		$+\Delta e_f \cdot p_{ef}$		$+\Delta e_b \cdot p_{eb}$				0
Σ	0	0	0	0	0	0	0	0	0

Figure 1: Transaction Flow Matrix, source: G&L 2007

Transaction flow matrix, part 2

- Once you have identified the first two parts of the transactions flow matrix, you have a complete picture of income sources and expenditures of each sector in your model.
- Naturally, the difference between income and expenditures yields the savings of each sector, which are then allocated to real and financial assets to accumulate wealth.
- The last part of the full flow matrix shows which assets and liabilities these savings/dissavings have been channelled to.
- In order to ensure that each column adds up to zero, we have to record the changes in assets/liabilities in a non-intuitive way and record changes in assets with a (-) sign and change in liabilities with a $(+)$ sign.
- Therefore, each column now shows

Income – Expenditures – Change in assets/liabilities =0

Full integration matrix

- Once you have written down the transactions flow matrix, you can move to derive the full integration matrix, which simply shows the changes in net worth of your sectors between the beginning of the period and the end of the period.
- In order to do so, you use the bottom part of the transactions flow matrix with opposite signs in order to make sure increases in assets lead to an increase in net worth and increases in liabilities lead to a decrease in net worth. (Do not forget to add change in tangible capital)
- One further consideration is the change in the value of some stocks of assets between the beginning of the period and the end of the period.
- In order to capture this, you will need to add rows for the assets whose values are subject to such change.
- The last row now becomes the net worth of each sector at the end of the period.

Example of Full Integration Matrix

		Households (1)	Production firms (2)	Banks (3)	Government (4)	Central bank (5)	Σ
	Net worth, end of previous period	NW_{h-1}	NW_{f-1}	NW_{b-1}	NW_{g-1}	0	K_{-1}
Change in net assets arising from transactions	Change in loans	$-\Delta L_h$	$-\Delta L_f$	$+\Delta L$			0
	Change in cash	$+\Delta H_h$		$+\Delta H_b$		$-\Delta H$	0
	Change in deposits	$+\Delta M_h$		$-\Delta M$			0
	Change in bills	$+\Delta B_h$		$+\Delta B_h$	$-\Delta B$	$+\Delta B_{cb}$	0
	Change in equities	$+\Delta e_f \cdot p_{ef} + \Delta e_b \cdot p_{eb}$	$-\Delta e_f \cdot p_{ef}$	$-\Delta e_b \cdot p_{eb}$			0
	Change in tangible capital	$+\Delta k_h \cdot pk$	$+\Delta k_f \cdot pk$				$+\Delta k \cdot pk$
Change in net assets arising from revaluations	Capital gains in equities	$+\Delta p_{ef} \cdot e_{f-1}$ $+\Delta p_{eb} \cdot e_{b-1}$	$-\Delta p_{ef} \cdot e_{f-1}$	$-\Delta p_{eb} \cdot e_{b-1}$			0
	Capital gains in tangible capital	$+\Delta pk \cdot k_{h-1}$	$+\Delta pk \cdot k_{f-1}$				$\Delta pk \cdot (k_{h-1} + k_{f-1})$
	Net worth, end of period	NW_h	NW_f	NW_b	NW_g	0	K

Figure 2: Full Integration Matrix, source: G&L 2007