

A monetary theory of production. An introduction to SFC modelling

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Money in the modern economy (McLeay et al., 2014)

- ▶ Roles of money

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- ▶ Roles of money
 - ▶ Store of value
 - ▶ Unit of account
 - ▶ Medium of exchange

Balance Sheets

- ▶ Lists Assets and Liabilities of an economic agent
- ▶ Assets are all the financial and real items owned by the agent
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Cash	
Deposits	
House	
Savings Account	

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Assets	Liabilities
Cash	Credit Card
Deposits	Mortgage
House	Car Loan
Savings Account	

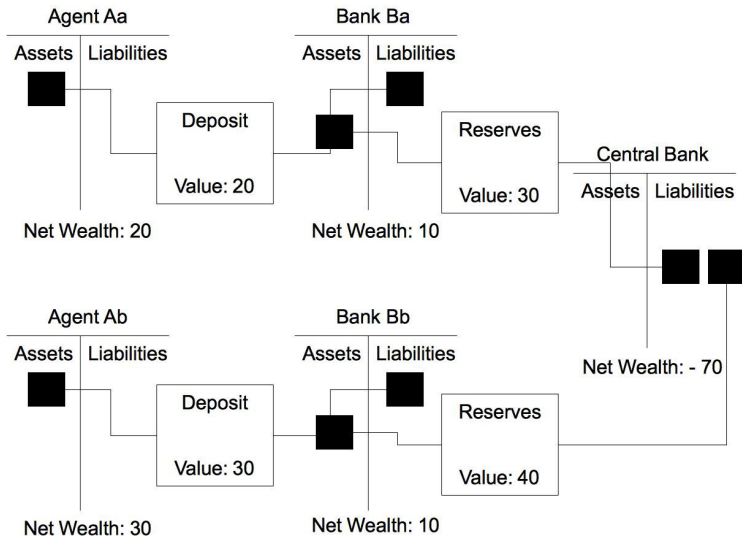
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Assets	Liabilities
Cash	Credit Card
Deposits	Mortgage
House	Car Loan
Savings Account	Net Worth

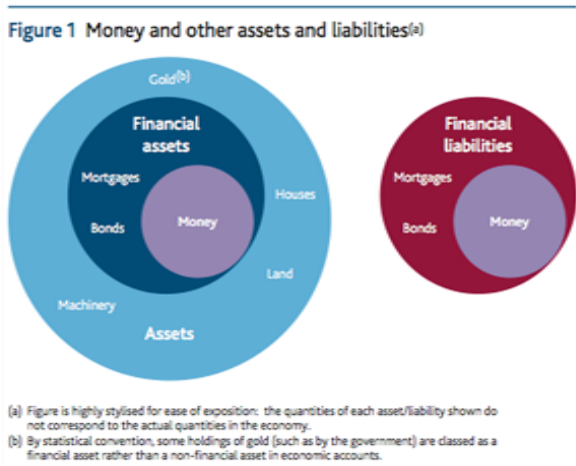
Balance sheets are always balanced, i.e. Assets = Liabilities

Balance sheets are interconnected



Global balance sheet

Money in the modern economy is an IOU, a financial asset, for someone and a liability for someone else



Money

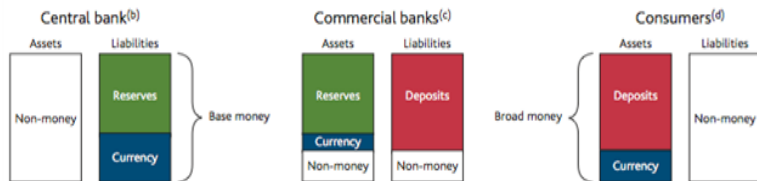
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- ▶ Different types of money

Money

- ▶ In principle, anyone could emit its own IOU, but money is a social institution that everyone trusts.
- ▶ Different types of money
 - ▶ Currency
 - ▶ 94%, fiat, i.e. not convertible to other assets
 - ▶ No link to any assets, thus no limitations to creation
 - ▶ Tax payments and trusts (technical and sociological)
 - ▶ Bank deposits
 - ▶ 97% of amount of money in circulation
 - ▶ Trust in bank, ease of use
 - ▶ Created by commercial banks
 - ▶ Central bank reserves
 - ▶ Electronic money
 - ▶ Medium of exchange for banks
 - ▶ Created by central bank

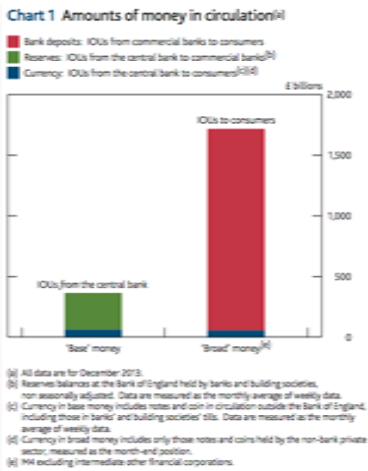
Types of money

Figure 2 Stylised balance sheets of different types of money holders and issuers in the economy^(a)



- (a) Balance sheets are highly stylised for ease of exposition: the quantities of each type of money shown do not correspond to the quantities actually held on each sector's balance sheet.
- (b) Central bank balance sheet only shows base money liabilities and matching assets. In practice the central bank holds other non-money liabilities. Its non-money assets are mostly made up of government debt. Although that government debt is held by the Bank of England's Asset Purchase Facility, so does not appear directly on the Bank of England's consolidated balance sheet.
- (c) Commercial banks' non-money assets would include government debt and non-money liabilities would include long-term debt and equity.
- (d) Consumers represent the private sector of households and companies. Balance sheet only shows broad money assets and corresponding liabilities. Consumers' non-money liabilities would include secured and unsecured loans.

Amounts of money in circulation



Money creation

Two misconceptions about money creation

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Lending creates deposits

Money creation

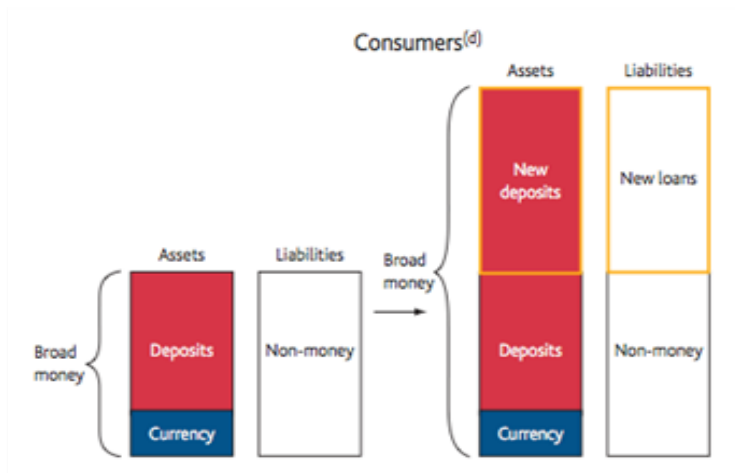
Two misconceptions about money creation

- ▶ Banks act simply as intermediaries, lending out the deposits that savers place with them
- ▶ The central bank determines the quantity of loans and deposits by controlling the quantity of central bank money

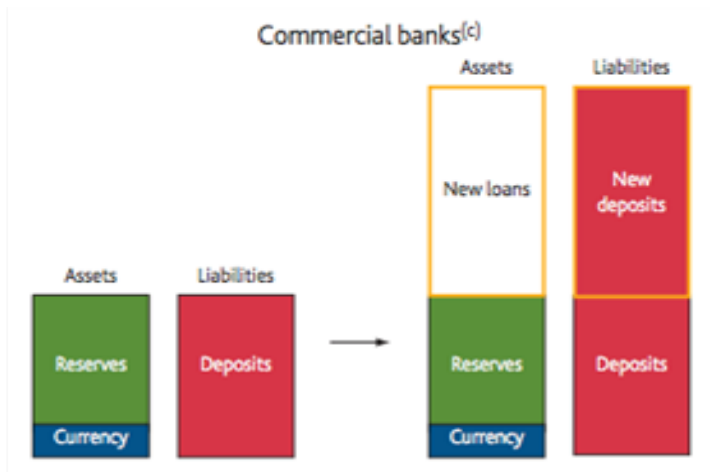
Lending creates deposits

Example: let's assume a household decides to buy a house from another household, using a 100% LTV mortgage.

Consumers balance sheets

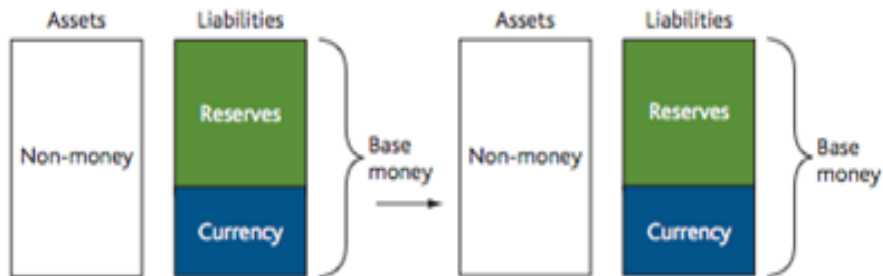


Commercial banks



Central Bank

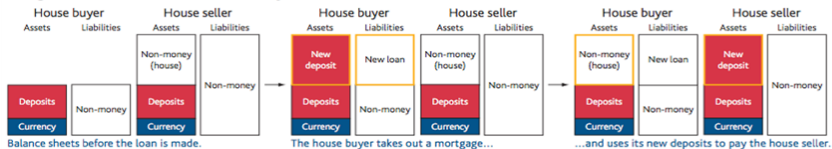
Central bank^(b)



Whole story

Figure 2 Money creation for an individual bank making an additional loan^(a)

Changes to the balance sheets of the house buyer and seller



Changes to the balance sheets of the house buyer and seller's banks



- But settling all transactions in this way would be unsustainable:
- The buyer's bank would have fewer reserves to meet its possible outflows, for example from deposit withdrawals.
 - And if it made many new loans it would eventually run out of reserves.



So the buyer's bank will in practice seek to attract or retain

Limits to money creation

- ▶ Banks' limits

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- ▶ Monetary policy
 - ▶ Interest rates and interbank market

Outline

1. Motivation
2. The PK-SFC approach
3. The SIMplest model
4. Conclusion

Financial frictions in DSGEs

- ▶ Core DSGE model simply neglected the financial side for a long time
- ▶ After the crisis, great effort to include a **financial sector and “financial frictions”** Brunnermeier et al. (2012)

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 - ▶ **incomplete markets**: either no market at all or unwillingness to engage in certain contracts because of agency problems (Quadrini, 2011)
 - ▶ Hence, credit constraint
 - ▶ Agents are unable to anticipate/postpone spending (for consumption or investment) or insure against uncertain events (to smooth consumption or investment)
 - ▶ **Unable to enforce their optimal state-contingent plan** → Episodes of financial fragility

Do Banks intermediate?

- ▶ DSGE models now able to mimic non-linear dynamics but still rely on external shocks to explain the origin of those non-linearities
- ▶ Financial frictions DSGE models **still fail to understand the inherent nature of finance and money** (Werner, 2014, 2015)

Do Banks intermediate?

- ▶ DSGE models now able to mimic non-linear dynamics but still rely on external shocks to explain the origin of those non-linearities
- ▶ Financial frictions DSGE models **still fail to understand the inherent nature of finance and money** (Werner, 2014, 2015)
- ▶ Most models either assume that
 - ▶ **Banks are totally absent and all lending is direct**
 - ▶ Financial institutions reduced to **mere intermediaries**
 - ▶ The **monetary side of the economy is fully determined in the real sphere** and savings need time to be accumulated through the production of additional goods

Accounting logic

- ▶ Someone's asset is someone else liability AND someone inflow is someone else outflow
 - ▶ *quadruple entry system* Copeland (1949)
- ▶ budget constraint for each individual sector and for the economy as a whole
 - ▶ “Walras’ law and adding up constraint” Tobin 1982
 - ▶ “budget constraint or system-wide consistency requirement”, Godley and Lavoie 2007

Money and finance misrepresentation: implications

Failing to understand the endogenous nature of bank money leads to **underestimate the sources of financial instability** and the consequences of shocks hitting the banking sector. (Benes et al., 2014)

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Failing to understand the nature and functioning of outside money leads to logically **inconsistent conclusions about fiscal and macro-prudential policies**.

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Failing to understand the nature and functioning of outside money leads to logically **inconsistent conclusions about fiscal and macro-prudential policies**.

SFC models can help to provide a fully integrated picture of the real and financial economy, tackling the endogenous nature of money.

Motivation: why should you use PK-SFC modelling?

- ▶ Highlights fundamental *real-financial* interactions
- ▶ Powerful *didactical* tool
- ▶ Strong *empirical* connection

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Where do the SFC models come from?

1. Morris A. Copeland:

- ▶ *Social Accounting for Moneyflows* (1949)

2. James Tobin

- ▶ Backus et al. (1980): arguably first complete SFC (matrix approach to accounting + closure).
- ▶ Tobin (1982): Nobel lecture, in part a SFC Manifesto:
 - 2.1 Precision regarding time
 - 2.2 Tracking of stocks
 - 2.3 Several assets and rates of return
 - 2.4 Modeling of financial and monetary policy operations
 - 2.5 Walras's Law and adding up constraints.

3. Wynne Godley

- ▶ formalization and development, thanks to a more appropriate economic approach (money matters..., see Godley and Lavoie, 2007, among many others)

Post-Keynesian SFC modeling

Thanks to the rigorous accounting rules underlying the construction of the accounting matrices SFC models provide a **complete, integrated, and coherent picture of the real and financial sides of an economic system** which allows to address fundamental questions such as:

- ▶ What form does personal saving take?
- ▶ Where does any excess of sectoral income over expenditure actually go to?
- ▶ Which sector provides the counterparty to every transaction in assets?
- ▶ Where does the finance for investment come from?
- ▶ How are budget deficits financed?

Avoid black boxes in describing stocks and flows dynamics, and real vs monetary variables.

What are we talking about?

1. accounting part
2. behavioral equations

Accounting: the matrix approach

Rules: consistency (stocks and flows, within and between)

- ▶ someone's asset is someone else's liability AND someone inflow is someone else's outflow
 - ▶ *quadruple entry system* (Copeland, 1949)
- ▶ budget constraint for each individual sector and for the economy as a whole ("Walras' law and adding up constraint" Tobin 1982 or "budget constraint or system-wide consistency requirement" Godley and Lavoie 2007)

1. Aggregate balance sheet: starting stocks of the economy.
2. Transaction flows: all the flows of the economy.
3. Flows of funds: how all flows end up in new stocks. End of the current period's stock = starting stocks of the following period.

Accounting part 1

THE INITIAL STOCKS: the aggregate balance sheet

Tab.1 Aggregate Balance Sheets. A (+) sign before a variable denotes an asset while a (-) sign denotes a liability

	Households	Firms	Banks	Gov.	Tot
Bank Deposits	+CA		-CA		0
Bank Loans		-L	+L		0
Capital		+K			+K
Net worth	Vh	Vf	Vr	Vg	V

Accounting part 2

CURRENT TRANSACTIONS: the transaction flows

Tab. 2 Current Transactions: (+) sign denotes receipt, (-) sign denotes a payment						
	Households	Firms		Banks	Gov.	Tot
		current	capital			
Consumption	-C	+C				0
Investment		$+\Delta K$	$-\Delta K$			0
Memo: Final Sales at market prices = $pX = C + I = W + P$						
Wages	+W	-W				0
Interests on L		$-r/L_{t-1}$		$+r/L_{t-1}$		0
Interests on CA	$+rcCA_{t-1}$			$-rcCA_{t-1}$		0
Dividends	+Ff	-Ff				0
Totals	SavH	Fu	$-\Delta K$	SavB	SavG	SAV

Accounting part 3

THE FLOW OF FUNDS: from the flows to the end of the period's stocks

Tab.3 Flow of Funds:					
(+) sign denotes sources of funds, (-) denotes uses of funds					
	Households	Firms	Banks	Gov.	Tot
Current Sav	+Sav H	+Fu	SavB	0	+SAV
Δ Bank Deposits	$-\Delta CA$		$+\Delta CA$		0
Δ Bank Loans		$+\Delta L$	$-\Delta L$		0
Δ Fixed K		$-\Delta K$			$-\Delta K$
Total	0	0	0	0	0
Δ Net Worth	SAVH	Fu	Vb	0	SAV

MEMO: The net worth of a sector is increased by its current savings during the period, plus capital gains.

Accounting part 4

THE END-OF-PERIOD STOCKS: the aggregate balance sheet

Tab.1 Aggregate Balance Sheets. A (+) sign before a variable denotes an asset while a (-) sign denotes a liability

	Households	Firms	Banks	Gov.	Tot
Bank Deposits	+CA		-CA		0
Bank Loans		-L	+L		0
Capital		+K			+K
Net worth	Vh	Vf	Vr	Vg	V

The equations: 2 steps

1. The accounting identities

All the identities and flows implied by the accounting
e.g. for firms (F = total profit)

$$F = +C + \Delta K + rc \cdot CA_{t-1} - W - rl \cdot L_{t-1} \quad (1)$$

$$Ff = F - Fu \quad (2)$$

2. The behavioral equations: economic theory comes into play

The closure: through theory we try to find an equation for each variable not directly determined by the accounting making theoretical assumptions on the behavior of the sectors.

$$Fu = \zeta F \quad (3)$$

$$C = \alpha_1 \cdot YD + \alpha_2 \cdot V_{-1} \quad (4)$$

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The structure of the SIMplest model and the accounting

Hypothesis

1. NO private money
 - ▶ no banks
 - ▶ no loans and thus no interest payment
2. Closed
 - ▶ no import nor export
 - ▶ no capital flows
3. Pure labour economy
 - ▶ no K
 - ▶ no intermediate costs
4. No supply constraint of any kind
5. No inventories
6. Quantity adjustment mechanism: $S = D$

Sectors

1. Households

- ▶ buy consumption goods and pay taxes
- ▶ get wages
- ▶ accumulate assets

2. Producers

- ▶ sell services or goods to households and govt
- ▶ pay wages

3. Government

- ▶ buy goods from firms
- ▶ get taxes

Assets

- ▶ high powered money (cash)

The Model part 1: the accounting matrices

Starting point the aggregate balance sheet

Tab.1 Aggregate Balance Sheets

	Households	Firms	Government	Tot
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The Model part 1: the accounting matrices

Starting point the aggregate balance sheet

Tab.1 Aggregate Balance Sheets

	Households	Firms	Government	Tot
Money Stock	$+H$		$-H$	0

(+) sign before a variable denotes an asset, (-) sign denotes a liability.

The Model part 1: the accounting matrices

Tab.2 Current Transactions

	Households	Firms	Government	Tot
Consumption				0
Govt. expenditure			$-G$	0
Wages				0
Taxes				0
Savings				0
Tot	0	0	0	0

(+) sign denotes an inflow, (-) sign denotes an outflow.

The Model part 1: the accounting matrices

Tab.2 Current Transactions

	Households	Firms	Government	Tot
Consumption				0
Govt. expenditure		+G	-G	0
Wages				0
Taxes				0
Savings				0
Tot	0	0	0	0

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The Model part 1: the accounting matrices

Tab.2 Current Transactions

	Households	Firms	Government	Tot
Consumption				0
Govt. expenditure		+G	-G	0
Wages		$-W \cdot N_d$		0
Taxes				0
Savings				0
Tot	0	0	0	0

(+) sign denotes an inflow, (-) sign denotes an outflow.

The Model part 1: the accounting matrices

Tab.2 Current Transactions

	Households	Firms	Government	Tot
Consumption				0
Govt. expenditure		$+G$	$-G$	0
Wages	$+W \cdot N_s$	$-W \cdot N_d$		0
Taxes				0
Savings				0
Tot	0	0	0	0

(+) sign denotes an inflow, (-) sign denotes an outflow.

NB. *Quadruple-entry* system (Copeland, 1949): from one flow implies three more flows: govt. buys goods ($-G$), firms receive the payment ($+G$;) and use it to pay wages ($-WB$) to households ($+WB$).

The Model part 1: the accounting matrices

Tab.2 Current Transactions

	Households	Firms	Government	Tot
Consumption	$-C$			0
Govt. expenditure		$+G$	$-G$	0
Wages	$+W \cdot N_s$	$-W \cdot N_d$		0
Taxes	$-T$			0
Savings				0
Tot	0	0	0	0

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The Model part 1: the accounting matrices

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Taxes	$-T$		$+T$	0
Savings				0
Tot	0	0	0	0

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Govt. expenditure		$+G$	$-G$	0
Wages	$+W \cdot N_s$	$-W \cdot N_d$		0
Taxes	$-T_s$		$+T_d$	0
Savings	Sav_h		Sav_g	0
Tot	0	0	0	0

(+) sign denotes an inflow, (-) sign denotes an outflow.

The Model part 1: the accounting matrices

Tab.3 The Flow of Funds

	Households	Firms	Government	Tot
Current Savings	Sav_h		Sav_g	0
Money Stock	$+\Delta H_h$		$-\Delta H_s$	0
Tot	0	0	0	0

(+) sign denotes a use of funds, (-) sign denotes a source of funds.

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Stock Flow Consistent models are *intrinsically dynamic* (see Macedo e Silva and Dos Santos, 2011)

The Model part 1: the accounting matrices

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(+) sign denotes a use of funds, (-) sign denotes a source of funds.

...the end of one period is the beginning of the following period.

Tab.1.b Aggregate Balance Sheets next period

	Households	Firms	Government	Tot
Money Stock	$+H_{t+1}$		$-H_{t+1}$	0

(+) sign before a variable denotes an asset, (-) sign denotes a liability.

What about outside money?

Tab. 2 Current Transactions: (+) sign denotes receipt, (-) sign denotes a payment							
	Households	Firms		Banks		Gov.	Tot
		current	capital	current	capital		0
Cons	-C	+C					
Inv		$+\Delta K$	$-\Delta K$				0
G		+G				-G	0
Memo: Final Sales at market prices = $pX = C + I + G = W + P$							
Wages	+W	-W					0
Taxes	-T					+T	0
Int on L		$-rL_{t-1}$		$+rL_{t-1}$			0
Int on CA		$+rcCA_{t-1}$		$-rcCA_{t-1}$			0
Divs.	+Ff	-Ff					0
New L			$-\Delta L$		$+\Delta L$		0
Totals	SavH	Fu	$-\Delta K$	SavB		SavG	SAV

Firms receive a loan from banks and use it to pay wages...

Back to our model

Tab.2 Current Transactions

	Households	Firms	Government	Tot
Consumption	$-C$	$+C$		0
Govt. expenditure		$+G$	$-G$	0
Wages	$+W \cdot N_s$	$-W \cdot N_d$		0
Taxes	$-T_s$		$+T_d$	0
Savings	Sav_h		Sav_g	0
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Tab.3 The Flow of Funds

	Households	Firms	Government	Tot
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Money Stock	$+\Delta H_h$		$-\Delta H_s$	0
Tot	0	0	0	0

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The Model part 2: the behavioral equations

From assumption 4 (no supply constraints) and 6 (volume adjustment $S = D$)

$$C_s = C_d \quad (5)$$

$$G_s = G_d \quad (6)$$

$$T_s = T_d \quad (7)$$

$$N_s = N_d \quad (8)$$

The Model part 2: the behavioral equations

...

(10) Disposable income; (11) Taxes; (12) Consumption; (13) GDP; (14) employment

$$YD = W \cdot N_S - T \quad (9)$$

$$T = \theta \cdot W \cdot N_S \quad (10)$$

$$C = \alpha_1 \cdot YD + \alpha_2 \cdot H_{h-1} \quad (11)$$

$$Y = C_S + G_S \quad (12)$$

$$N = \frac{Y}{W} \quad (13)$$

The Model part 2: the behavioral equations

...

$$\Delta H_s = H_s - H_{s-1} = G - T \quad (14)$$

$$\Delta H_h = H_h - H_{h-1} = YD - C \quad (15)$$

watertight accounting \Rightarrow Walrasian principle (n^{th} equation implied by the remaining $n-1$)

$$\Delta H_s = \Delta H_d \quad (16)$$

NB that is our *redundant equation*: when trying to compute a model, it is important to identify one and not include it in the computation, otherwise the model would be overdetermined. Remember it can always be used to check if the model is correct (e.g. if $\Delta H_s \neq \Delta H_d$ we had a mistake)

Keynesian multiplier

Equations

$$C_d = \alpha_1 \cdot YD + \alpha_2 \cdot H_{-1} = \alpha_1 \cdot YD \quad (3.13)$$

$$Y = C + G = \alpha_1 \cdot Y \cdot (1 - \theta) + G$$

$$Y^* = \frac{G}{1 - \alpha_1 \cdot (1 - \theta)} \quad (3.14)$$

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Short run vs. Long run

- ▶ (3.14) is the short run multiplier, depends on start-of-period stock values (i.e $H_{-1} = 0$)

Keynesian multiplier

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$$Y = C + G = \alpha_1 \cdot Y \cdot (1 - \theta) + G$$

$$Y^* = \frac{G}{1 - \alpha_1 \cdot (1 - \theta)} \quad (3.14)$$

Short run vs. Long run

- ▶ (3.14) is the short run multiplier, depends on start-of-period stock values (i.e $H_{-1} = 0$)
- ▶ Need to obtain the steady state to compute long-run multiplier

Keynesian multiplier

Equations

$$C_d = \alpha_1 \cdot YD + \alpha_2 \cdot H_{-1} = \alpha_1 \cdot YD \quad (3.13)$$

$$Y = C + G = \alpha_1 \cdot Y \cdot (1 - \theta) + G$$

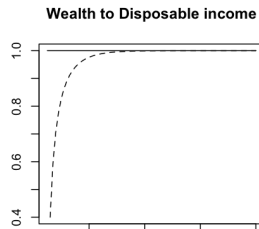
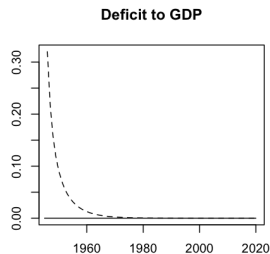
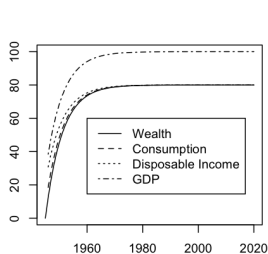
$$Y^* = \frac{G}{1 - \alpha_1 \cdot (1 - \theta)} \quad (3.14)$$

Short run vs. Long run

- ▶ (3.14) is the short run multiplier, depends on start-of-period stock values (i.e $H_{-1} = 0$)
- ▶ Need to obtain the steady state to compute long-run multiplier
- ▶ Steady state: $Y^* = \frac{G}{\theta} = \frac{20}{0.2} = 100$

Simulation results

[Link to Shiny Application](#)



Outline

1. Motivation
2. The PK-SFC approach
3. The SIMplest model
4. Conclusion

Why should you use PK-SFC modelling?

- ▶ Importance of (im)balances both in flow and stock levels, and of stock-flow norms
 - ▶ A seemingly sound situation might hide *imbalances building up* and leading to unsustainable situation
 - ▶ Importance of financial side of economy and *feedback* from real and finance
- ▶ The PK-SFC approach offers demand-driven models integrating finance and real sides of the economy

Thank you!

- ▶ Comments and questions most welcome to a.godin@kingston.ac.uk
- ▶ <http://antoinegodin.eu>
- ▶ <http://antoinegodin.shinyapps.io/SIMple>
- ▶ <https://github.com/S120/PKSFC>

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