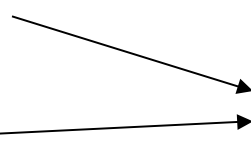




Stock-Flow-Consistent Modeling: Lecture 2 - Main principles

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SFC Main Principles

- 1) Horizontal consistency
 - 2) Vertical consistency
 - 3) Flows-to-stocks consistency
 - 4) Stocks (balance sheets) consistency
 - 5) Stocks-to-flows consistency
- imply
Quadruple entry
- 

#1. Horizontal consistency

Horizontal consistency

When considering institutional sectors:

Income for somebody is a payment from somebody else: (everything comes from somewhere and goes somewhere: no *black holes*)

This principle is relative to monetary flows.

Variables which are meaningful only in an interval of time are «flows». An example is monthly income.

A Social Accounting Matrix (SAM) is a good way to ensure that the first principle is respected. An alternative is the Transaction Matrix

A simple Social Accounting Matrix

	Prod.	Hous.	Non-fin.	Fin.l firms	Gov.	RoW	C/A	Total
Production		C			G	E	I	Q
Households	W		TRfh	TRbh	TRgh	TRwh		Yh
Non-fin.firms	Π			TRbf	TRgf	TRwf		Yf
Fin.firms		TRhb	TRfb		TRgb	TRwb		Yb
Government	Ti	TRhg	TRfg	TRbg		TRg		Yg
Rest of world	M	TRhw	TRfw	TRbw	TRgw			Yw
Capital acc.		Sh	Sf	Sb	Sg	Sw		S
Total	Q	Yh	Yf	Yb	Yg	Yw	I	

A sample transactions matrix

	Hous.	Non-financial b.		Banks	Gov.	RoW	Total
		Ca	Ka				
Consumption	-C	+C					0
Gov. Expenditure		+G			-G		0
Net exports		+NX				-NX	0
Investment		+I	-I				0
<i>Memo: output</i>		<i>GDP</i>					
Wages	+W	-W				-Ww	0
NF profits	+Div	- Π	+RP			+RPw	0
Net indirect taxes		-IT			+IT		0
...							

Which approach is better?

Pros of the Transaction Matrix:

- Easier to compare to NIPA
- Possibility of mapping data without reaching who-to-whom classification

Cons:

- Less intuitive for checking who-to-whom consistency

Flow accounting and NIPA

Note that the SAM and the TM incorporate the first sections of National Accounting, but to a greater level of detail

We will discuss these points using:

Cuentas institucionales de la economia, por sector

NIPA accounts

The sequence of NIPA accounts:

- ▶ Production
- ▶ Generation of primary income
- ▶ Distribution of primary income
- ▶ Distribution of secondary income
- ▶ Use of income....
..... ***Saving***
- ▶ Capital account....
..... ***Net lending***

Mexico. 2017. Cuentas institucionales de la economía, por sector

	Prod	Hog	INF	IF	GG	RDM	TOT
Valor agregado bruto	-21,921	+7,412	+10,533	+883	+1,876		0
Sueldos y salarios	+4,823	-1,156	-2,043	-163	-1,461		0
Contribuciones sociales de los empleadores	+895	-6	-464	-36	-389		0
Impuestos sobre la producción y las importaciones	+1,423	-0	-95	-18	-19		-1,291
Subsidios	-82		+7				+74
Excedente bruto de operación	+10,384	-1,771	-7,939	-667	-7		0
Ingreso mixto bruto	+4,477	-4,477					0

Are NIPA accounts sufficient?

Horizontal consistency is respected in NIPA accounts, but the who-to-whom information is usually missing for most transfers, and for income from capital.

Part of the missing information can usually be obtained from Balance of payments statistics, and from the Government accounts.

However, these two latter publications follow different criteria, and may not be comparable with NIPA data

Comparing data sources

	CN		BdP
Exportaciones	8,190		8,328
Importaciones	8,577		8,724
Saldo corriente con el exterior	-382		-363

The capital account

In the Capital account of NIPA we have

- ▶ Gross saving -
- ▶ Gross investment +
- ▶ Net incoming capital transfers =
- ▶ Net lending/borrowing

Net lending shows whether a sector is increasing its net financial wealth (reducing its debt), or the opposite. An increase in net financial wealth by a sector implies a decrease for at least another sector.

Mexico. 2017. Net lending/borrowing

Préstamo neto (+) / endeudamiento neto (-)

Hogares	+1,533
Sociedades no financieras	-1,714
Sociedades financieras	+380
Gobierno general	-579
Resto del mundo	+379

#2. Vertical consistency

Vertical consistency

Every transaction involves at least two entries within each unit

Example: consumer expenditure implies, say, a reduction in the consumer's cash balance

This links the real side to the financial side of the economy, or between income-expenditure accounts and flow of funds

Quadruple entry accounting

The horizontal and vertical principles, taken together, imply that every transaction involves a quadruple entry in accounting (Copeland)

For example, when a household purchases a product from a firm, the accounting registers an increase in the revenues of the firm and the expenditure of the household, and at the same time a decrease in at least one asset (or increase in a liability) of the household and correspondingly an increase in at a least one asset of the firm.

Flow of funds

Net lending/borrowing implies a change in holdings of some financial asset/liability.

These are detailed in the Flow of funds matrix

Note that for each asset we should be able to identify which sector is issuing it (borrowing funds) and which sectors are acquiring it (lending funds).

Borrowing and lending for each asset must be equal

The Flow of funds matrix can be read vertically to identify the sources of funds for, say, real investment

A simple Flow of funds matrix

	Hous.	Non-fin. firms	Financial firms	Gov.	Rest of the world	Total
Real assets	+I _h	+I _f		+I _g		+I
Deposits	+ΔD		-ΔD			0
Loans	-ΔL _h	-ΔL _f	+ΔL			0
Government debt	+ΔB _h		+ΔB _b	-ΔB	+ΔB _w	0
Equities	+pe*ΔE _h	-pe*ΔE	+pe*ΔE _b		+pe*ΔE _w	0
Foreign debt			+ΔF _b		-ΔF	0
Total	S _h	S _f	S _b	S _g	S _w	+I

Flow of funds as published

SNA08 has the following details:

- Oro monetario y DEG
- Dinero legal y depósitos
- Títulos de deuda
- Préstamos
- Participaciones de capital y participaciones en fondos de inversión
- Seguros, pensiones y garantías estandarizadas
- Derivados financieros y opciones sobre acciones asignadas a los asalariados
- Otras cuentas por cobrar / por pagar

Net lending in Mexico. 2017.

	A	P	A-P
Hogares	1,528	-5	1,533
Sociedades no financieras	1,446	3,160	-1,714
Sociedades financieras	1,649	1,269	380
Gobierno general	945	1,524	-579
SUM	5,568	5,948	-380
Resto del mundo	-1,519	-1,898	379

A: Adquisición neta de activos financieros

P: Emisión neta de pasivos

#3. Flows-to-stocks consistency

Flows-to-stocks consistency

At constant prices, the change in a stock is given by a flow

$$\Delta s_t = s_t - s_{t-1} = f_t$$

$$s_t = s_{t-1} + f_t$$

For instance, the stock of ice cream in the fridge at the end of the day (S_t) is equal to the stock at the beginning of the day (S_{t-1}) plus the ice cream I bought during the day (flow), less the ice cream I have eaten during the day (flow)

Capital gains

At current prices, the change in a stock must take into account net capital gains. Start from the previous identity and multiply by the price p , and use capital letters for the current price value

$$p_t * s_t = p_t * s_{t-1} + p_t * f_t$$

$$S_t = p_t * s_t ; S_{t-1} = p_{t-1} * s_{t-1} ; F_t = p_t * f_t$$

add and subtract $p_{t-1} * s_{t-1}$ to the first equation:

$$S_t = S_{t-1} + F_t + (p_t - p_{t-1}) * s_{t-1}$$

Capital gains #2

Now multiply and divide the last term by p

$$S_t = S_{t-1} + F_t + \lambda_t * S_{t-1}$$

where λ_t measures the growth rate in the price level. The last term defines net capital gains.

For instance, the value of housing in Mexico at the end of 2018 was given by the value of housing at the end of 2017, plus the value of new housing built during 2018, plus (or minus) the change in the market price of housing during 2018, times the initial value.

Do capital gains matter?

Note that, in a world of perfectly informed individuals, net capital gains should not matter at the macroeconomic level, in most cases.

Capital gains/losses on financial assets imply a gain/loss for the creditor, and a loss/gain for the debtor. They obviously matter when the creditor/debtor is abroad:

If a country has a foreign debt denominated in US\$, a devaluation of its currency against the US\$ will generate a capital loss (in domestic currency)

Do capital gains matter? #2

What about net capital gains on real assets?

If the market price of my home increases, I am richer! If I was planning to sell my home to pay for retirement, I can now increase my consumption and reduce my saving.

But the individual who was planning to buy my home now has to save more, in order to be able to afford it.

Capital gains should not matter, but they do matter quite a lot...

Fundamental flows-to-stocks links

The stock of capital increases with net investment.

Household net financial assets increase with saving.

Government debt increases with government borrowing.

The net international position changes according to the current account balance.

The last three relations are based on **net lending** of an institutional sector.

#4. Stocks consistency

Stocks (balance sheet) consistency

- The financial liabilities of an agent or sector are the financial assets of some other agent or sector
- Net financial wealth for all sectors (including the foreign sector) must be zero.
- Wealth for the world as a whole is only composed of real assets
- Wealth for a single country is given by real wealth plus foreign assets, less foreign debt

A simple Balance sheet matrix

	Hous.	Non-fin. firms	Financial firms	Gov.	Rest of the world	Total
Real assets	+Kh	+Kf		+Kg		+K
Deposits	+D		-D			0
Loans	-Lh	-Lf	+L			0
Government debt	+Bh		+Bb	-B	+Bw	0
Equities	+pe*Eh	-pe*E	+pe*Eb		+pe*Ew	0
Foreign debt			+Fb		-F	0
Total	Vh	Vf	Vb	Vg	Vw	+K

Mexico. 2017. Balance sheet

	Hog	SNF	SF	GG	Rd M	Tot
Activos no financieros producidos	31,389	48,205	670	7,963		88,828
Activos no financieros no producidos	6,142	14,721	375	15,926		37,165

	Hog	SNF	SF	GG	RdM	Tot
Activos	24,859	20,363	26,843	6,768	22,941	101,774
Pasivos	4,236	45,985	26,480	13,660	11,414	101,774

#5. Stocks-to-flows feedback

Stocks-to-flows feedback

In the accounting (i.e. interest payments depend on the opening stock of debt)

In “behavioral” assumptions:

Real wealth affects consumption

The stock of capital affects investment, etc.

When developing a theoretical model, including a stock requires to model its feedback on flows

“Equilibrium” vs steady growth

A steady state is achieved when stocks stabilize (useful in simple theoretical models)

Steady growth is achieved when stocks (and flows) grow at the same rate. This implies that ratios (stock-flow; stock-stock; flow-flow) are stable.

(Godley's example of water in a lake)

We can look at stock-flow ratios for an economy to check (in)stability

Consistency!

Consider the accounting identity for net lending

$$\{NIh + NIn + NI_f\} + NIg + NIw = 0$$

$$NAFA = DEF + CA$$

A reduction in government deficit, for a given current account balance CA, will imply a reduction in the net acquisition of financial assets of the private sector NAFA.

We will discuss **financial balances** again...