Topics on External Debt

EUI

Lecture 1: Introduction, data and baseline models

Hernán D. Seoane

UC3M

Spring 2017

A few stylized facts in Emerging Economies

Table: Business cycle moments

Moments	Poor	Emerging	Rich
Output Volatility (%)	6.1	8.7	3.3
Consumption to Output Volatility	1.12	0.98	0.87
Cyclicality of Government Spending	0.08	-0.08	-0.39
Cyclicality of Trade Balance	-0.11	-0.21	-0.26

Source: Schmitt-Grohe and Uribe (2015). Quadratic detrending annual data for the postwar period.

A few stylized facts in Emerging Economies

1. Excess volatility of emerging and poor countries
2. Less consumption smoothing: depending on the data you might find stronger findings regarding this point. For instance, HP filtered gives huge differences between emerging and developed economies
3. Countercyclical trade balance increases with income (or income growth): also differences arise from data treatment
4. Countercyclical government spending increases with income
5. Sudden stop episodes

A few stylized facts in Emerging Economies

1. Instead of detrending data, another option is to study expansions and contractions using the level of real GDP
2. Calderon and Fuentes (2010) follow Burns and Mitchell (1946) and study business cycle by defining sequences of expansion and contraction
3. Find turning points by identifying peaks and trough. A business cycle must have
   1. Complete cycles: from peak to peak and have two phases: contraction and expansion (peaks and troughs alternate)
   2. A complete cycle must last for at least 5 quarters (at least 2 for the expansion and 2 for the contraction)
4. Sample of 23 emerging countries (12 LAC, 8 EAP, 3 other) and 12 OECD economies

A few stylized facts in Emerging Economies

Recession and Expansions

Table: Amplitude, duration and cumulation of business cycles

Countries /groups	Duration		Amplitud		Cumulation %		# contractions
	Contraction	Expansion	Contraction	Expansion	Contraction	Expansion	
Argentina	4.5	7.1	-9.4	12.1	-22.7	61.3	8.0
Chile	3.3	30.0	-10.1	55.6	-25.5	855.5	3.0
Mexico	3.7	12.6	-4.4	13.9	-8.1	145.3	6.0
LAC (12) Average	3.5	16.0	-6.2	21.3	-12.8	335.8	4.8
OEE Average	4.8	17.1	-4.8	28.9	-10.3	388.0	3.3
OECD Average (12)	3.6	23.8	-2.2	20.2	-4.6	330.3	3.3

Calderon and Fuentes (2010), the data is quarterly real GDP from 1980:1 to 2006:4.

- Duration: number of quarters from peak to trough during the recession and trough to peak during the expansion
- Amplitude: maximum drop and maximum increase for contraction and expansion
- Cumulative variation: captures the idea of “lost” output during contractions and the output gains during expansions. Computed as an area.

Today's lecture

- Brief introduction to small open economy models and variables
- The complete markets economy
- The incomplete markets economy
- Sources: Enrique Mendoza's class notes, Schmitt-Grohe and Uribe (2017), Sargent and Ljunqvist (2010)

The complete markets economy

- Small open economy with perfect access to capital markets
- 1 bond, no uncertainty
- No frictions (no default risk, borrowing limits, externalities, etc)

The complete markets economy

$$\max \sum_{t=0}^{\infty} \beta^t u(c_t)$$

$$c_t = y_t - b_{t+1} + b_t R$$

- Basic SOE setup, a unique tradable good, y_t can be an endowment process and b_t are assets, if $b_t > 0$ the rest of the world is paying returns on their debt and if negative the SOE is a debtor
- FOC

$$u'(c_t) = \beta R u'(c_{t+1})$$

- Assume $\beta R = 1$ implies optimal constant consumption $c_t = c$
- Plug it into the intertemporal budget constraint

$$c = \frac{R-1}{R} \left(\sum_{t=0}^{\infty} R^{-t} y_t \right) + b_0(R-1)$$

The complete markets economy

- In this setup you have perfect consumption insurance
- Consumption is constant but depends on your initial debt
- Current account

$$b_{t+1} - b_t = y_t - c + b_t r$$

- Here if $y_t < c$ you borrow (CA deteriorates) and if $y_t > c$ you save, CA improves
- Pro-cyclicality of the CA, which is not in line with the data

The incomplete markets economy

- Consider now the case with incomplete markets

$$\max \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_t)$$

$$c_t = y_t - b_{t+1} + b_t R$$

$$b_t \in B, \quad B = [b_1 < b_2 < ...b_z]$$

- Consider also the case with a borrowing constraint $a_{t+1} \geq -\phi$, where ϕ can be the natural debt limit $b' \geq -\left[\frac{y_{min}}{R-1}\right]$ or an ad-hoc limit
- This is the case of Aiyagari (1994)

The incomplete markets economy

- Optimality conditions for this problem imply

$$u'(c_t) \geq \beta R \mathbb{E}_t u'(c_{t+1})$$

- with equality if the debt limit does not bind
- Define

$$M_t = \beta^t R^t u'(c_t)$$

- And

$$M_{t+1} - M_t = \beta^t R^t \left[\beta R \mathbb{E}_t u'(c_{t+1}) - u'(c_t)\right]$$

- Rewrite the FOC as

$$\mathbb{E}_t \left[M_{t+1} - M_t\right] \leq 0$$

- Implying that M_t is a supermartingale with non-negative M_t, and converges almost surely to a non-negative random variable

The incomplete markets economy

- There are 3 cases depending on the values of βR
- If $\beta R > 1$: in this case $u'(c_t)$ has to go to zero (otherwise M_t cannot converge), this means that consumption has to go to infinity for the marginal utility of consumption going to zero. The only way this is possible is if agents accumulate foreign assets to infite amounts
- If $\beta R = 1$: same as case 1, proof in SL (2010) following Chamberlain and Wilson (2000)
- If $\beta R < 1$: $u'(c_t)$ can be finite and varies randomly implying a well behaved debt distribution where incentives to consume early interact with precautionary savings motive

Discussion

- Using these models as baseline a huge literature intends to answer how to approach the previous stylized facts
- Shocks? Are they different in Emerging Economies? If so which shocks are important? Many papers on this(Aguiar and Gopinath, 2006; etc)
- Is it about transmission channels? Frictions? Which ones matter? Financial frictions for instance (Neumeyer and Perri, 2006; etc)
- In this course I want to focus on the role of external debt and financial frictions
- I leave the second and third bullet points to Evi

SOE Endowment model

$$E_0 \sum_{t=0}^{\infty} \beta^t u(c_t)$$

$$d_t - d_{t-1} = r d_{t-1} + c_t - y_t$$

- d_t is the debt position (net) assumed in period t and due in $t+1$
- A no Ponzi condition $\lim_{j \to \infty} E_j \frac{d_{t+j}}{(1+r)^j} \leq 0$
- The Lagrangian for this problem is

$$L = E_0 \sum_{t=0}^{\infty} \beta^t \left\{ u(c_t) + \lambda_t \left[d_t - d_{t-1} - r d_{t-1} - c_t + y_t \right] \right\}$$

SOE Endowment model

- Euler equation is

$$u'(c_t) = \beta(1+r)E_t[u'(c_{t+1})]$$

- with the standard interpretations: in the margin the household is indifferent between consuming in period t or saving the extra unit of consumption for period $t+1$
- The intertemporal budget constraint

$$(1+r)d_{t-1} = E_t \sum_{j=0}^{\infty} \frac{y_{t+j} - c_{t+j}}{(1+r)^j}$$

SOE Endowment model

- Note that the definition of the trade balance is

$$tb_t = y_t - c_t$$

- The intertemporal budget constraint implies then that

$$(1+r)d_{t-1} = E_t \sum_{j=0}^{\infty} \frac{tb_{t+j}}{(1+r)^j}$$

SOE Endowment model

- Assume $u(c_t) = -\frac{1}{2}[c_t - c]^2$ and $\beta(1+r) = 1$
- Euler equation is

$$c_t = E_t[c_{t+1}]$$

- Standard RW result
- Using the intertemporal budget constraint we can get

$$c_t = \frac{r}{(1+r)} E_t \sum_{j=0}^{\infty} \frac{y_{t+j}}{(1+r)^j} - r d_{t-1}$$

- note that it depends on the the income process

SOE Endowment model

- Note, $\frac{r}{(1+r)} E_t \sum_{j=0}^{\infty} \frac{1}{(1+r)^j} = 1$
- Consumption is a weighted average of your expected lifetime stream of endowments
- Endowments are exogenous
- d_{t-1} is predetermined

$$c_t = \frac{r}{(1+r)} E_t \sum_{j=0}^{\infty} \frac{y_{t+j}}{(1+r)^j} - rd_{t-1}$$

- is a closed form solution of c_t
- Define $y_t^p = \frac{r}{(1+r)} E_t \sum_{j=0}^{\infty} \frac{y_{t+j}}{(1+r)^j}$

- Plugging the closed form solution to c_t in the budget constraint, we get

$$d_t - d_{t-1} = y_t^p - y_t$$

- is a closed form solution of debt
- An expression for the current account

$$ca_t = tb_t - rd_{t-1}$$

- Combining it with the sequential budget constraint

$$ca_t = -(d_t - d_{t-1})$$

- The current account equals the change in the net foreign asset position (a deficit in the current account is associated with an increase in foreign debt)

- we can also write

$$ca_t = y_t - y_t^p$$

- you run a current account surplus when income is larger than your permanent income
- $E_t y_{t+j} = \rho^j y_t$
- Also

$$tb_t = y_t - y_t^p - rd_{t-1}$$

- Recall that we assume endowment follows a mean reverting AR(1) process
- $E_t y_{t+j} = \rho^j y_t$
- Here

$$c_t = \frac{r}{(1 + r - \rho)} y_t - r d_{t-1}$$

- Consumption responds positively to income, but not 1 to 1
- Recall: $tb_t = y_t - c_t$
- Recall: $ca_t = tb_t - r d_{t-1}$ or $ca_t = -(d_t - d_{t-1})$

- you can build the path of sovereign debt

$$d_t = d_{t-1} - \frac{1-\rho}{(1+r-\rho)} y_t$$

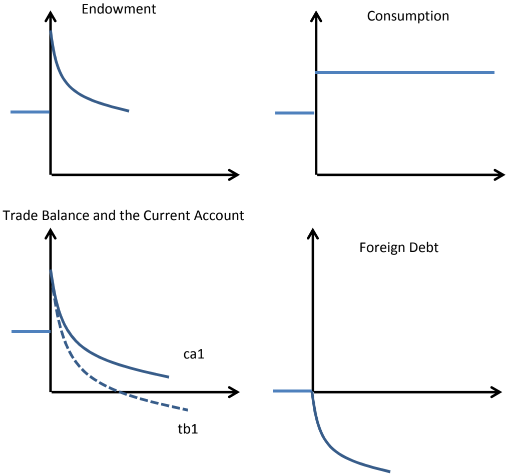
- There is a unit root for the international assets
- The trade balance

$$tb_t = rd_{t-1} + \frac{1-\rho}{(1+r-\rho)} y_t$$

$$ca_t = \frac{1-\rho}{(1+r-\rho)} y_t$$

- A positive shock to output have a permanent effect on foreign debt and a permanent deterioration on the trade balance

SOE Endowment model: stationary shock



SOE Endowment model

- If $\rho \to 1$, you tend to consume all the increase in endowment
- No changes in your debt position, trade balance or current account

SOE Endowment model

- Problem, current account is pro-cyclical (it improves during expansions)
- Trade balance is procyclical
- In the data it is the opposite
- What happens with permament shocks?

Bibliographic references

- Uribe and Schmitt-Grohe (2017), Open Economy Macroeconomics, Ch. 1 and 2
- Sargent and Ljunqvist (2004), Recursive Macroeconomic Theory, (2nd Ed) Ch 17
- Calderon, C. and Fuentes, R. (2010), "Characterizing the Business Cycles of Emerging Economies". Policy Research Working Paper 5343, World Bank