Sovereign Debt Maturity Structure and its Costs[1]

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[1]The views expressed in this paper are those of the author and do not necessarily reflect the position of the Bank of Italy.

Purpose of the work

How are countries deciding on the maturity structure of their debt?

- What are the forces that shape the lending game between a sovereign and its international lenders

- How policy interventions interact with those forces possibly changing the outcome of the game

*Propose a **tool** to analyse optimal debt contract between a sovereign and its international lenders and understand the the factors that shape the terms of the contract.*

Trade-off proposed in the literature between long- and short-term debt for EMEs

1. Long-term debt decreases the probability of sovereign default due to lower roll-over needs.

2. Short-term debt has disciplinary role thus reducing the cost of debt.

Elements that shape the trade-off:

- The possibility of a liquidity crisis
- Strictly positive probability of a sovereign default
- Capital markets discipline through cost of debt

Together with financial frictions:

- Limited liability on debt dilution and default
- Market incompleteness

Possible applications

→ Make use of the basic model to conduct exercises

Disentangle how policy options in case of liquidity and solvency crises can condition ex-ante debt maturity structure and its cost.

Policy options analyzed:

- Private debt restructuring after default (e.g. CACs)

- IFI intervention in case of market exclusion (liquidity crisis), with different (alternative) modalities (e.g. IMF lending framework approved in 2016).

Main findings

Results of the basic model:

- The expectation hypothesis on the yield curve holds;

- The country is indifferent between short and long - term debt;

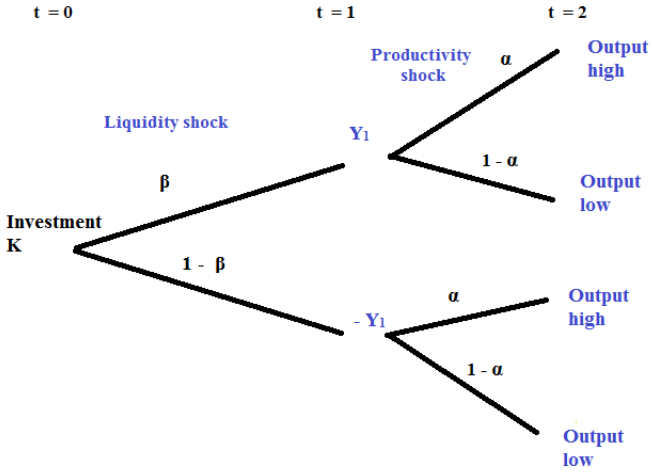
- **Debt dilution leads to long-term borrowing limit.**

Any policy options affect ex-ante decisions on debt cost and maturity structure.

With private debt restructuring and any type of IFI intervention only short-term debt is issued and the expectation hypothesis is violated.

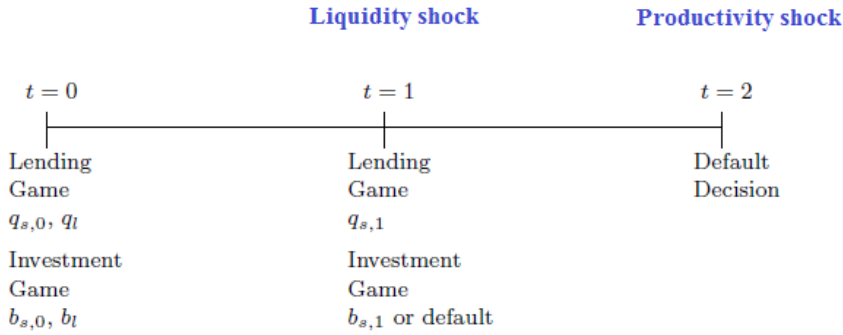
$\Rightarrow$ This result is consistent with the empirical evidence on EMEs, which tend to issue more short-term obligations (Broner, Lorenzoni and Schmukler, 2013).

Basic model - game tree



Model solved by backward induction applying the Sub-game Perfect Nash Equilibrium concept.

Basic model - timeline



Default after output realization entails output loss.

Basic model - main ingredients

Lending game: risk-neutral atomistic international lenders, whose outside option is the world risk - free rate $R = 1$, set debt price $q_j(i) = 1/(1 + r_j(i))$

$$q_j \quad = \quad Prob\{\text{The Country is Solvent}\}.$$

Investment game: a risk-neutral country maximizes expected welfare at $t = 2$ (linear function of the expected output).

$$max_{b_{s,0},b_{s,1},b_l} E(W).$$

Basic model - solution

At $t = 1$, the country is subject to two constraints determined by the no-commitment friction:

- *Feasibility constraint*: the country has to have enough resources to cover the liquidity need.

- *Incentive compatibility constraint*: it has to be convenient for the country not to default in some state $\Rightarrow$ limit to debt dilution.

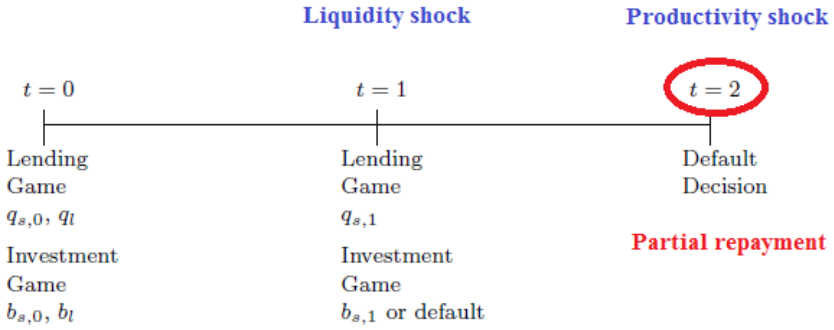
A long-term debt limit arises by combining those constraints.

Results

The expectation hypothesis holds.

The country is indifferent between short- and long-term debt.

Private debt restructuring after default - timeline



Ass: 1. Partial default entails lower output loss than full default; 2. International lenders can set the haircut.

Private debt restructuring after default - results

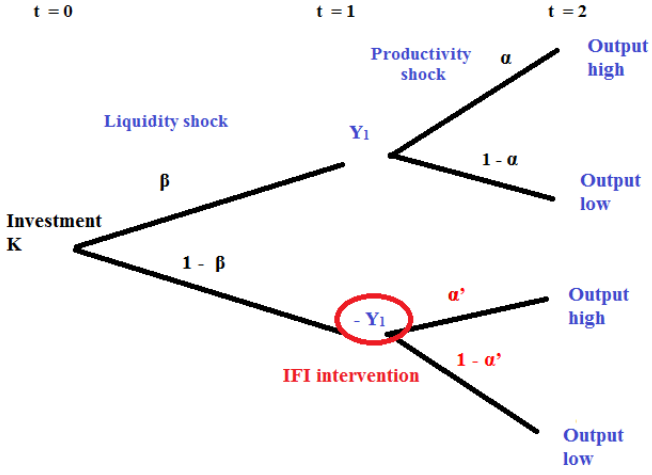
Expectation hypothesis holds.

Country issues only long-term debt since, due to partial repayment, its cost is lower than the probability of repaying it.

Long-term debt limit is not binding.

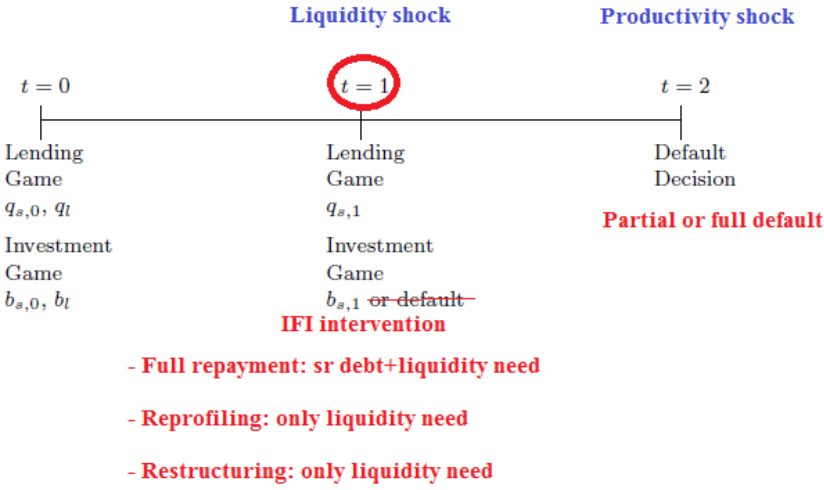
At $t = 1$ long-term debt is diluted up to the incentive compatibility constraint.

IFI intervention - game tree



Ass: 1.Concessional lending rate; 2. IFI preferred creditor status; 3. $\alpha' > \alpha$.

IFI intervention - timeline



IFI intervention - results

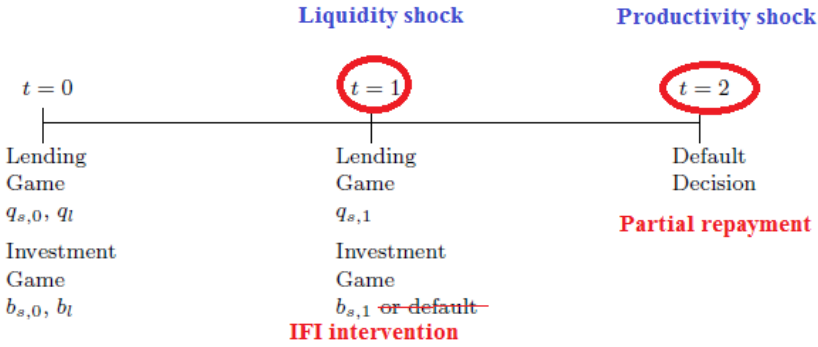
Full repayment:
- Country issues only short-term debt (due to the IFI concessional lending rate); the expectation hypothesis does not hold.

Reprofiling:
- Country indifferent between short and long-term debt; long-term debt limit can be binding; the expectation hypothesis does not hold.

Restructuring:
- Country indifferent between short and long-term debt and the expectation hypothesis holds.

Reprofiling and restructuring are ex-ante welfare equivalent.

Private debt restructuring after default and IFI - timeline



Private debt restructuring after default and IFI - results

The three types of IFI intervention deliver the same result:

- Country issues only short-term debt since long-term debt limit is binding and the expectation hypothesis does not hold.

IFI intervention with reprofiling or restructuring are again ex-ante welfare equivalent.

Related literature (a subset)

On maturity structure and debt dilution:

- Bolton and Jeanne (2009), renegotiable debt, segmented investors.

- Aguiar and Amador (2020), Hatchondo et al (2016), debt dilution and default probability.

- Fernandez and Martin (2014), debt seignority and IFI (no lending).

Final remarks

Tool to study optimal contract between a sovereign and its international lenders.

- Financial frictions constrain the choice of a country on the maturity structure of its debt.

- Any policy options available in case of liquidity and solvency crises have an impact on the maturity and cost of sovereign debt.

Appendix - Some equations of the basic model

$$max_{b_{s,0},b_{s,1},b_l} E(W) \qquad = \beta[Y_1 + q_{s,1}b_{s,1} - b_{s,0} + \alpha(Y_{2,H} - b_l - b_{s,1}) + (1-\alpha)\frac{Y_{2,L}}{2}]. \tag{1}$$

Incentive compatibility constraint

$$b_{s,1} \leq \frac{Y_{2,H}}{2} - b_l. \tag{2}$$

Feasibility constraint

$$b_{s,1} \geq \frac{b_{s,0} - Y_1}{q_{s,1}}. \tag{3}$$

Maximum amount of long term bonds the country can borrow:

$$b_l^{max} \leq \frac{q_{s,0}q_{s,1}}{q_{s,0}q_{s,1} - q_l}(\frac{Y_{2,H}}{2} + \frac{Y_1}{q_{s,1}} - \frac{K}{q_{s,0}q_{s,1}}). \tag{4}$$