Linkages across Sovereign Debt Markets

Arellano and Bai - 2013

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- Sovereign debt crises occur in tandem.
  - GIIPS in Eurozone crisis.
  - Latin America in 1980s.
  - Reinhart and Rogoff (2011): systematic clustering in last 200 years.
- Multicountry model of contagion based on
  - Common lenders
  - Renegotiation
- Mechanism explains *half* the correlation of Greek and Italian spreads.
  - It *alone* predicts a correlation of spreads of 43% (97% in data)
  - Predicts 30% correlation of borrowing, 56% in data.

- Two countries: Home and Foreign.
- Risk-averse competitive external lenders.
- After default
    - Direct output cost,
    - Exclusion until renegotiation.
- Price of debt reflects
    - Cost of funds for lenders,
    - Risk-adjusted default probability,
    - Risk-adjusted recovery rate.
- Default probability and recovery rate are *correlated* across countries.
    - *Only* because of common lenders.

- Both countries are symmetric.
- Receive stochastic endowment y_t^i
    - Markov with transition $\pi(y', y)$.
- Issue debt b_t^i and decide whether to repay, to maximize

$$\mathbb{E}_t \left[\sum_{s=0}^{\infty} \beta^s u(c_{t+s}^i) \right]$$

- Lenders have endowment y_L, utility $g(\cdot)$ and discount $\delta > \beta$.
- Vector of relevant states is

$$s = \{b, h, y\}$$

    - $h_t^i = 0$ means that country i has good *credit standing*.

- Repayment decision
  - Countries decide simultaneously
- New Borrowing
  - Also simultaneous
- Consumption

BUDGET CONSTRAINTS

- Without default ($d_i = 0$), country i's budget constraint is

$$c_i(s, b', d) = y_i - b_i + q_i(s, b', d)b_i'$$

- If i defaults at t,
  - No borrowing at t + output loss (as in Arellano, 2008), so

$$c_i(s, b', d) = y_i^d = \begin{cases} y_t & \text{if } y_t \leq (1-\lambda)\bar{y} \\ (1-\lambda)\bar{y} & \text{if } y_t > (1-\lambda)\bar{y} \end{cases}$$

  - $h_{t+1}^i = 1$.
- To set $h^i = 0$ again, i needs to pay the recovery $\phi_i(s, b', d)$.

$$c_i(s, b', d) = y_i - \phi_i(s, b', d), \qquad b_i' = 0$$

  - Countries choose when to reenter
  - Recovery ϕ is Nash-bargained with the lenders.

- Value function for i

$$v_i(s, b', d) = u\left(c_i(s, b', d)\right) + \beta \sum_{y'} \pi\left(y', y\right) v_i(s')$$

- Borrowing is Nash when both countries have good standing
    - Both q and $v(s')$ are affected by b'_{-i}.
- When only i has good standing, $-i$'s actions are predetermined.

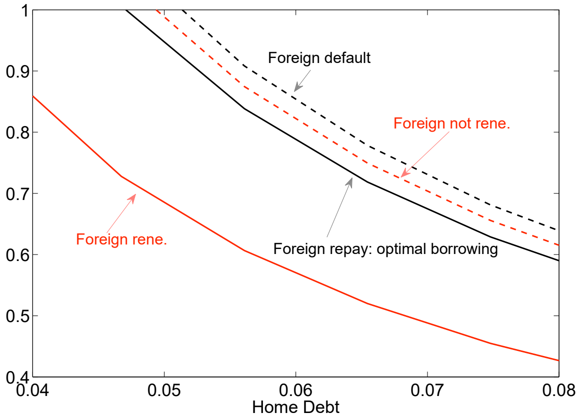
- If i's renegotiation fails, gets financial autarky forever with

$$v_{i,aut}(y) = u(y_i^d) + \beta \sum_{y'} \pi(y', y) v_{i,aut}(y')$$

  - $v_{i,aut}$ is *independent* of what happens to $-i$.
- If i excluded, lenders get value from single-country eq'm $V_f^L(s_{-i})$
- If both excluded, lenders get endowment

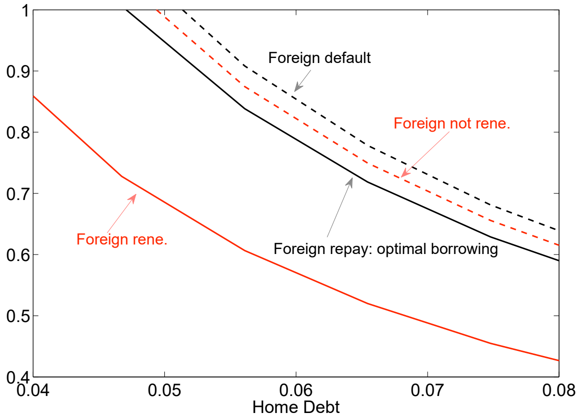
$$V_{aut}^L = \frac{g(y_L)}{1-\delta}$$

- Lenders price bonds so $V_{aut}^L \leq V_f^L(s_{-i})$



- Joint renegotiation: lowest recovery

RECOVERY FUNCTIONS



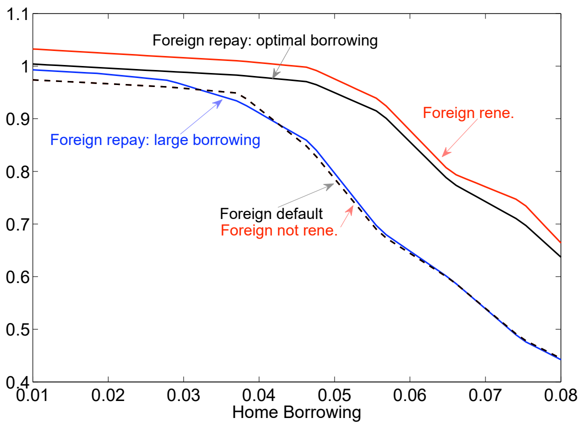
- 'Solo' renegotiations: highest recovery, very rare.

- Lenders price bonds so

$$Q_i = \sum_{s'} \left[m(s', s)\left(1 - D_i(s')(1 - \zeta_i(s'))\right)\right]$$

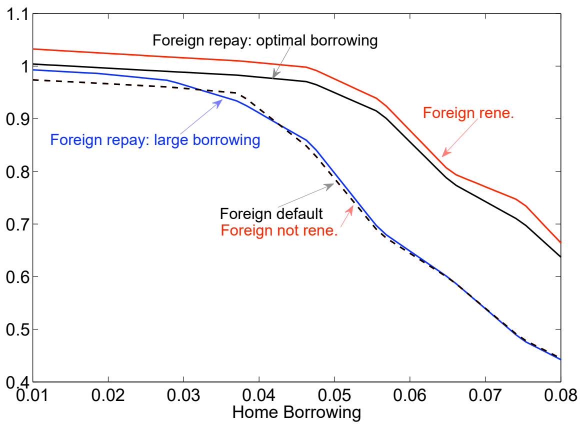
$$\zeta_i(s) = \sum_{s'} \left[m(s', s)\left((1 - D_i(s'))\frac{\phi_i(s')}{b_i} + D_i(s')\zeta_i(s')\right)\right]$$

- Bond prices for *i* reflect default incentives of *both* countries.
- The *worst* state for the lenders is joint renegotiation.

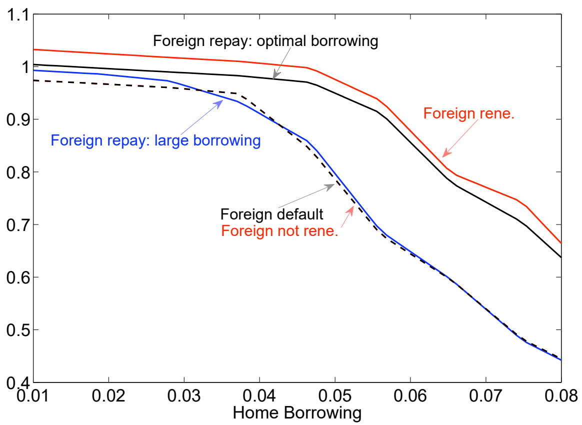


- If i borrows more, default more likely, lower price

BOND PRICE FUNCTIONS

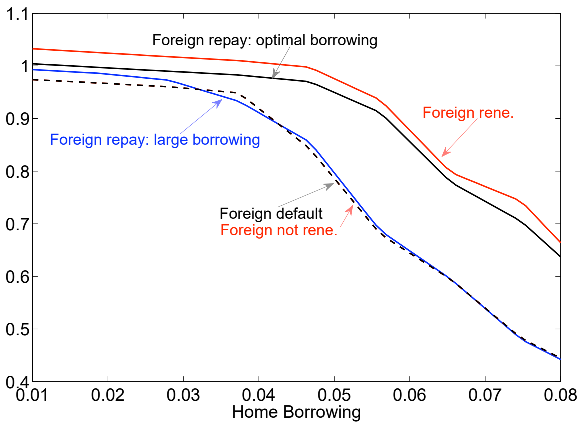


- If $-i$ defaults, default more likely, lower price



- If $-i$ borrows more, default also more likely, lower price

BOND PRICE FUNCTIONS



- If $-i$ renegotiates, lenders in good position, default less likely.

	Default	Repay	Renegotiation	Nonrenegotiation
Independent	75	73	7	0
Dependent	25	27	93	100
Self-fulfilling	14	0	36	87

- 98% of dependent defaults happen because the other country defaults. 2% because it is not renegotiating.

	Default	Repay	Renegotiation	Nonrenegotiation
Independent	75	73	7	0
Dependent	25	27	93	100
Self-fulfilling	14	0	36	87

- All the dependent repayments happen because the other country repays.

	Default	Repay	Renegotiation	Nonrenegotiation
Independent	75	73	7	0
Dependent	25	27	93	100
Self-fulfilling	14	0	36	87

- Of dependent reneogtiations, 55% because other renegotiates, 39% because other repays.

	Default	Repay	Renegotiation	Nonrenegotiation
Independent	75	73	7	0
Dependent	25	27	93	100
Self-fulfilling	14	0	36	87

- All the dependent nonrenegotiations happen because the other country is defaulting.

- Multicountry model of sovereign debt
  - Emphasizes debt linkages through common creditors as *only* channel.
- Strong prevalence of synchronized defaults
  - Default abroad lowers the price of debt at home
  - Default abroad lower recoveries at home.
- Explains significant portion of interest rate correlations.