Financial Crises, Liability Dollarization, and Lending of Last Resort in Open Economies

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Motivation

- Financial sector stability depends on the capacity of domestic authorities to provide lending of last resort support
- In open economies, this capacity may be limited:
  - Banks partly funded in dollars
  - Currency mismatch (either explicit or implicit)
  - Limited fiscal capacity
  - Currency, banking, and fiscal crises tend to go together
- Foreign currency reserves may help (Obstfeld-Shambaugh-Taylor, Gourinchas-Obstfeld)

This paper

- Model panics in open economy with flexible exchange rates
- Endogeneize mismatch/liability dollarization
- Identify challenges for domestic LOLR
- See if reserves help

Ingredients

- Small open economy
- Agents: households, banks, international investors
- Tradable and non-tradable goods (relative price = exchange rate)
  - Households can save in T and NT
  - Banks can borrow in T and NT
- Government with limited fiscal capacity

Households

- Preferences

$$\mathbb{E}\left[\sum_{t=0}^{2}\beta^t U(c_t)\right]$$

$$c_t = (c_t^T)^{\omega}(c_t^N)^{1-\omega}$$

- Supply 1 unit of labor to tradable sector
- Endowment e_c^N of non-tradables
- Tradable = numeraire
- p_t price of NT

- Budget constraint

$$q_t^T a_{t+1}^T + p_t q_t^N a_{t+1}^N + c_t^T + p_t c_t^N = w_t + p_t e_c^N + a_t^T + p_t a_t^N$$

Technology and foreign investors

- Production of tradables

$$Y_t = K_t^{\alpha} L_t^{1-\alpha}$$

- Banks can convert 1 unit of tradable in capital
- Consumers can convert $\psi > 1$ units of tradable in capital
- Capital fully depreciates
- Foreign investors: risk neutral, consume T, discount rate β
- Can only hold T bonds

Banks

- Bankers are risk neutral agents who consume only tradables at $t = 2$
- Budget constraint at $t = 0, 1$

$$k_{t+1} = \underbrace{r_t k_t - b_t^T + p_t(e_b^N - b_t^N)}_{\text{net worth } n_t} + q_t^T b_{t+1}^T + p_t q_t^N b_{t+1}^N$$

- Collateral constraint

$$b_{t+1}^T + p_{t+1} b_{t+1}^N \leq \theta k_{t+1}$$

Roadmap

1. No government intervention
   - $t = 1, 2$: continuation equilibria
   - $t = 0$: endogenous dollarization
2. Lending of last resort
   - $t = 1, 2$: ex-post interventions
   - $t = 0$: reserve accumulation

Continuation equilibrium: NT market

- In equilibrium price is constant in periods 1 and 2
- Equilibrium condition in NT good market

$$\frac{1}{p_1}\frac{1-\omega}{1+\beta}\left(a_1^T + p_1 a_1^N + w_1 + \beta w_2 + (1+\beta)p_1 e_c^N\right) = e_c^N + e_b^N,$$

- Since future wages are $w_2 = (1-\alpha)K_2^\alpha$ we have an increasing relation

$$p_1 = \mathcal{P}(K_2)$$

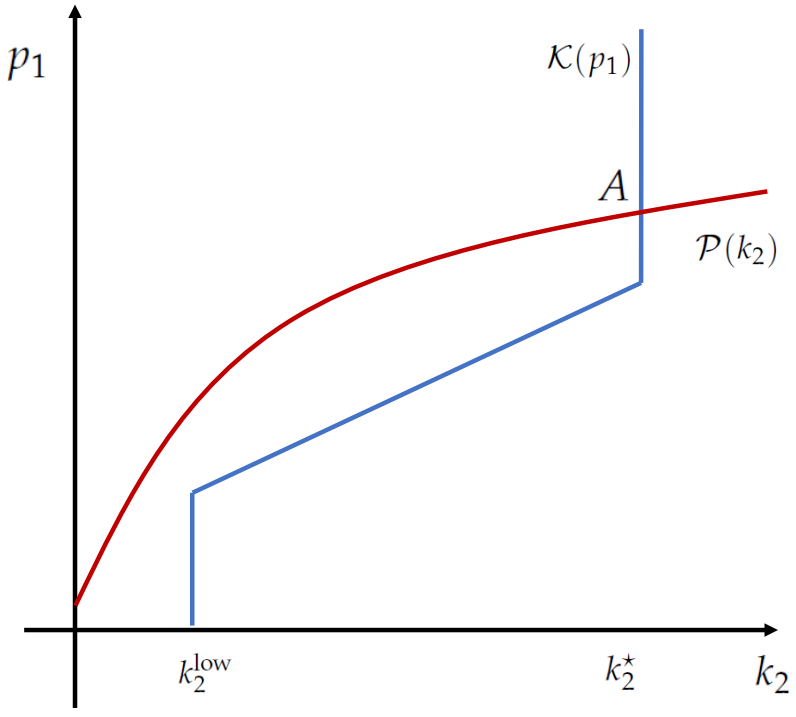
- A version of the Balassa-Samuelson effect

Continuation equilibrium: Banks

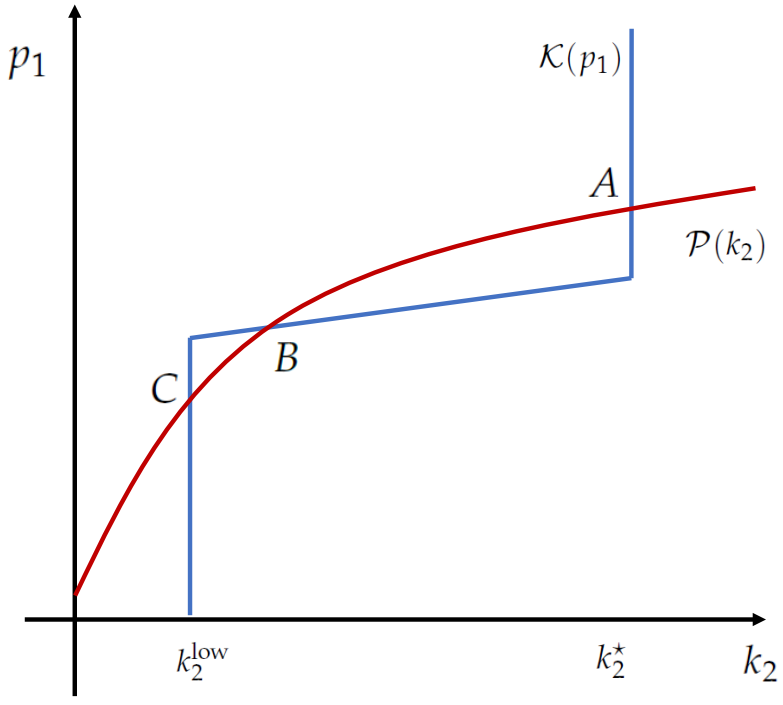
- Net worth is increasing in p_1 (assuming $e_b^N > b_1^N$)
- Three cases:
  - High net worth: reach first best K^*
  - Low net worth: reach K^{low} at which consumers use inferior investment technology
  - Intermediate net worth: K_2 is increasing in p_1
- So we have another increasing mapping

$$K_2 = \mathcal{K}(p_1)$$

Continuation equilibria



(a) Unique continuation equilibrium



(b) Multiple continuation equilibria

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Endogenous dollarization

- Will banks choose debt composition that exposes them to a crisis?
- Or: can we sustain multiple continuation equilibria, with a sunspot selecting both with positive probability?
- A: Yes
- Banks have a hedging motive, which tends to eliminate multiplicity
- But households have a hedging motive too, which can dominate

Fragile equilibria

- Portfolio choice between T and NT saving/borrowing
- In fragile equilibrium, N bonds pay higher return in state of the world in which marginal utility of wealth is lower

$$1 + i_0^T - (1 + i_0^N) E\left[\frac{p_1}{p_0}\right] = Cov\left(\left(1 + i_0^N\right)\frac{p_1}{p_0}, \frac{\lambda_1}{E[\lambda_1]}\right) < 0$$

- This holds both for banks' and consumers' marginal utility of wealth λ_1
- Theory of dollarization: banks borrow in dollars because it's cheap; it's cheap because dollars appreciate when things go bad

Safe equilibrium

- When fragile equilibrium exists, there is also a safe equilibrium in which the continuation equilibrium is unique
- In safe equilibrium

$$1 + i_0^T - (1 + i_0^N) E\left[\frac{p_1}{p_0}\right] = Cov\left(\left(1 + i_0^N\right)\frac{p_1}{p_0}, \frac{\lambda_1}{E[\lambda_1]}\right) = 0$$

- Now no risk, consumers no longer ask for protection

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Lending of Last Resort

- At $t = 1$ benevolent government lends to banks $b_2^{T,g}$ and takes the potential losses

$$\theta k_2 - b_2^{T,g}$$

- Benevolent government wants to eliminate Pareto dominated equilibrium
- Limited fiscal capacity:
  - Government taxation is non-distortionary up to upper bound

$$\xi Y_t$$

  - Microfoundation: less efficient informal sector, where labor efficiency is ζl_t

Timing

- Agents form expectations K_2^e and set maximum they are willing to lend to the government based on expected fiscal revenue $\xi(K_2^e)^\alpha$
- Consumers trade on NT market based on expected wages (that depend on K_2^e)
- Government borrows and lends to banks to buy capital
- Result: with this timing multiple equilibria can be present even if the government intervenes optimally
  - Why? Because p determines net worth and K_2^e determines fiscal capacity
  - When both are low, banks finance low k_2, self-fulfilling

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Reserves

- Suppose now government has position A_1^T, A_1^N
- The value of this position is

$$A_1^T + pA_1^N$$

- Now when expectations are low, p is low
- Government can take positions $A_1^N < 0 < A_1^T$ and possibly eliminate bad equilibrium
- Interpretation: borrowing in domestic currency to accumulate foreign currency resereves makes LOLR commitment credible

Reserves (continued)

Remarks:

- Required reserves increase with the leverage of the financial sector. Obstfeld et al. (2010); Ainzemann and Lee (2007)
- Reserve might never be used in equilibrium. Aizeman and Sun (2012); Jeanne and Sandri (2016)
- Reserves reduce exchange rate volatility

Moral hazard?

- For given interest rates, bankers have incentives to issue more dollar debt
- However, households save more in NT, bankers have less incentives to borrow in dollars

Concluding

- What does it mean to have a stable currency?
- Item: having abundant sources of funding in that currency
- Stable inflation is important, but also needs financial stability, so agents willing to save in local currency
- Future work: explore more interactions with other policy tools (monetary policy, regulation, currency interventions)