Double Contagion: The Impact of Globalization and Exchange Rate Regime on Financial Fragility

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Q1. Does globalization increase financial fragility?

- Fragility certainly increased over past decades, but was it due to globalization, or financial liberalization?
- Allen & Gale (JPE, 2000): 4 regions of a world economy, each with a Diamond-Dybvig-style bank, regions linked through interbank deposits
- Finding: complete structure makes the economy less fragile
- Brusco and Castiglionesi (JF, 2007) get the opposite result if banks face moral hazard due to the limited liability and can invest in a 'gambling' low-return asset

Empirical Evidence

- Degryse and Nguyen (IJCB, 2007) find that a symmetric banking system with complete structure of interbank linkages is more vulnerable to contagion than a 'multiple-moneycenter' structure (where a few 'money-center banks' are linked together and linked to otherwise disconnected banks).
- Mistrulli (2005) got the opposite result.

Q2. Is it possible to reduce financial fragility by switching to flexible exchange rate regime?

- Conventional wisdom: definitely yes! Crises in Mexico in 1994, in Asia in 1997 and in Argentina in 2001 were aggravated by the attempts to maintain the currency peg.

- Chang and Velasco (JET, 2000): theoretical support

- But: The fear of floating persists in emerging market economies. Caballero and Krishnamurthy (2001), Calvo and Reinhart (QJE, 2002), Eichengreen and Razo-Garcia (EP, 2006), Hausmann et al. (2001).

- (Another issue: What is the impact of a switch to the flexible exchange rate regime in a particular country, when other countries keep their pegs?

Introduction 4/4

Our paper:

- Open-economy monetary version of Allen and Gale (JPE, 2000). One of the four regions is a separate country with its own currency.

- Open economy, money and central bank are introduced *a la* Chang and Velasco (JET, 2000).

- Framework allows for both banking and currency crisis in different parts of the world and for the contagion.

- We show that a switch to complete structure of interregional links, interpreted as globalization, may increase financial fragility, i.e. the finding of Allen and Gale is reversed if we make the economy multi-country.

- A switch to a fully flexible exchange rate in the Small economy may increase the level of financial fragility in the WORLD economy, because it transmits the effects of a shock rather than absorbs it.

- Implication: Fear of floating

The Model Setup 1/2

- The World consists of two countries: Large and Small
- The Large country consists of 3 regions: A, B and C
- The Small country consists of just one region: D
- Each region is populated by a continuum of ex ante identical agents with Diamond-Dybvig endowments and preferences.
- The price of consumption good in the world market is fixed and equals one dollar.
- Each consumer gets 1 unit of consumption good in period 0, but will consume in period 1, or 2.
- Long-run technology yields $r < 1$ in period 1 and $R > 1$ in period 2.
- Alternative technology is a world market investment, gross return is 1 in either period.

- With probability λ an agent is impatient, consumes in period 1, $U = U(C_1)$
- With probability $(1 - \lambda)$ an agent is patient, $U = U(\chi(m) + C_2)$, where m is the real money balances carried over from period 1 to period 2.
- Assuming purchasing power parity, $m = M/E_2$, where E_2 is the nominal exchange rate in period 2; $E_1 = 1$.
- $\bar{m}$ is the 'satiation' level of real money balances. $\chi'(\bar{m}) = 0$ for some $\bar{m} > 0$.

Social Planner problem

$$U = \lambda u(x) + (1 - \lambda) u(\chi(m) + y) \to \max \qquad (1)$$

subject to:

$$k + b \le 1 \qquad (2)$$

$$\lambda x \le b + rl \qquad (3)$$

$$(1 - \lambda) y \le R(k - l) \qquad (4)$$

$$x \le \chi(m) + y \qquad (5)$$

$$x, y, m, k, l, b \ge 0$$

Central Banks

- Large country uses dollars; Small country uses pesos
- Large country: The Central bank does not act as a Lender of Last Resort, but can lend dollars to commercial banks in period 1 and allows commercial banks to use these loans only for withdrawals of reportedly patient agents (M).
- This Chang-Velasco assumption yields Pareto optimality (the social optimum) in a decentralized setup.
- The Central bank provides exactly $h = (1 - \lambda)\bar{m}$ in real per-agent terms.
- Small country: The Central Bank also lends pesos for withdrawal of patient agents, but also acts as a Lender of Last Resort in case of a banking crisis. However, if such emergency credit is used, the Central Bank obtains control over the long term asset in period 1, and liquidates the asset as needed to sell the dollars to agents claiming impatience.

Competitive Equilibrium

Like in all DD models the social optimum can be decentralized using banking system. A commercial bank is formed in each region in order to

provide liquidity insurance, like in all DD models.

- it takes demand deposits in period 0;
- it pays x (in real terms) to every depositor who claims to be impatient in period 1;
- it pays M units of domestic currency to all reportedly patient depositors in period 1;
- it pays the rest to the reportedly patient depositors in period 2;
- The bank splits the investment portfolio between the short-run (world market) investment and the illiquid investment.

The possibility of a banking crisis

Competitive Equilibrium

$$U = \lambda u(x) + (1 - \lambda)u(\chi(m) + y) \to \max \qquad (1)$$

subject to:

$$k + b \leq 1 \qquad (6)$$

$$\lambda x + (1 - \lambda)M \leq b + h + rl \qquad (7)$$

$$(1 - \lambda)y - (1 - \lambda)M \leq R(k - l) - h \qquad (8)$$

$$\chi(M) + y \geq x \qquad (9)$$

$$X, y, M, k, l, b \geq 0,$$

The system (1), (6)-(9) yields the same values for x, y, k, l and b as the system (1)-(5) if $M = \bar{m}$ and $h = (1 - \lambda)\bar{m}$.

Two Equilibria

No-crisis Equilibrium

- Allocation coincides with the social optimum.
- Only impatient agents withdraw in period 1
- Central bank provides $\bar{m}$ units of currency (per patient agent), and the exchange rate $E_2 = 1$ (no devaluation) in the Small country.

Crisis Equilibrium

- The main condition: $b + rk < x$
- banking crisis in Large country
- currency crisis in Small country, $E_2 > 1$.

Currency Crisis

- Central Bank in the Small country bails out the commercial bank, but takes the long-run investment;
- All depositors come to the Central bank to exchange pesos for dollars;
- The Central Bank terminates all the illiquid investment to get dollars;
- Nothing is left for the patient agents in period 2, hence it is indeed optimal for all agents to (attempt to) withdraw in period 1.

Stochastic Share of Impatient Agents

	A	B	C	D	Probability of the state
S_1	λ	λ	λ	λ	p
S_2	w_H	w_L	w_H	w_L	$0.5(1-p)$
S_3	w_L	w_H	w_L	w_H	$0.5(1-p)$

- Assume that p is sufficiently close to 1
- Assume $(w_H + w_L)/2 = \lambda$
- In all states the aggregate share of impatient agents equals λ
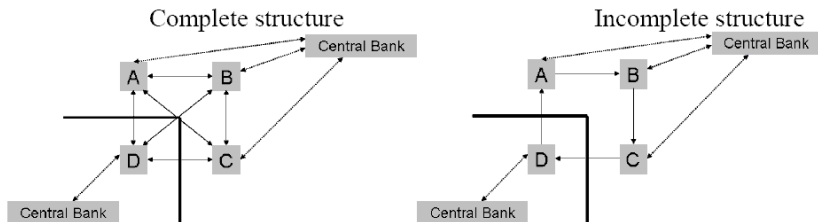
optimum can be still attained if interbank deposits are allowed. The required size of interbank deposit is $z/2 = (w_H - \lambda)/2$ for the complete structure and $z = (w_H - \lambda)$ for incomplete structure, respectively.

Analysis of crisis

Suppose that in one region there is a (banking or currency) crisis. How likely is the spread of the crisis to all the world economy?

Spread of the crisis depends on

- Completeness of the interregional links
- Policy of the Central Bank in the Small country: what share of illiquid asset, v, it is willing to liquidate in period 1 to provide dollars to allegedly impatient agents.
- In which region the crisis starts.
- Consider 2 cases:
    - $v = 0$, i.e. Central Bank of the Small country does not sell illiquid assets to try to maintain the fixed exchange rate. Analogue of the flexible ER regime.
    - $v = 1$, Central Bank sells all the illiquid assets. Analogue of the 'fear of floating' regime.

How to compare the likelihood of crisis under alternative assumptions?

- Compare the set of parameter values that ensures that a crisis in one region spreads to the whole world economy.
- If under certain conditions the set is larger, the world economy is more fragile.

Bank Buffer

- Buffer is the maximum amount of dollars that can be obtained by liquidating the long-term asset in period 1 without causing a run by patient depositors.
- $g(\lambda) = r \left[k - \frac{(1-\lambda)(x - \chi(m))}{R} \right]$

Analysis of Financial Fragility: An Example

Assumptions

- Incomplete Market Structure
- Fear-of-Floating Exchange Rate Regime
- Crisis starts in region D

Analysis

- All depositors (including foreign banks) withdraw their deposits, they get $(1 + z)x$ pesos.
- The demand for dollars equals $(1 + z)x$.
- The dollar reserves at the central bank will be at most $b + rk + zx$.
- Peso is devalued and the new exchange rate is $E^1 = \frac{(1+z)x}{b+rk+zx} > 1$.
- The bank in region C will suffer loss $zx - zx/E^1$.
- The bank in region C will be bankrupt if its loss exceeds the buffer: $zx(1 - 1/E^1) > g(\lambda)$.
- This is a necessary and sufficient condition for a global run.

Incomplete structure:

- Under fear of floating ($v = 1$) the economy is more fragile than under the flexible ER regime ($v = 0$).
- Why? Under $v = 0$, the truly patient depositors do not join the run.

Results 2/3

Complete structure:

- Under flexible ER ($v = 0$) the economy is more fragile than under fear of floating ($v = 1$).
- When one region (A, or B, or C) is in crisis, the central bank of the Small country devalues, and the two remaining regions are under double pressure, as their deposits in two regions are devalued.
- These results do not depend on the exact form of the utility function
- The framework is the most favorable to the flexible ER regime:
  - Financial crisis cannot start in the country with floating ER regime.
  - There are no other welfare-reducing effects of the exchange-rate instability present in the 'real world.'
  - The run-avoidance under the floating ER regime yields a *lower* exchange-rate depreciation than under the fear-of-floating regime when an external shock hits the economy.

Comparison of the complete and incomplete structure under 'fear of floating' ER regime

Complete structure is less fragile (like in the original Allen-Gale model)

Comparison of complete and incomplete structure under flexible ER regime

- The comparison depends on the parameters of the model.
- For the utility function with constant relative risk aversion $U(x) = (x^{1-\theta})/(1-\theta)$ and utility-from-holding money function $\chi(m) = \sqrt{\bar{m}^2 - (m - \bar{m})^2}$ for $m \leq \bar{m}$, there exists a set of parameter values for which the complete market structure is more fragile.
- Example: $R = 1.5, r = 0.8, \bar{m} = 0, 2, \lambda = 0, 5, \theta = 2, z = 0.1$

Conclusions:

Global economy with the flexible exchange rate regime in the Small country under complete structure can be more fragile than:

- the global economy with the 'fear of floating' in the Small country under complete structure and
- the global economy with the flexible exchange rate regime under incomplete structure.

The main reason: Under flexible exchange rate regime the Small country does not absorb an external shock, but transmits it to the rest of the world.