Globalization, Exchange Rate Regimes and Financial Contagion

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Introduction

- Increased interconnections and exposure to exchange rate risk - twin properties of modern finance and the sources of financial fragility.

Two related questions we ask in this paper:

- Does increased interconnection of financial networks contributes to fragility of multi-currency financial networks?
- Does a switch to a flexible exchange rate regime in some part of the financial network ameliorates or amplifies network fragility?

The first question: Interconnection

- We observe increased interconnection and rising fragility in financial networks. Is it a causal relationship?
- Allen and Gale (JPE 2000) analyze the relationship between interconnectedness and financial contagion using a multi-region single currency Diamond-Dybvig (1983) style model.
- Higher degree of interconnectedness reduces the fragility of the banking system (provides a better insurance against liquidity shocks).
- Does the result hold when there are multiple currencies in the network? A-G point to this problem but do not discuss it.

The second question: ER regime

- Majority of recent crisis episodes occurred in countries with managed exchange rate regimes.
- In Mexico in 1994, in Asia in 1997, and in Russia in 1998 attempts to maintain the exchange rate peg invited speculative attacks that made the resulting devaluation deeper.
- One may conclude that (emerging) economies should adopt `corner solutions,' i.e. either flexible ER regime, or a complete dollarization (euroization).

The second question: ER regime

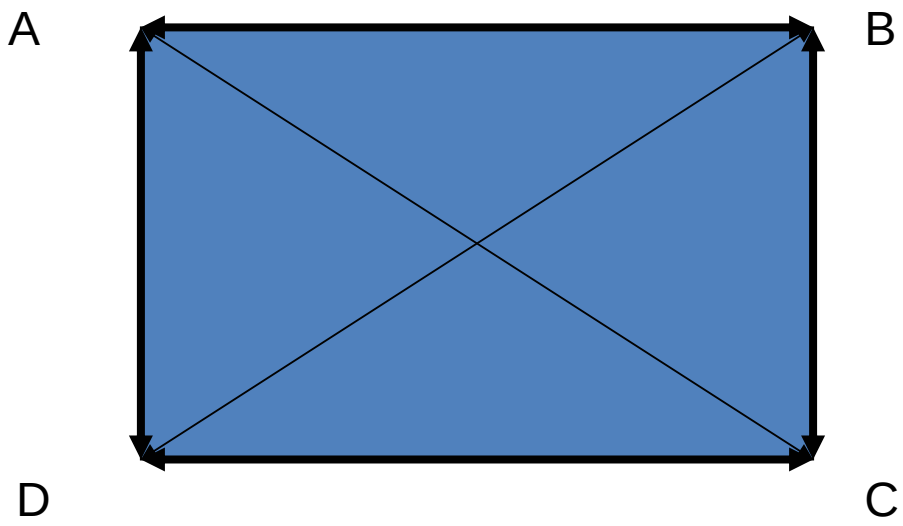
- After the collapse of the currency board in Argentina (2001) floating ER regime seemed like the best option.
- Chang and Velasco (JET 2000): a monetary open-economy Diamond-Dybvig-style model that supports this paradigm. Flexible ER regime eliminates the possibility of both currency and banking crises in a small open economy and achieves the first-best allocation.
- Under fixed ER regime both types of crises possible.
- They do not discuss how a switch from the managed to the flexible FX regime in a particular country impacts the fragility of the global financial system.

Our model

- One of the first theoretical contributions that study how a switch in ER regime and a degree of interconnectedness of a banking network influence stability of global financial networks.
- Extend financial contagion Allen and Gale (2000) model to the case of a two-country multi-region economy with open-economy monetary features of Chang and Velasco (2000).
- The large country has 3 regions: A, B, C (think of the Euro zone)
- Fourth region is the separate country with its own currency and a central bank (think of countries outside Euro zone)
- Like in A-G, central bank of the large country does not intervene to prevent the crisis. Small country central bank may or may not act as LOLR (we consider both cases).

Incomplete set of links

Complete set of links



Our main results

- Under the fear of floating or monetary union in D, moving from incomplete to complete set of links reduces a chance of global contagion (like A-G)
- In contrast to A-G, increased level of interconnectedness may increase fragility of the network if the smaller country maintains a floating ER regime (but not always).
- With incomplete links, floating ER regime in the smaller country results in smaller chance of global contagion (extends C-V result)
- In contrast to C-V, when links are complete, a higher risk of global contagion results from a shift to the floating FX regime in the smaller country.

Discussion of the main results

- Why a combination of complete links and flexible exchange rate is special? The country with floating ER regime `re-exports' negative shocks to the neighboring regions of the larger economy via the exchange rate depreciation, rather than absorbs them. These regions cannot follow suit, and so are more likely to suffer from the financial meltdown.
- Our results may rationalize the fear of floating in many emerging markets economies as well as fear of letting peripheral euro zone countries leave the currency union.
- Note that our framework `most favorable' to the floating ER regime: no negative effect of floating rate on the real economy, no foreign currency denominated loans.
- Also, the run-avoidance under the floating ER regime yields a lower ER depreciation than under the fear-of-floating regime when an external shock hits the economy.

Related literature

- Interbank linkages and contagion: A-G, Brusco and Castiglionesi (2007), Freixas et al (2000). Typically consider single currency networks. More recently Cao and Illing (2011)
- Impact of exchange rate regime on financial fragility of individual countries: Chang and Velasco (2000), Kawamura (2007).
- Fear of floating (Hausmann et al (2001), Calvo and Reinhart (2002), Caballero and Krishnamurthy (2001)). Reasons for fear of floating: difficulty of hedging ER shocks in underdeveloped markets, inability to borrow long term in the local currency, lack of credibility (risk premium shocks), high exchange rate pass through, inelastic supply of foreign funds in times of crisis.
- We conjecture there exists another reason: pressure of large countries and international institutions in order to reduce fragility of the increasingly interconnected global financial system

The model setup

- The World consists of two countries: Large and Small
- The Large country consists of 3 regions: A, B and C. Has currency - dollars
- The Small country consists of one region: D. Has currency - pesos
- 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 (or storage) investment, with gross return 1 in both periods.

The model setup

- Impatient
  - Probability λ
  - Consumes at time 1

    $U = U(C_1)$
- Patient
  - Probability $1 - \lambda$
  - Consumes at time 2

    $U = U(\chi(m) + C_2)$
  - Here, m is the real money balances carried from period 1 to period 2.

Social planner problem

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

such that

$k + b \leq 1$ budget constraint at t=0

$\lambda x \leq b + rl$ budget constraint at t=1

$(1-\lambda)y \leq R(k-l)$ budget constrain at t=2

$x \leq \chi(m) + y$ incentive for patient not to lie at t=1

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

Note that m is not present in the left-hand side of any constraint. This is because money is costless to produce, and hence the Social planner can create money up to the satiation level

Central banks

- Large country uses dollars; Small country uses pesos
- Large country: The Central bank does not act as a LOLR, 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
- 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.

Central Banks

- Small country: The Central Bank lends pesos for withdrawal of patient agents, but can also act as a LOLR in case of a banking crisis.
- However, if such emergency credit is used, the CB obtains control over the long term asset in period 1, and liquidates the asset as needed to sell the dollars to agents claiming impatience.
- Fear of floating ER: CB is willing to liquidate long term investment in order to preserve the exchange rate
- Floating ER: CB commits not to liquidate
- Useful benchmark: currency union in the small country (A-G)

Competitive equilibrium

- Like in all DD models the social optimum can be decentralized using banking system. A commercial bank in each region provides 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 invests in short-run storage technology and the illiquid investment.
- Possibility of a bank run

Multiple equilibria in a given region

- No crisis equilibrium
  - Allocation coincides with the social optimum.
  - Only impatient agents withdraw in period 1
  - Central bank provides appropriate units of currency (per patient agent), and
  - ER rate at time 2 is equal to 1 in the small country.
- Crisis equilibrium
  - Banking crisis in the large country
  - Currency crisis in the small country (ER rate > 1 at time 2)
  - Main condition

$$b + rk < x$$

Stochastic share of impatient agents across regions

	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)

Stochastic share of impatient agents

- Assume that p is sufficiently close to 1
- Also

$$(w_H + w_L)/2 = \lambda$$

In that case, in all states the aggregate share of impatient agents is λ

Complete vs incomplete interbank deposit structure

- With interbank deposits it is possible to achieve social optimum
- Minimum amount of interbank deposit that achieves that is z (for the incomplete structure) and z/2 (for complete structure)
- Here, $z = w_H - \lambda = \frac{w_H - w_L}{2}$

Analysis of crisis

- Suppose that in one region of the large country there is a banking crisis or there is a currency crisis in the small country. How likely is the spread of the crisis to all four regions? Spread of the crisis depends on
  - Completeness of the interregional links
  - Policy of the CB in the small country: what share of illiquid asset it is willing to liquidate in period 1 to provide dollars to allegedly impatient agents (and thus preserve ER rate). If that share is zero, flexible ER regime. If 1, fear of floating.
  - Often, it depends on which region the crisis starts from.

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 entire economy. Pecking order: banks liquidate short term assets, then deposits in other regions, than long term investments.
- If under certain conditions the set is larger, the global network is more fragile.
- Bank 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.

$$g(\lambda) = r[k - \frac{(1-\lambda)(x - \chi(m))}{R}]$$

Analysis of Financial Fragility: An Example

Assumptions

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

Analysis

- If 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.

Analysis of Financial Fragility: An Example

- Analysis (continued)
- 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 suffcient condition for a global run.

Results

- **Proposition 1.** Under incomplete market structure, conditions for a global run are at least as stringent under flexible ER regime as under fear of floating regime
- Proposition 1 states that the global economy is more fragile under the fear-of-floating regime than under the flexible exchange rate regime when the market structure is incomplete.

Results

- Proposition 1 extends the results of Chang and Velasco (2000) to a network economy with incomplete links. The flexible ER rate arrangement allows the monetary authority to refrain from termination of the long-term technology.
- This, in turn, ensures that the patient agents have no incentive to run and mitigates (in this model) or prevents (in the model of Chang and Velasco) the financial crisis.

Results

- **Proposition 2.** Under the fear-of-floating ER regime in D, conditions for a global run are more stringent under the complete market structure than under incomplete market structure.
- It states that the global contagion is more likely when the structure of interbank links is incomplete than when it is complete. This is essentially the original A-G result.

Results

- Conditions for the global run in our model under the monetary union are identical to conditions under fear of floating regime (for both complete and incomplete set of links).
- If a crisis unravels under the fear-of-floating regime, the central bank in the small country does exactly what a commercial bank in the large country does.
- It attempts to honor the nominal commitment and liquidates long-run technology investment to satisfy the demand for dollars of allegedly impatient depositors.
- The banking crisis is replaced with the currency run, but contagion conditions are the same, as the liquidation of long-term investment implies the same loss of value.

Results

- **Proposition 3.** If a financial crisis originates in a region of the large country, under the complete system of interbank links the exchange rate depreciation is higher under fear of floating than under flexible ER regime.
- The intuition behind the proposition: when the small country has floating ER, the truly patient depositors have no incentive to join the run. Demand for dollars is smaller than under the fear-of-floating regime, and the demand effect dominates the supply effect.

Results

- **Proposition 4.** When the market structure is complete, conditions for a global run are more stringent under fear of floating (or monetary union) than under flexible FX regime.
- Chang and Velasco (2000) result is reversed when the structure of interbank links is complete. In that case global economy is more fragile, if the small economy has a flexible exchange rate regime.
- This result is independent of the functional form of the utility function of the representative agent.

Results

- Obtained under most favorable conditions for flexible regime
- Why does a combination of flexible ER regime in one country and a complete system of interbank links jointly contribute to the global financial fragility?
- The country with flexible ER regime `re-exports' negative shocks (including the shock of a bank run in one of the regions of the large country) to the other regions of the large economy via FX depreciation.

Results

- These regions are under dual pressure, as each of them loses a part of the value of the deposit in the region affected by the bank run, and a part of the value of the deposit in the small country.
- However, these regions cannot follow the small country and devalue, and so they are more likely to suffer from the financial meltdown.

Results

- If the small country has a flexible ER regime and the bank run originates in region C, then the conditions for the global contagion are more stringent under the complete market structure (A-G holds)
- However, if the initial bank run happens in regions A or B instead, then the comparison of contagion conditions depends on the functional form of the utility function and the parameters of the model.
- Let

$$U(x) = \frac{x^{1-\theta} - 1}{1-\theta}$$

$$\chi(m) = \sqrt{\bar{m}^2 - (m - \bar{m})^2}$$

Results

- Then, there exists a set of parameter values for which the complete market structure is more fragile. For 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 ER 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 ER regime the small country does not absorb an external shock, but transmits it to the rest of the world.

Possible critique

Why would a small country maintain a fear-of-floating ER regime if other countries benefit from it?

Response: Because of the pressure from larger-country governments and multilateral organizations (EU, IMF, etc.).

- Our model provides an additional argument against potential secession of Greece (and other countries with weak fundamentals) from the euro zone.
- If euro zone countries are financially interconnected, financial contagion is more likely when one of the regions switches to an independent currency with a floating exchange rate.

Possible critique

In the real world financial institutions of large countries do not hold deposits in small-country currencies.

- Response: Even if cross-border assets are dollarized, devaluation in the small country increases the probability of default on these assets, and their expected value falls.

Possible critique

The model is literature driven. What is its relevance to the current crisis?

- Think of the euro-zone as a large country. The initial crisis strikes one of the regions (Greece, Portugal, Ireland, etc.). What ER regime in neighboring countries (UK, Poland, Hungary, etc.) makes the whole network more vulnerable?