Contagion of self-fulfilling financial crises due to diversification of portfolios

Itay Goldstein and Ady Pauzner

discussion by Michal Szkup

NYU

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Motivation

In last decade of XXth century we saw:

- Increasing globalization of financial markets which lead to greater diversification of investment
- A number of crises that spread from one country to another
- In some cases, crises spread between countries which did not appear to have any economic ties
- Goal: propose a mechanism that can account for this type of contagion
- Mechanism: contagion through portfolio diversification and wealth effects.
There are two countries each characterized by fundamentals $\theta_j$, $j \in \{1, 2\}$

There is a continuum of identical agents, $i \in [0, 1]$

they have utility $u(c)$ over consumption

- $u(c)$ increasing and twice differentiable
- $-\frac{u''(c)}{u'(c)}$ is decreasing (DARA utility)

each agent holds investment of 1 in each country
Model (Information Structure)

- At the time agent make their investment decisions in country $j$ they don’t know $\theta_j$, $j \in \{1, 2\}$
- They believe that $\theta_j \sim u[0, 1]$, $j \in \{1, 2\}$, independent across countries
- Agents observe noisy signal of $\theta_j$
  
  $$x^i_j = \theta_j + \varepsilon^i_j$$
  
  $$\varepsilon^i_j \sim u[-\varepsilon, \varepsilon] \text{ iid}$$

- Noise parameter $\varepsilon$ is assumed to be very small
Model (Returns)

- Agent can choose when to withdraw his investment
- If withdrawn early, return is 1
- If withdrawn at maturity, the return is $R(\theta_j, n_j)$
- $R_{\theta_j} > 0$ and $R_{n_j} < 0$
- $\exists \theta$ such that $R(\theta, n_j) < 1 \ \forall n_j$
- $\exists \theta$ such that $R(\theta, n_j) > 1 \ \forall n_j$
Model (Timing)

- The model is sequential
- First the agents decide whether to terminate their investment in country 1
- They observe the outcome in country 1
- Based on their information and outcome in country 1 they make their decisions in country 2
Consider agent $i$ deciding whether to terminate or not his investment in country 2.

Agent $i$ acts based upon all the information he has:
- signal $x_2^i$
- his wealth in country 1, $w_1^i$
- and distribution of wealth of other agents in country 1

The difference in utility in the case she waits compared to early withdrawal is

$$\Delta (x_2^i, n_2 (\theta_2), w_1^i) = \frac{1}{2\varepsilon} \int_{x_2^i-\varepsilon}^{x_2^i+\varepsilon} \left[ u \left( R (\theta_2, n_2 (\theta_2)) + w_1^i \right) - u \left( 1 + w_1^i \right) \right] d\theta_2$$

There are two types of agents in country 2:
- those who earned return 1 in country 1
- those who earned return $R (\theta_1, n_1 (\theta_1))$
Existence

Proposition

For any $\theta_1$ and $n_1 \in [0, 1]$, there exists a unique equilibrium in country 2.

1. In this equilibrium, each agent who ran in country 1 runs in country 2 if and only if his signal $x_2^i$ is below $x_{2,r}^*$

2. An agent who didn’t run in country 1 runs in country 2 if and only if her signal is below $x_{2,nr}^*$
Agent $i$ to make a decision relies on his private information only.
He will have to take into account the effect of his decision on his total wealth.
He has to predict the distribution of wealth in period 2.

**Proposition**

*For sufficiently small $\epsilon$, there exists a threshold equilibrium in country 1,*
Contagion

• Let $\Gamma (n_1, \theta_1)$ be the distribution of wealth after the events in country 1 take place

**Theorem**

*If the distribution $\Gamma_1 \succeq_{FSD} \Gamma_2$ then* $\theta_{2,r}^* (\Gamma_1) < \theta_{2,r}^* (\Gamma_2)$ *and* $\theta_{2, nr}^* (\Gamma_1) < \theta_{2, nr}^* (\Gamma_2)$

• If agents are wealthier then the crisis is less likely

**Intuition**

- It is risky to keep investment
- As wealth of agent $i$ increases he is willing to bear more risk
- Hence he is willing to keep his investment intact for wider range of signals
Correlation

Here we assume that $\epsilon \to 0$ ("limiting case")

The fact that $\theta_1$ affects the threshold $\theta_2^*$ implies that the returns become correlated.

The expected return from investment in country 2 is given by

$$E \left[ w_2 | \theta_1 \right] = \theta_2^* \left( \theta_1, n_1 (\theta) \right) + \int_{\theta_2 = \theta_2^* (\theta_1, n_1 (\theta))}^{1} R (\theta_2, 0)$$
Welfare Implications

- Diversification affects welfare through two channels:
  - direct channel (diversification of risk) - positive effect
  - indirect channel (contagion effect and risk effect) - negative effects
  - overall effect of increase in diversification is ambiguous

Fig. 8. Average welfare as a function of $\beta$. 
Conclusions

- We saw that diversification of investment coupled with wealth effects may act as a contagion channel.
- In this setup diversification results in positive correlation of returns in two countries.
- Increase in diversification may be welfare reducing.
"Contagion Effect"

- the more diversification, the more correlated are returns
- as long as agents who invest in country 2 hold some wealth in country 1 their wealth will be affected by the outcome in country 1
- when $\beta$ decreases, agents hold less wealth in the "home country" and hence they are less likely to run
- on the other hand more agents now hold significant amount of money in each country so the base for run is greater
- so the overall effect of decrease in $\beta$ may be non-monotone.
Appendix

"Risk Effect"

- the more agent has wealth in a given country the more likely he is to run
- when \( \beta \) decreases, agents hold less wealth in the "home country" and hence they are less likely to run
- on the other hand more agents now hold significant amount of money in each country so the base for run is greater
- so the overall effect of decrease in \( \beta \) may be non-monotone.