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

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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.

Model (Agents)

- There are two countries each characterized by fundamentals θ_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 θ_j, $j \in \{1, 2\}$
- They believe that $\theta_j \sim u\left[0, 1\right]$, $j \in \{1, 2\}$, independent across countries
- Agents observe noisy signal of θ_j

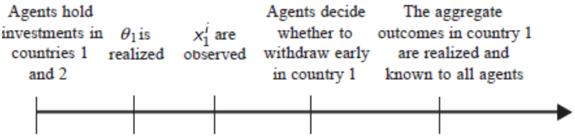
$$\begin{aligned} x_j^i &= \theta_j + \varepsilon_j^i \\ \varepsilon_j^i &\sim u\left[-\varepsilon, \varepsilon\right] \; iid \end{aligned}$$

- Noise parameter ε 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- If withdrawn early, return is 1
- If withdrawn at maturity, the return is $R(\theta_j, n_j)$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 $R_{n_j} < 0$
- $\exists\underline{\theta}$ such that $R(\underline{\theta}, n_j) < 1 \ \forall n_j$
- $\exists\overline{\theta}$ such that $R(\overline{\theta}, n_j) > 1 \ \forall n_j$

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
- 

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

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

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

Existence

Proposition

For any θ_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 $x_{2,nr}^*$*

Country 1

- 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 ϵ, 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

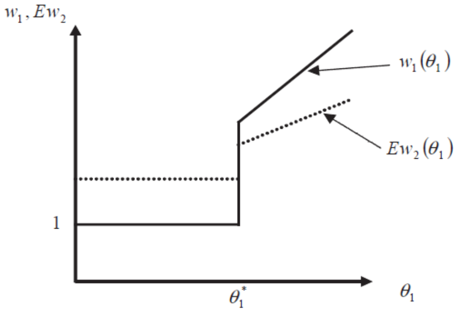
Theorem

If the distribution $\Gamma_1 \succ_{FSD} \Gamma_2$ *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 $\varepsilon \to 0$ ("limiting case")
- The fact that θ_1 affects the threshold θ_2^* implies that the returns become correlated



- The expected return from investment in country 2 is given by

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

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

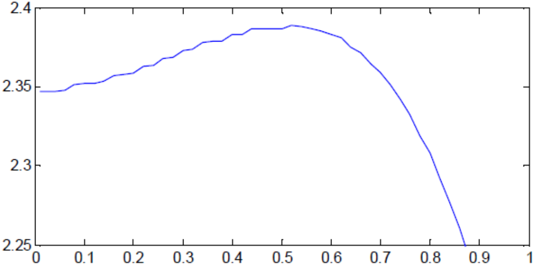


Fig. 8. Average welfare as a function of β.

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.

Appendix

- "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 β 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 β may be non-monotone.

Appendix

- "Risk Effect"
  - the more agent has wealth in a given country the more likely he is to run
  - when β 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 β may be non-monotone.