The Financial Origins of Non-Fundamental Risk

Sushant Acharya[⋆] Keshav Dogra[‡] Sanjay R. Singh[§]

[⋆]Bank of Canada

[‡]Federal Reserve Bank of New York

[§]UC Davis and FRBSF

November 2022

The views expressed herein are solely the responsibility of the authors and should not be interpreted as reflecting the views of the Bank of Canada, Federal Reserve Banks of New York, San Francisco or the Federal Reserve System.

Question

Can the financial sector be a source of non-fundamental risk for the economy?

- Rajan (2005): “Has Financial Development Made the World Riskier?”
- Danielsson and Shin (2003): “Endogenous Risk”

A stylized model where non-fundamental volatility emerges with financial intermediation:

- no fundamental sources of risk present
- full-information rational expectations framework

Environment

- two dates: 0 and 1
- three agents: households, financial intermediaries and outside investors
- fixed endowment of cookies (c) at both dates
- fixed endowment of trees at date 0
- trees are claims to apples (a) at date 1
- trees can be traded at date 0

Households

only consume cookies (c)

$$U^h(c_0^h, c_1^h) = c_0^h + \left[\mathbb{E}(c_1^h)^{1-\gamma}\right]^{\frac{1}{1-\gamma}}, \gamma > 1$$

- risk-averse over date 1 consumption
- born with χ_0^h cookies, and all the trees, $e_0 = 1$.

Financial Intermediaries

consume apples (a_1) or cookies (c_j)

$$U^f(c_0, c_1, a_1) = c_0^f + \mathbb{E}\left(c_1^f + a_1^f\right)$$

- risk-neutral over date 1 consumption
- born with $\chi_0^f < 1$ cookies, no trees

Outside Investors

unit mass of OIs (Stein, 2012)

 only trade and consume at date 1

$$U^o(c_1, a_1) = v(a_1^o) + c_1^o$$

where $v'(\cdot) > 0$ and $v''(\cdot) < 0$.

- only agents with cookies at date 1
- large amt of cookies χ_1
- Assume $v'(0) > 1 > v'(1)$: interior soln

key market incompleteness: OIs do not participate in date-0 market

Equilibrium

prices $\{p_0, p_1\}$ and quantities (cookies, apples and trees)

- all agents optimize
- markets for cookies (🍪) and trees (🌲) at dates 0 and 1 clear,
- market for apples (🍎) at date 1 clears

Endogenous Fragility with Insurance Contracts

Only fundamental equilibria exist when trees are the only assets traded.

- 🌲🌲 are safe assets ($p_1 = 1$)

Allow FIs to sell insurance contracts z^f at date 0 at price q

- pays out $1 - p_1$ if $p_1 < 1$
- equivalent to a put option on trees
- non-negative consumption constraint on FIs limit amt of insurance sold

$$\underbrace{(1 - p_1(s))z^f}_{\text{insurance payout}} \leq \underbrace{p_1(s)e^f}_{\text{value of trees}} \qquad \text{in all states } s$$

- If HHs expect $p_1 = 1$ in all states of the world, then no demand for insurance.
- 🌲🌲 continue to be safe assets
- Fundamental equlibria that we constructed exist, with $q = z^f = 0$.
- ... but not the only set of equilibria that exist

Equilibrium with Insurance

There exists an equilibrium in which,

- with non-zero probability, price decline at date 1 can be self-fulfilling
- when p_1 is low, FIs sell trees to pay out on their insurance contracts, pushing down the price
- if households anticipate that prices might fall, they demand insurance from FIs
- issuance of insurance actually makes price declines possible.
- supply of private safe assets may create its own demand: *Say's law for risk*

Key market incompleteness: OIs are not allowed to participate at date 0

Equilibrium with Insurance: Welfare

1. HHs
   - worse off than in fundamental eqm
   - welfare with insurance

$$\underbrace{\chi_0^f + \chi_0^h}_{c_0^h} + \left[\lambda \underline{p}^{1-\gamma} + (1-\lambda)\left(e^h(\lambda)\right)^{1-\gamma}\right]^{\frac{1}{1-\gamma}}$$

   - $\lambda \to 0$, welfare converges to no-insurance case

2. FIs 
   - weakly better off than in fundamental eqm
   - have the option to consume their endowment χ_0^f in the first period.

3. OIs 
   - benefit from fire-sales
   - sell cookies for apples at steep discounts
   - better off than in fundamental eqm
   - welfare with insurance

$$(1-\lambda) \underbrace{\left[v(\overline{e}) - \overline{e}\right]}_{\text{no insurance welfare}} + \lambda \underbrace{\left[v(1) - v'(1)\right]}_{>0}$$

Policy to eliminate financial fragility

FIs should be the "natural" buyers of trees at date 1

- because of excessive leverage, they are forced to *sell* trees in some states
- explicit ban on such financial transactions would return the economy to a unique equilibrium setup (strict enough tax or leverage restrictions)
- or reduce the excess returns to leveraged investments in risky assets

Consider two sets of crisis-fighting policies

1. increase supply of publicly backed safe assets (issue debt, bailouts)
2. reduce demand for private safe assets (social insurance, market maker of last resort)

Conclusion

Private creation of safe assets by leveraged intermediaries can lead to fragility

- Safe assets are produced due to demand for safety by households
- Demand for safety arises from fragility induced by the privately-supplied safe assets
- Economy becomes vulnerable to self-fulfilling fire sales

Novel contribution

- leverage is not being used to amplify exogenous fundamental shocks
- instead, financial system *generates* risk in an otherwise fundamentally safe economy

In the paper

- show fragility also arises with trading of bonds/repo contracts

Other private safe assets

allow FIs to issue risk-free non-state contingent bonds b at price q^b

- pay one cookie to the holder at date 1
- bonds are backed by FIs' holdings of trees: *repo* transactions

HHs budget constraints

$$\begin{aligned} c_0^h + p_0 e^h + q^b b^h &= \chi_0^h + p_0 && (1) \\ c_1^h &= p_1 e^h + b^h, && (2) \end{aligned}$$

FIs budget constraints

$$\begin{aligned} c_0^f + p_0 e^f &= \chi_0^f + q^b b^f && (3) \\ c_1^f + p_1 a_1^f + b^f &= p_1 e^f && (4) \end{aligned}$$

non-negative consumption on FIs:

$$b^f = p_1 \left(e^f - a_1^f \right) - c_1^f \leq p_1 e^f \quad (5)$$

in all states of the world

Other private safe assets

for every equilibrium that exists in insurance economy, a corresponding equilibrium exists in the bond economy

- FIs have to pay out in all states of the world
- *but* FIs sell more when $p_1 = \underline{p} < 1$ to meet obligations

fundamental equilibrium:

- zero spread between expected return on bonds and trees
- both bonds and trees are riskless assets

non-fundamental equilibria

- date 0 price of bonds is higher
- That is, risk-free rate is lower in these equilibria
- safe rate endogenously falls as a *result* of private safe asset creation
  (contrast to a typical safe assets scarcity narrative)

Mapping the contracts to real world

bonds as *repo contracts*

- At date 0, HHs buy e^f trees from FIs by paying $q^b \underline{p} e^f$ cookies
- market value of trees in the contract $p_0 e^f$
- FIs promise to repurchase these trees at price $\underline{p}$
- Implicit haircut is $1 - q^b \frac{\underline{p}}{p_0}$.
- MBS market stress during Covid-19

total return swap

- FIs are hedge funds that enter into contract with investment banks (HHs)
- FI receive the return on underlying asset (tree) and make payments on a pre-set rate (interest rate on risk-free bond)
- HH buys e^f trees on behalf of FIs, who put up initial margin if χ_0^f.
- Date 1: HHs pay FIs gross return on reference asset $p_1 e^f$, net of preset rate $\frac{p_0 e^f - \chi_0^f}{q^b}$.
- Archegos Capital Management in March 2021