Risk-Taking Dynamics and Financial Stability

An Evolutionary Perspective

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Motivation

Motivation:

- Traditional focus of macroprudential research: factors behind booms and busts for financial sector as a whole
  - e.g. sector-wide/aggregate distortions like exuberance, agency problems, externalities, ...
- This paper: focus instead on composition of the financial sector
  - booms and busts accompanied by growth and demise of high risk-takers
  - examples in 2000s: Countrywide, WaMu, AIG Fin Services, ...

Key Contributions

- **Composition of financial sector** matters for macro phenomena:
  - drives pro-cyclicality: during booms, high risk-takers take over
  - captures important aspect of Minsky's financial instability hypothesis
- **Novel dynamic selection effects of policy intervention**:
  - stem from evolutionary forces rather than optimizing behavior
  - neglected in traditional (rep. agent) analysis

$\rightarrow$ role for non-conventional policy measures, e.g.:
growth limits, stress tests, ...

$\rightarrow$ novel adverse selection effects of bailouts

$\rightarrow$ ...

Related Literature

- **Role of net worth in financial sector,** e.g. Gertler-Kiyotaki (2010), Gertler-Karadi (2011), Brunnermeier-Sannikov (2014), ...
  $\rightarrow$ we introduce heterogeneity in financial sector

- **Net worth dynamics of heterogeneous agents**, e.g. beliefs (Blume and Easley, 1992; Geanakoplos, 2009; Burnside et al., 2015), preferences (Borovicka, 2015), ...
  $\rightarrow$ we focus on financial sector and impact of financial policy (most closely related: Coimbra and Rey, 2017)

- **Booms and busts**, e.g. Minsky (1986), Kiyotaki-Moore (1997), ...
  $\rightarrow$ we provide a novel, complementary explanation

Baseline setup

- $i = 1...N$ types of bankers with log preferences

$$U_i = \sum \beta^t \mathbb{E}\left[\log c_{it}\right]$$

unit mass of agents each with initial endowment k_{i0}

- Each type chooses from a set of investment strategies each period
  - a strategy S_{it} delivers stochastic return $\tilde{R}\left(S_{it}\right)$
  - return depends on aggregate state of nature $\omega \in \Omega$, independent over time

- Different interpretations for set of investment strategies:
  - different leverage strategies: $\tilde{R}\left(S_{it} = x\right) = xr + (1-x)\tilde{R}_t$
  - differences in diversification: $\tilde{R}\left(S_{it} = \{\alpha_j\}\right) = \sum_j \alpha_{ij}\tilde{Q}_{jt}$

    note: $\alpha_{ii} \geq \bar{\alpha}$ may capture agency frictions that require minimum investment in its own project $\tilde{Q}_i$

- Extensions (later): differences in beliefs $\mathbb{E}_i[\cdot]$, discount factors β_i

Optimization Problem

$$\max_{c_{it}, k_{it}, S_{it} \in \mathfrak{S}_i} \mathbb{E}\left[\sum_t \beta^t \log c_{it}\right] \qquad \text{s.t.} \qquad c_{it} + k_{it+1} = \tilde{R}_t\left(S_{it}\right) k_{it}$$

Lemma (Optimal Strategy under Laissez-Faire)

- *investment strategy S_{it} is time-invariant, independent of wealth and maximizes geometric mean return*

$$S_i = \arg\max_{S_i \in \mathfrak{S}_i} E\left[\log \tilde{R}\left(S_i\right)\right]$$

- *law-of-motion for type i capital with growth factor $\tilde{G}_{it} = \beta \tilde{R}_t\left(S_i\right)$*

$$k_{it+1} = \tilde{G}_{it} k_{it}$$

- *unless there is complete risk-sharing, capital shares of different types fluctuate over booms and busts*

in vector notation: $k_{t+1} = \tilde{G}_t k_t$

Volatility and Procyclicality

Example of two-state economy $\omega \in \{L, H\}$ with $E\left[\log \tilde{R}\left(S_i^*\right)\right] = \bar{R}$

Example (Volatility and Procyclicality in Two-State Economy)

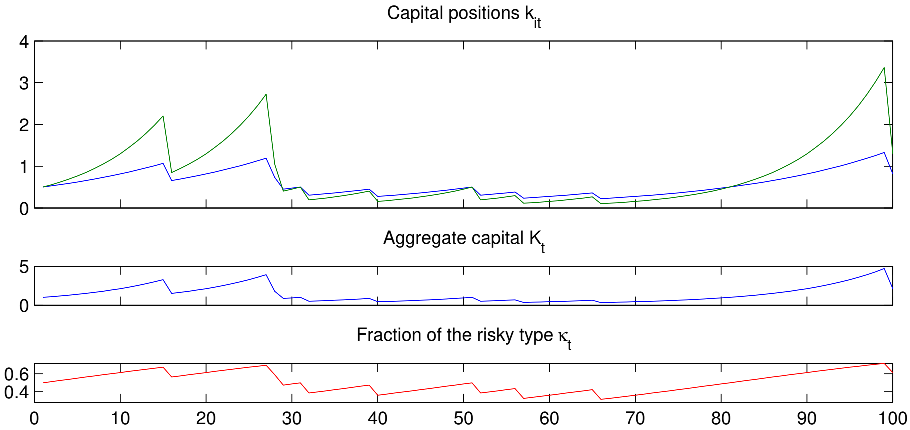
Volatility: The more risky the wealth distribution of bankers, the greater the n-period-ahead volatility of aggregate wealth.

Pro-cylicality: The more positive shocks the economy experiences,

- the greater the n-period-ahead volatility of aggregate wealth and
- the greater the loss from a negative shock.

$\rightarrow$ Minsky's financial instability hypothesis
$\rightarrow$ Observation: capital shares $\kappa_{it} = k_{it} / \sum_i k_{it}$ fluctuate pro-cyclically

Simulation 1: Volatility and Procyclicality



First-Best

Planner allocates capital and consumption and picks strategies $\forall t$ to solve

$$\max_{\kappa_{it}, c_{it}, S_{it}} \sum_{i=1}^{N} \sum_{t=1}^{\infty} \theta_i \beta^t E[\log c_{it}]$$

Proposition (First Best)

1. *Planner chooses time-invariant capital shares κ_i^* and investment strategies S_i^**
2. *Optimal capital shares κ_i^* equate risk-adjusted returns for all i,*

$$E\left[\lambda^* \tilde{R}\left(S_i\right)\right] = c \forall i \qquad (1)$$

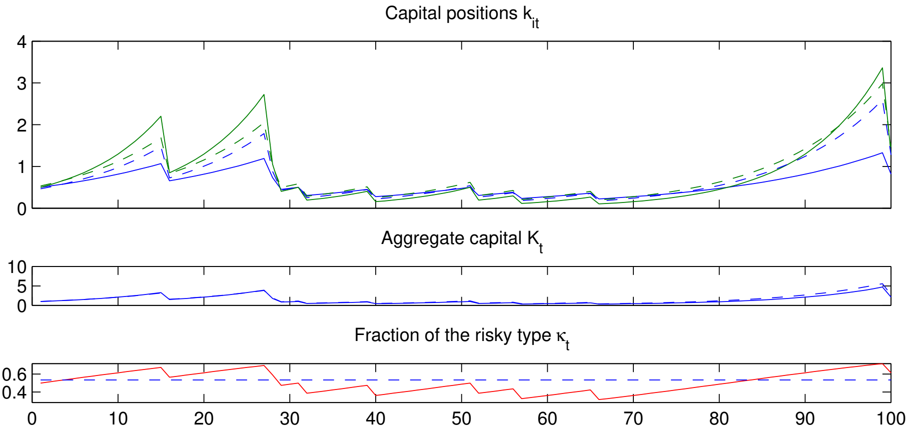
where social marginal utility $\lambda^* \simeq 1/\sum \kappa_i^* \tilde{R}\left(S_i^*\right)$ is time-invariant

3. *Economic growth is a.s. faster than in the decentralized economy.*

Note: first best solves [static] portfolio allocation problem

- overcomes the imperfections in risk markets
- social marginal utility λ more stable than private λ_i captures benefits of diversification

Simulation 1': Dynamics of First-Best Capital Allocation



Constrained Planning Problem

Planner who respects internal capital accumulation $k_{it+1} = G_{it} k_{it}$

Proposition (Constrained optimum in private ownership economy)

1. *Planner chooses time-varying investment strategies $S_{it} \in \mathfrak{S}_i$ that are counter-cyclical and satisfy*

$$E\left[\lambda_t \tilde{R}'(S_{it})\right] = 0 \forall i \tag{2}$$

   since social marginal utility $\lambda_t \simeq 1 / \sum \kappa_{it} \tilde{R}(S_{it})$ is time-varying

2. *Economic growth is a.s. in between decentralized economy and first-best.*

Note:

- social pricing kernel λ_t more risk-averse (risk-loving) if more capital held by risky (safe) types
- may justify both taxes and subsidies on strategies such as leverage, diversification etc.

Novel Effects of Financial Regulation

Implementing a more stable capital allocation

Proposition (Effects of Financial Regulation)

Restricting risk-taking in a given period t leads to:

- *a* **static effect** *on period t volatility from restricting the choice set and*
- *a* **dynamic selection effect** *from changing the wealth composition in all future periods, which*
  - *reduces volatility if the period t shock is positive*
  - *increases volatility if the period t shock is negative*

$\rightarrow$ the dynamic effect of regulation is inherently counter-cyclical

Role for unconventional policy instruments:

- limits on growth
- stress tests
- ...

Novel Effects of Government Policies

Proposition (Effects of Government Policies)

Any government policy that differentially affects different risk types has **dynamic selection effects.**

Examples:

- support for home ownership among low-income individuals:
  $\rightarrow$ selects for institutions specializing in subprime
- bailouts: usually occur after high risk-takers make large losses
  $\rightarrow$ select for high-risk strategies
- monetary policy: low interest rates select for high-leverage strategies
  $\rightarrow$ “risk-taking channel” of monetary policy

Capital Reallocations

Reallocations of capital among different types:

- allows for richer dynamics than purely internal net worth accumulation
- captured by transition matrix $M = (m_{ij})$, where m_{ij} is fraction of type i capital reallocated to type j each period
- (Vector) law of motion $k_{t+1} = MG_t k_t$

Interpretations:

1. changes in type of a given financial institution
   - via change in management, personnel, internal decision-makers, information, ...
2. changes in set of financial institutions who are operating
   - via mergers, take-overs, firm entry and exit
3. reallocations due to public policy actions
4. (more broadly) reallocations of internal funds by external investors

Capital Reallocation

Examples:

- symmetric reallocation: M non-stochastic and symmetric
- momentum: reallocates towards recent winners
- reversal: reallocates towards recent losers

Proposition (Effects of Capital Reallocation)

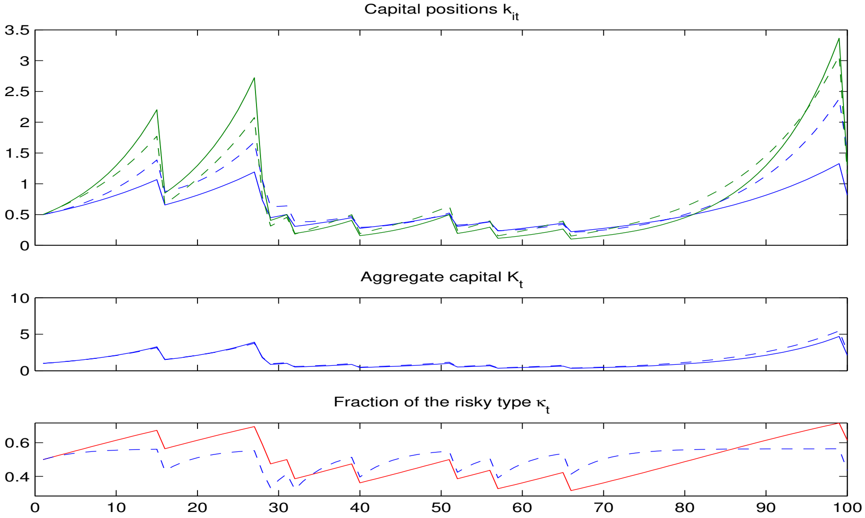
A small amount of reallocation that is

(i) symmetric: increases the growth rate of the economy a.s.

(ii) momentum-based: reduces the growth rate of the economy a.s.

(iii) reversal-based: increases the growth rate of the economy a.s.

Simulation 2: Symmetric Reallocation



Spillovers to the Real Economy

Extension to capture spillovers to the real economy

- Unit mass of workers:
  - same (log) utility as bankers
  - supply one unit of labor
  - live hand-to-mouth so $c_t = w_t$,
- after shock realization, capital k'_{it} lent to real economy for production

$$y_{it} = A{k'_{it}}^{\alpha} \ell_{it}^{1-\alpha}$$

- Equilibrium wage satisfies $w_t = (1-\alpha)AK'_t$

Spillovers to the Real Economy

Observe: Workers care about stable supply of risk capital

Proposition (Spillovers)

1. *Aggregate bank capital creates spillovers to the real economy.*
2. *The results on (a) procyclicality and (b) optimal capital allocation continue to hold.*

Role of Financial Regulation:

- → ensure stable supply of capital to the real economy
- → desirable to stabilize capital shares of different investment technologies
- → output and wages less volatile
- → output and wages on average higher

Spillovers and Bailouts

Bailouts

- workers benefit from providing bailout transfers to bankers when capital falls below a threshold $\hat{K}$

Proposition (Bailouts and Natural Selection)

The introduction of lump-sum bailouts

- *increases the fraction of capital controlled by high risk-types*
- *allows for long-run survival of inferior risk types (that would otherwise go extinct)*

Conclusions

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- Heterogeneity in risk exposure creates novel channel that drives the riskiness of the aggregate economy
- Pro-cyclicality
- Policy interventions have dynamic selection effects
  - Question: which financial institutions will benefit?
- Role for smoothing cycles – in both directions