Nobel Symposium "Money and Banking"

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Clarion Hotel Sign, Stockholm

Nobel Symposium 2018: Money and Banking

Markus K. Brunnermeier
Princeton University

Stockholm, May 27th 2018
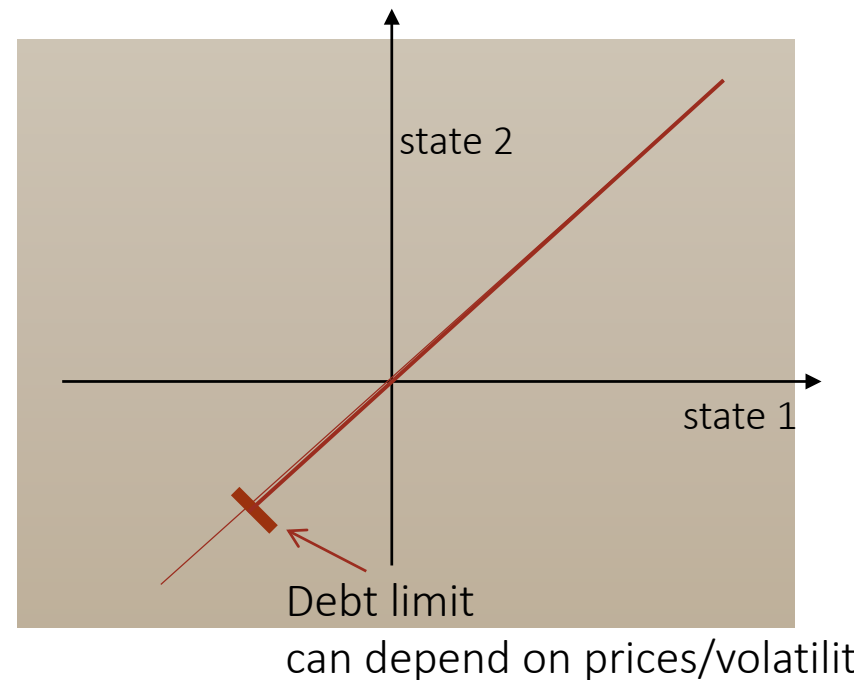
Types of Distortions

- Belief distortions
  - Match "belief surveys"   *(BGS)*

- Incomplete markets
  - "natural" leverage constraint *(BruSan)*
  - Costly state verification   *(BGG)*

- + Leverage constraints
  (no "liquidity creation")
  - Exogenous limit   *(Bewley/Ayagari)*

  - Collateral constraints
    - Next period's price   *(KM)*
      $$Rb_t \leq q_{t+1} k_t$$
    - Next periods volatility   *(VaR, JG)*
    - Current price

- Search Friction   *(DGP)*

state 2

state 1

Debt limit
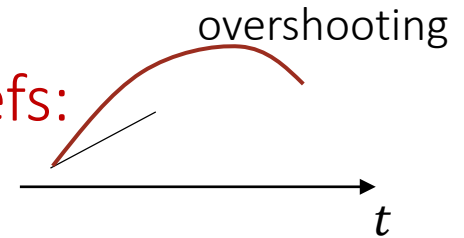can depend on prices/volatilit

Overview

- Types of distortions/frictions

- Run-up phase
  - Distorted beliefs
  - Concentration of risk

- Crash phase
  - Fire-sales
  - Paradox of Prudence
  - Spillovers

- Recovery phase

- Endogenous volatility dynamics – volatility paradox

- Welfare/Regulation

Run-up 1: Beliefs "Distortions"

overshooting

- **Representativeness heuristic/Diagnostic beliefs:**
  - As if error terms followed AR(1)
  - Overestimate of productivity after good shock
  - Bubbles/overinvestment driven by *level of beliefs* a la Miller (1977)
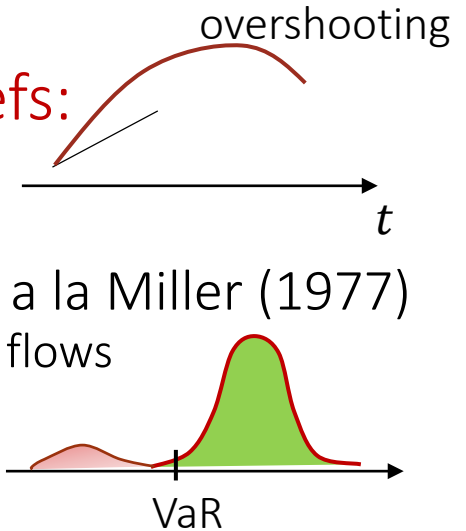   - AS: Surveys consistent with each other, mutual fund flows

t

- **Heterogeneous beliefs:** optimists and pessimists

"consensus beliefs" ≠ marginal buyer's beliefs

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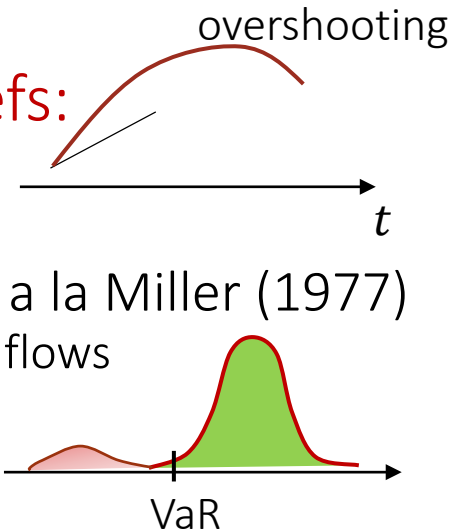
  - Local thinking "neglect of tail risk" ≈ VaR

VaR

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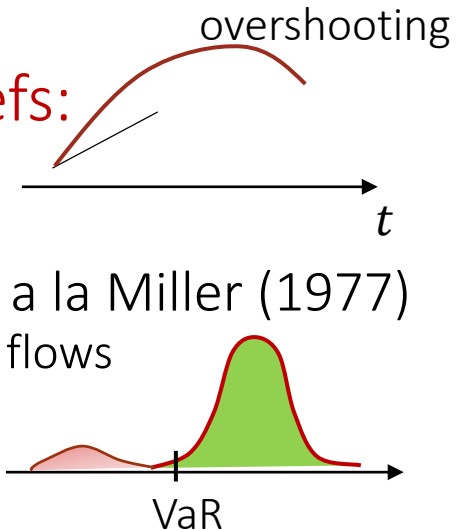
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- **Heterogeneous beliefs:** optimists and pessimists
  - + limited commitment ⇒ Leverage cycle
  - "Marginal buyer" vary with shocks

  - Surveys elicit "consensus beliefs" ≠ marginal buyer's beliefs

overshooting

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VaR

Run-up 1: Beliefs "Distortions"

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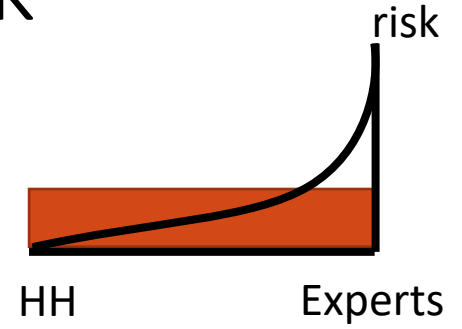

VaR

- Heterogeneous beliefs: optimists and pessimists
  - + limited commitment ⇒ Leverage cycle
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  - Surveys elicit "consensus beliefs" ≠ marginal buyer's beliefs

- Switching heterogeneous beliefs ⇒ Speculation
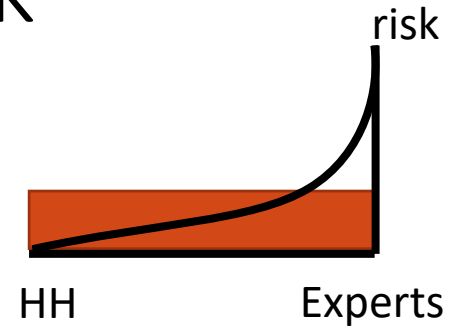 (Resale option a la Harrison-Kreps/Scheinkman-Xiong):
  - optimist/pessimist "switching" + short-sale constraint
  - ⇒ Bubbles, volatility, and transaction volume

Run-up 2: Concentration of Risk

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- Belief extrapolation:
  - No risk concentration necessary

risk

HH   Experts

- Financial frictions models:
  - "Experts" hold most of aggregate risk in good times
  - Low volatility, but risk builds up in background
  - Credit cycle: (BGG/KM/BruSan)

  - Leverage cycle: (JG/BruPed)   extreme leverage in cts. time limit

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Run-up 2: Concentration of Risk

- ■ Belief extrapolation:
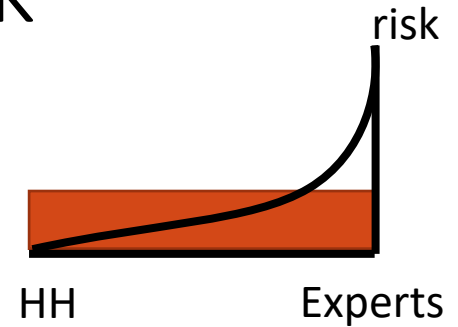 - No risk concentration necessary

- ■ Financial frictions models:
  - "Experts" hold most of aggregate risk in good times
  - Low volatility, but risk builds up in background
  - <u>Credit cycle:</u>   (BGG/KM/BruSan)
    - ■ Experts save their way out of constraint *after string of good shocks*
    - ■ Buffer against crisis
  - <u>Leverage cycle:</u>   (JG/BruPed)   extreme leverage in cts. time limit
    - ■ Most concentrated risk *after string of good shocks*
    - ■ 2 key differences (besides hetero. beliefs):
      - More than two groups
      - Bubble don't burst, but deflate
        - ■ Worst case moves up
        - ■ Higher debt capacity
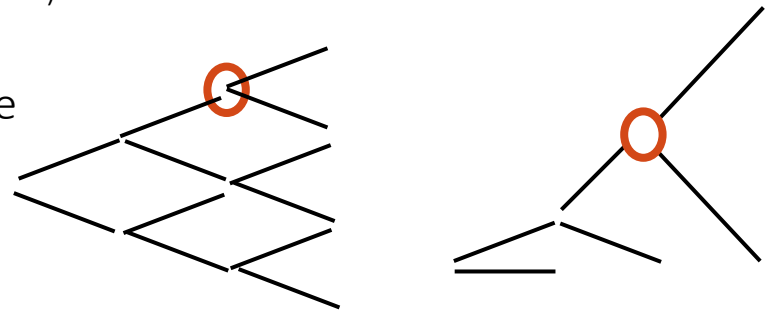
Crash 1: Fire Sales

- Definition: Assets transferred to second-best users

- BGG: No second-best user

- KM: Negative shock $\Rightarrow$ Experts sell to HH (gatherers), "Market illiquidity"

- Shleifer-Vishny (1992):
  - Fire sales $\Rightarrow$ GE debt capacity matters
  - Restructuring > Fire sales

- Are fire-sales good or bad?
  - BruSan: Two competing effects
    - Ex-post: Fire sales stabilize economy in crisis, but misallocation
    - Ex-ante: Lead to excessive leverage (fire-sale/pecuniary externality) (Stein et al.,…)

Crash 2: Paradox of Prudence

- ■ "Micro-prudence" of bank is "macro-imprudent"

Crash 2: Paradox of Prudence

- "Micro-prudence" of bank is "macro-imprudent"

- Two "spirals" amplify
  - Liquidity spiral   (price of capital)
  - Disinflationary spiral   (price of money)

Like Keynes' Paradox of Thrift, but in risk-space

Crash 2: Paradox of Prudence

- "Micro-prudence" of bank is "macro-imprudent"

- Two "spirals" amplify

  - Liquidity spiral   (price of capital)
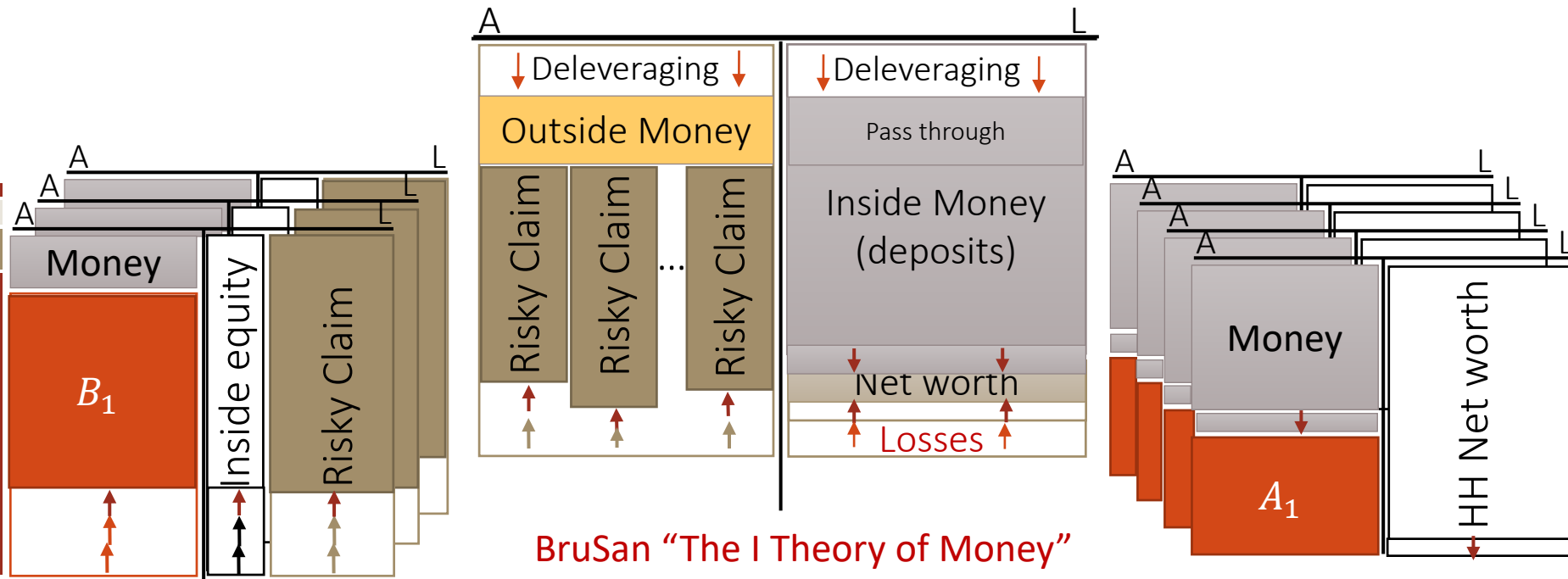
  - Disinflationary spiral   (price of money)

    - Banks issue less inside money (& diversify less risk risk) ⎫
    - HH demand more money   ⎬ ⇒ Lower inflation
                                                                  ⎭

Brunnermeier – Nobel Symposium: Money and Banking

BruSan "The I Theory of Money"

Crash 3: Spillovers Across Assets

- Belief extrapolation: No spillovers
  - Unless "baked-in" in beliefs

- Net worth channel:
  - BGG/KM/BruSan: Expert net worth affects all assets
  - Diamond-Rajan (2005)
  - JG-Leverage cycle: Spillovers from "crossover" investors
    - Margins spike in one market
    - ⇒ Crossover investors transfer capital from other markets
  - BruPed: Multiple equilibria:
                                    Joint jump in price across assets
    - Even assets with uncorrelated payoffs jump together
    - Could also be integrated in a DD-model

- Measurement: *CoVaR*

Speed of Recovery

- Speed of Recovery
  - KM: deterministic
  - BruSan: Length of recession is stochastic
      $\Rightarrow$ precautionary savings

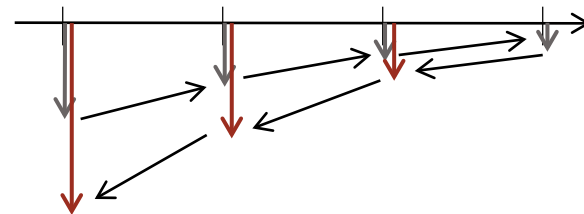# Mean & Leverage Dynamics

■ Impulse Response curves:
  - Amplification
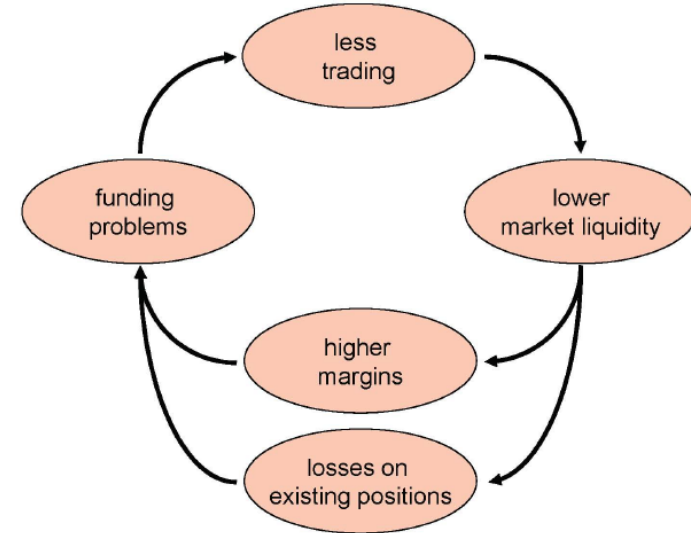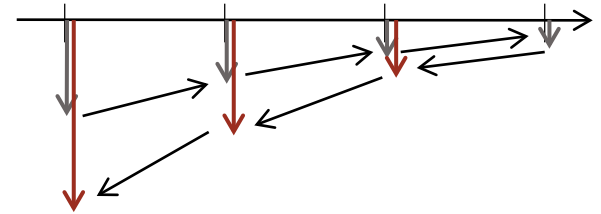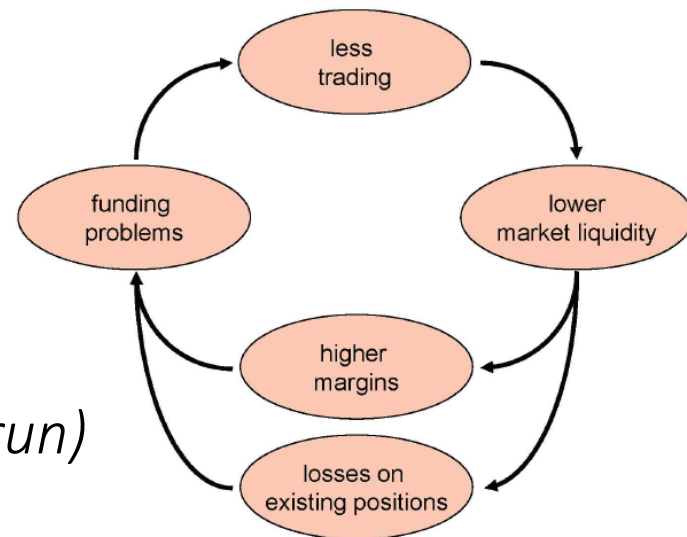
Mean & Leverage Dynamics

- ■ Impulse Response curves:
  - Amplification

- ■ Credit cycle: *(Loss spiral)*
  - Constant volatility exog. shocks
  - ⇒ Countercyclical leverage
  - Underinvestment (second best user problem)

- ■ Leverage cycle: *(Margin spiral/Repo run)*
  - Exogenously time-varying volatility
    ARCH/Scary bad news ⇒ Destabilizing Margins
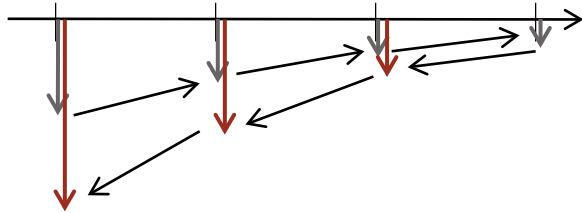 - ⇒ Pro-cyclical leverage

- ■ Evidence: Pro- vs. countercyclical leverage depends on
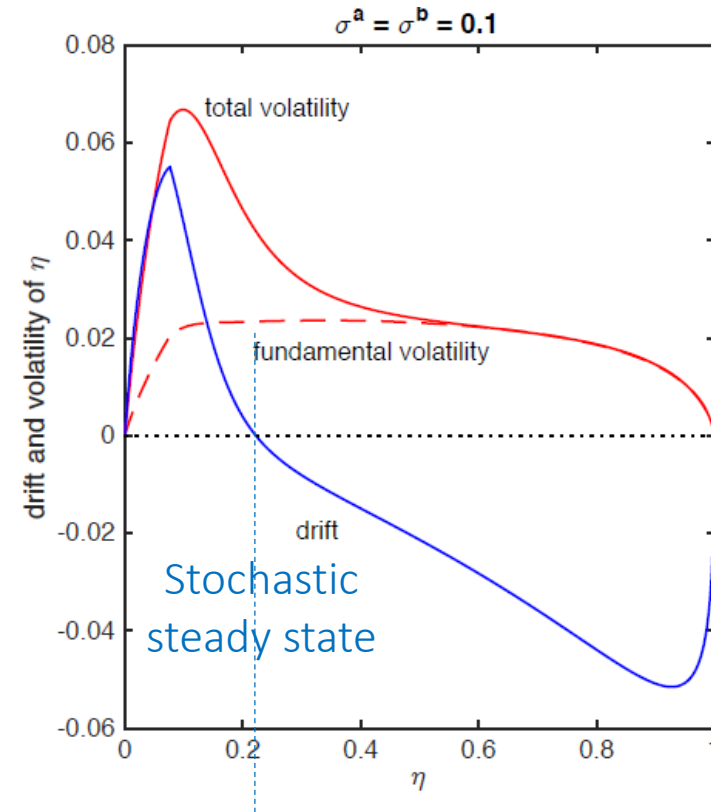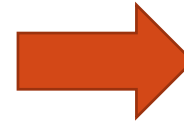 - investor type, book vs. market, new issuance vs. overall

Endogenous Volatility & Volatility Paradox

- **Endogenous Risk/Volatility Dynamics in BruSan**
  - Beyond Impulse responses

  - Input: constant volatility
  - Output: endogenous risk
               time-varying volatility

$\sigma^a = \sigma^b = 0.1$

total volatility

fundamental volatility

drift

Stochastic steady state

⇒Precautionary savings
  - Role for money/safe asset

⇒ **Nonlinearities** in crisis ⇒ endogenous fait tails, skewness

- **Volatility Paradox**
  - Low exogenous (measured) volatility leads to
    high build-up of (hidden) endogenous volatility   (Minksy)

Financial Regulation/Welfare Criterion

- Important macro-prudential tools:
  - Countercyclical buffer, liquidity regulation, LTV, DTI, spillover metric,

- Belief extrapolation (mean dynamics):
  - Paternalistic: lean against price movements (all the time)

- Heterogeneous beliefs
  - JG: Financial innovation causes boom & bust (no welfare loss risk-neutral)
  - Speculation: Tobin tax insufficient?
  - Welfare criterion (BSX)

- Fire-sale externality/spillovers   (CoVaR measure)
- Loosen borrowing constraints *in bad times* (BGG/KM)
- Also control concentration of risk *in good times* (JG/BruSan)

Conclusion

- "Run-up", "Crisis", and "Recovery"-mechanisms
  - Belief-focused (representative + heterogeneous)
  - Friction-focused, where risk is central

- Risk concentration, fire-sales, spillovers, ...

- Paradox of Prudence

- Volatility Paradox
  - Mean-Amplification, Exog. ARCH, Endog. Volatility Dynamics

- Macro/Monetary models with financial sector should include
  - physical investment
  - inside money creation

Extra Slides

Recovery from Crisis/Resilience

- Belief extrapolation: Recovery speed determined by belief persistence
    - Perceived AR(1) coefficient on errors

- BGG/KM: Recovery in tandem with experts' balance sheets

- JG: Recovery with experts' balance sheets & disagreement/volatility
    - Less disagreement $\Rightarrow$ Lower margins $\Rightarrow$ Higher marginal buyer

- BruSan: Length of recovery is stochastic
$\Rightarrow$ additional precautionary savings

Extra Slide: Pro- vs. Counter-cyclical Leverage

- Adrian-Shin (2014): Book vs. market leverage
  - Intermediaries finance new assets with debt ⇒ Procyclical

- Geanakoplos-Pedersen (2014): New vs. old leverage
  - Margins spike in crisis ⇒ Procyclical

- He, Kelly, Manela (2017): Different constraints
  - "Equity constraint": BGG/BruSan, countercyclical leverage
  - "Debt constraint": Leverage cycle, procyclical leverage
  - Book/market leverage positively correlated for dealers
  - Evidence from HFs in Ang et al. (2011)
    - HFs procyclical, investment banks countercyclical