

Macroeconomic Framework for Quantifying Systemic Risk by Zhiguo He and Arvind Krishnamurthy

Discussion by Tobias Adrian

Federal Reserve Bank of New York

The New Normal for Monetary Policy, FRBSF, March 27, 2015

The views expressed here are those of the author and do not necessarily reflect those of the Federal Reserve Bank of New York or the Federal Reserve System

Overview

- ▶ Contribution of the paper
 1. He-Krishnamurthy have been pioneering macro-finance models with intermediaries, building a coherent framework over the years
 2. The current paper is applying this framework to study systemic risk

- ▶ Review
 1. The model
 2. The quantitative results

- ▶ My comments
 1. Funds and banks
 2. Stress testing

Households and Production

► Households

$$\mathbb{E} \left[\int_0^{+\infty} e^{-(\rho t)} \frac{((c_t^y)^{1-\phi} (c_t^h)^\phi)^{1-\gamma}}{1-\gamma} dt \right]$$

► Production

$$Y_t = AK_t$$

$$dK_t/K_t = i_t - \delta dt + \sigma dZ_t$$

$$\Phi(i_t, K_t) = i_t K_t + \frac{\kappa}{2} (i_t - \delta)^2 K_t$$

► Price of capital q_t , price of housing P_t

Intermediaries

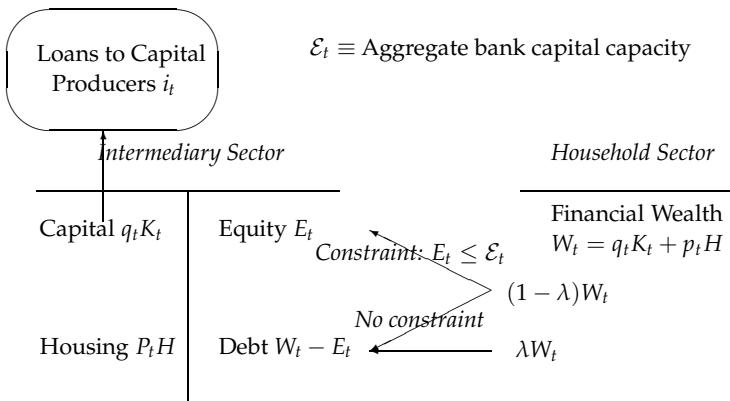
- ▶ Mean-variance preferences, equity capacity constraint $E_t \leq \varepsilon_t$

$$\mathbb{E}[dR_t - r_t dt] + \frac{m}{2} \mathbb{V}[dR_t] \quad \text{s.t.} \quad \frac{d\varepsilon_t}{\varepsilon_t} = m dR_t$$

Intermediaries

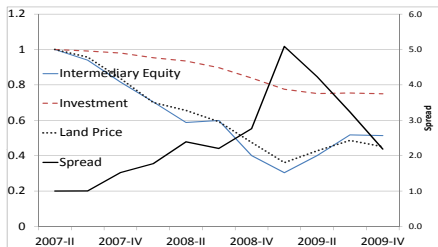
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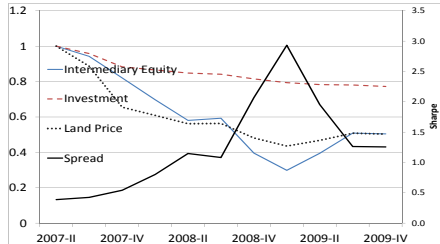


Amplification: Model and Data

(a) Model

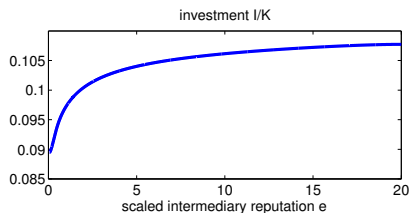
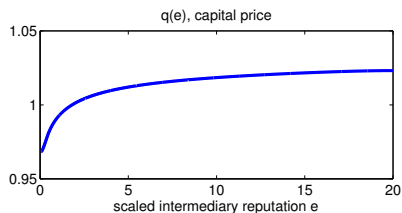
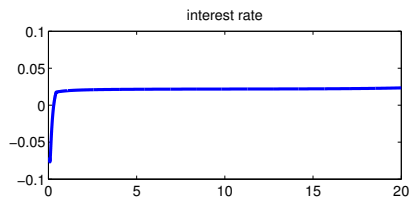
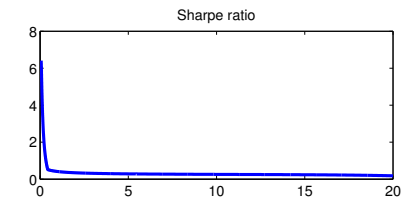


(b) Data



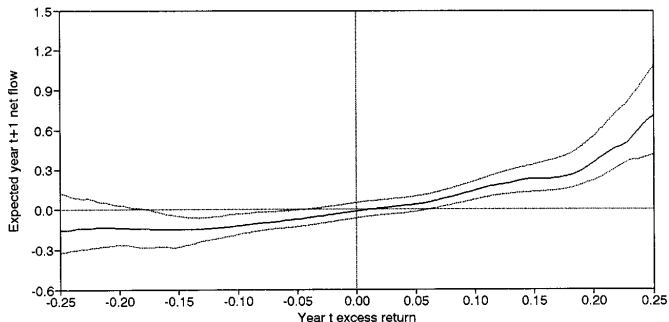
- ▶ Strong amplification effects when the capital constraint binds
- ▶ Captures joint dynamics of intermediary equity, land prices, spreads

Intermediary Wealth Share $e = E/K$ as Key State Variable



- ▶ Leverage inversely related e
- ▶ Systemic risk when capital constraint binds and leverage shoots up

Key Assumption: Capital Constraint is Mutual Fund Flow-Performance Chevalier-Ellison 1997



- ▶ Skin in the game constraint is key amplification mechanism
- ▶ Generates strongly countercyclical leverage

Comments

1. Funds and banks
2. Stress testing

Countercyclical Net Equity Issuance of Banks



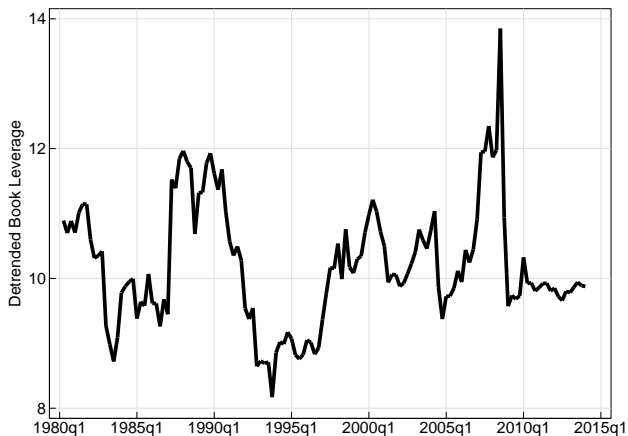
- ▶ Huge issuance in the depth of the crisis
- ▶ Same is true for dealers

Countercyclical $e = E/K$ for Banks



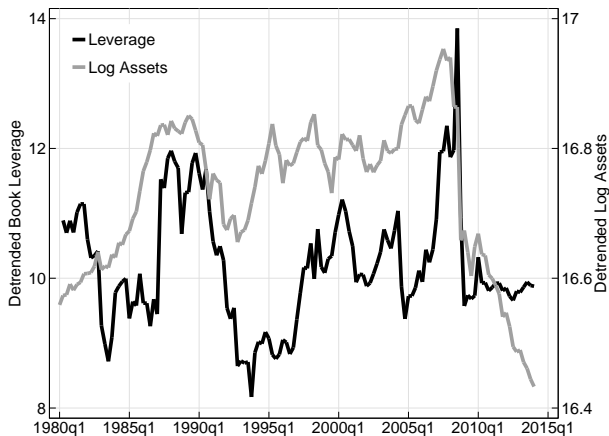
- ▶ Ratio of commercial bank equity to nonfinancial equity declines during expansions and rises sharply during downturns

Procyclical Book Leverage of Banks



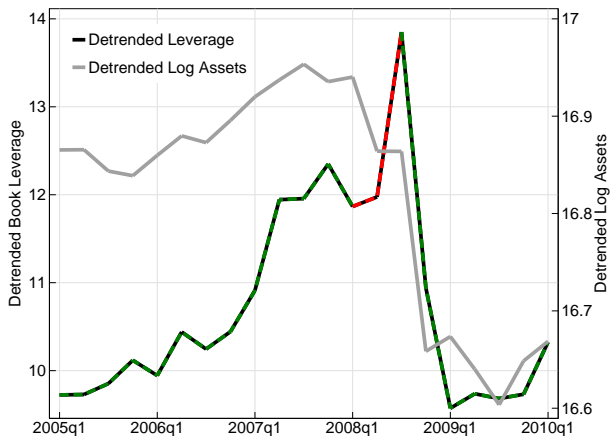
- ▶ Countercyclical equity results in procyclical leverage

Procyclical Book Leverage of Banks

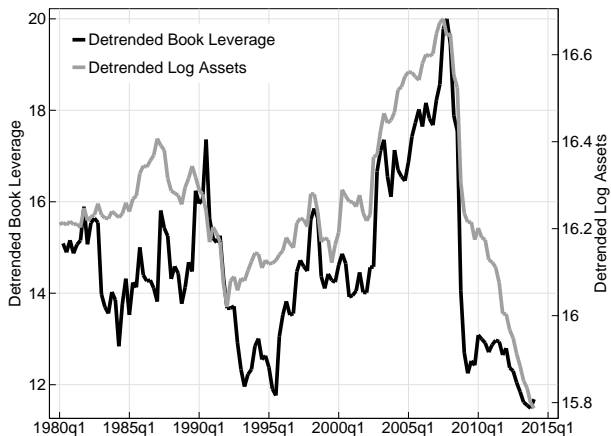


► Adrian-Shin 2008, 2010, 2014

Procyclical Book Leverage of Banks

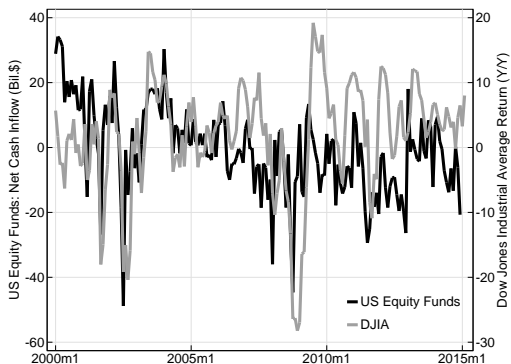


Procyclical Book Leverage of Broker-Dealers



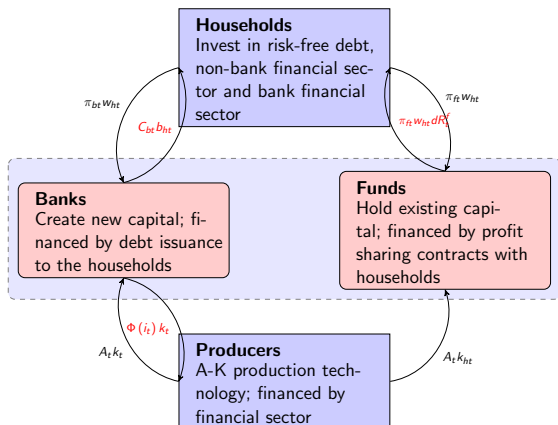
Procyclical Equity of He-Krishnamurthy

- ▶ Countercyclical leverage is due to procyclical equity flows
- ▶ Data strongly supports this for mutual funds



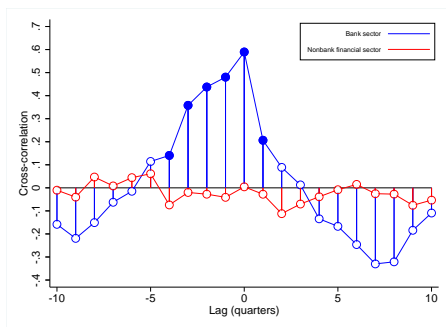
Reconciling Cyclicity of Leverage

Adrian-Boyarchenko 2013

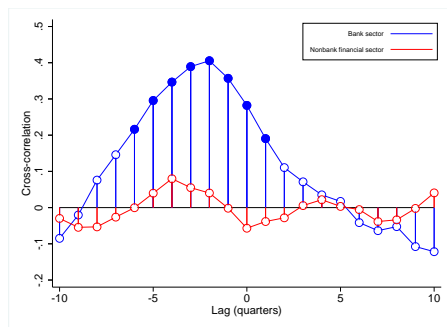


Leverage Growth and Financial Sector Asset Growth

(c) Model

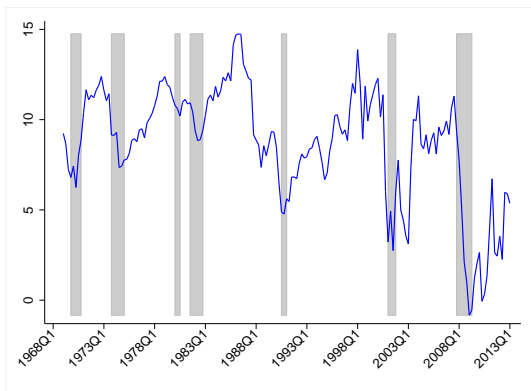


(d) Data



Funds and Banks

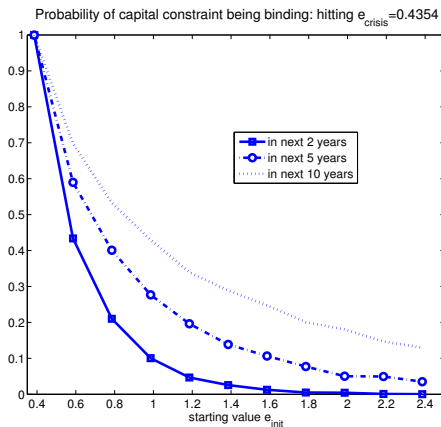
- ▶ He-Krishnamurthy matches the fund sector well
- ▶ Modeling the bank sector requires different constraints
- ▶ This explains procyclicality of financial sector assets



Stress Testing in He-Krishnamurthy

- ▶ Stress test scenario is mapped into underlying shock to capital
- ▶ Stress test assumptions similar to CCAR
 - ▶ 6 quarters of adverse shocks to equity
 - ▶ Cumulatively -30% return on equity
- ▶ Probability of crisis calculated via simulation
- ▶ Model captures feedback effects

Probability of Crisis in He-Krishnamurthy



- ▶ What if capital regulation would be based to stress tests?

Stress Test based Capital Regulation

- ▶ Consider a forward-looking capital constraint

$$\max_{\{i, \beta, k\}} \mathbb{E}_t \left[\int_t^{TD} e^{-\rho(s-t)} w_t(i, \beta, k) ds \right]$$

s.t.

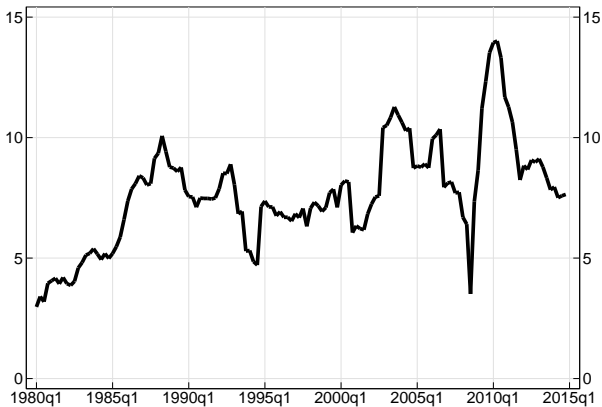
$$\theta_t^{-1} \geq \vartheta \sqrt{\mathbb{E}_t \left[\int_t^T (\sigma_{k,s}^2) ds \right]}$$

- ▶ “Choose optimal capital plan”
- ▶ While VaR constraint is proportional to contemporaneous risk, CCAR makes capital proportional to forward looking risk
- ▶ Equilibrium dynamics change
- ▶ Adrian-Boyarchenko 2012 conjecture that this mitigates procyclicality

Conclusion

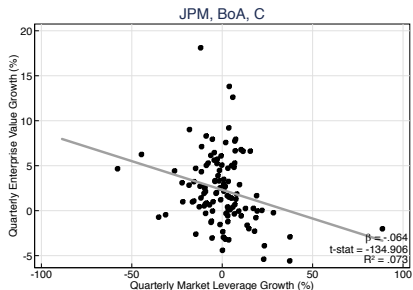
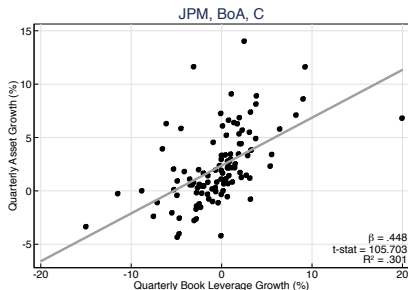
- ▶ He and Krishnamurthy have pioneered models of financial intermediation within a macro context
- ▶ Contribution of this paper is to consider systemic risk
- ▶ My comments
 1. The theory models fund sector, not banking
 - ▶ Banks exhibit procyclical leverage (Adrian-Shin)
 - ▶ Risk based capital constraints can explain procyclicality (Adrian-Boyarchenko)
 2. How do stress tests influence equilibrium outcomes?
 - ▶ Impact of stress tests on equilibrium outcomes is not modeled
 - ▶ Conjecture that CCAR mitigates procyclicality

Countercyclical Dealer Equity

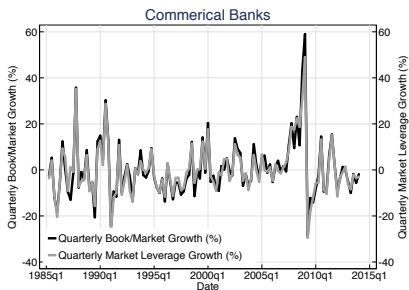


Book Leverage is Proccyclical

Market Leverage is Countercyclical



Market Leverage moves with Book-to-Market



- ▶ The book-to-market ratio is outside of the control of banks
- ▶ Banks manage accounting based ROE and book leverage