

Leverage Across Firms, Banks and Countries

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Facts: Before and During the 2007–2009 Crisis

- ① A low interest rate environment
- ② “New” Banking System: “Originate and Distribute”
 - Loans are pooled, tranced and resold via securitization
 - Securitization created a shadow banking system which funded the traditional system—investment banks raised (short term) funds via RePo's (and commercial paper)
 - Securitization allowed financial sector to increase leverage and led to a large expansion of credit
- ③ Amplification and Contagion
 - Many argue that mortgage crisis turned into a global financial meltdown mainly because of a **leveraged** and interconnected financial system

This paper: International Micro-Data Perspective on Leverage, 2000–2009

- Extensive theoretical literature: changes in leverage can propagate an adverse shock to the real sector
 - ★ Kiyotaki and Moore, 1997; Bernanke and Gertler, 1995; Shin, 2005....
- For the current crisis:
 - ★ Theoretical papers endogenize leverage and the transmission of shocks from financial to real sector (Fostel and Geanakoplos, 2008; Fahri and Tirole, 2010); Brunnermeier (2009)...
 - ★ Leverage is procyclical for top 5 U.S. investment banks and broker-dealers (Adrian and Shin, 2008, 2009)
 - ★ Greenlaw, Hatzius, Kashyap, and Shin, 2008: Similar result for top 5 U.S. commercial banks

What are the Stylized Facts?

No systematic empirical evidence so far on the dynamics of leverage process across different types of banks and firms from different countries before and during the crisis.

- 1 What is the pattern in leverage in the run-up to the crisis?
- 2 Does the de-leveraging after the crisis started differ across different types of banks and different types of firms?
- 3 Do our findings differ across developed countries and emerging markets? If so, do these differences relate to institutional structures and regulatory differences across countries?

Main Finding

Excessive risk taking in the financial sector before the crisis was not easily detectable in the aggregate data

Why?

- Pre-crisis visible increases in leverage was mainly limited to investment banks in developed countries
- Large banks also took large risks although this was mainly visible after the crises started
- For many banks, the risk involved the quality rather than the amount of assets, which became apparent only during the crisis
- Banks in emerging countries with tighter regulation invested less aggressively and were able to maintain their leverage ratios during the crisis.

Outline

- Data
- Figures: Dynamic Patterns in Leverage Ratio (2000–2009)
 - ★ For U.S. and Europe banks (includes financial firms)
 - ★ For U.S. and Europe non-financial firms (in paper, not in presentation today)
- Regressions: Bank-level regression with a broader set of countries (includes emerging markets)

Our Aim and Data

To be geographically expansive, systematic and quantitative:

- We want to avoid conclusions based on a limited set of countries.
- We utilize the most comprehensive and harmonized world-wide firm/establishment/bank level data set: ORBIS from Bureau van Dijk, 1999–2009.
- An umbrella product that covers the other well-known databases such as AMADEUS, ZEPHYR, BANKSCOPE, and OSIRIS.
 - 35,000+ banks (BANKSCOPE) from 150+ countries
 - 55+ million public and private companies from 100+ countries (AMADEUS, ORBIS)
 - 60,000+ publicly quoted companies worldwide (OSIRIS)

International Comparability and Our Focus

Data is regulatory, obtained from official registries:

- For banks, we have a universal globally standardized format that is transparent and internationally comparable (Fitch universal system).
 - ★ Fitch devised a single spreadsheet for the entire universe of banks by placing all the accounting systems on the same basis.
- Banks: Includes hedge funds, broker-dealers..from 70 countries (25,000 banks, 200,000 observations)
- Firms: Large (> 150 employee) non-financial firms from the U.S. and 31 European countries (100,000 firms, 1.5 million observations)
 - ★ Coverage varies due to country differences in reporting standards

Leverage Measures

- Assets/Equity
- Off-balance-sheet items/Assets
 - ★ Obligations that are contingent liabilities of a bank; do not appear on its balance sheet.
 - Managed Securitized Assets Reported Off-Balance Sheet (only few banks report)
 - Acceptances and Documentary Credits Reported Off-Balance Sheet (only few banks report)
 - Other Off-Balance Sheet Exposure to Securitization (only few report)
 - Guarantees (all except investment banks report)
 - Committed Credit Lines (all except investment banks report)

“Aggregate” and “aggregated” data

We briefly show aggregate Flow of Funds data (for comparison, not new)

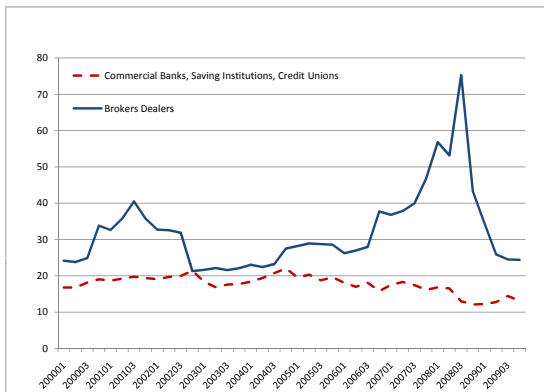
And **aggregated** (by us) data

Conceptual difference: Flow of Funds net out banks' claims on each other

U.S. Financial Sector, Leverage: Aggregate Flow of Funds

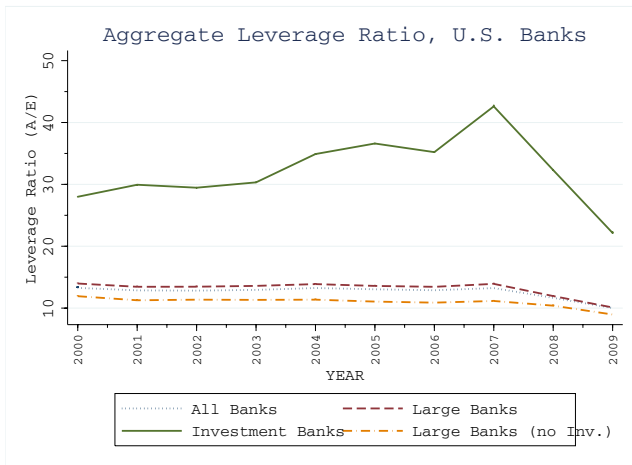
Aggregate data shows a run-up in leverage of investment banks between 2004–2008 and then a sharp de-leveraging

- ★ SEC changes net capital rule for investment banks; no cap on leverage, April 28, 2004



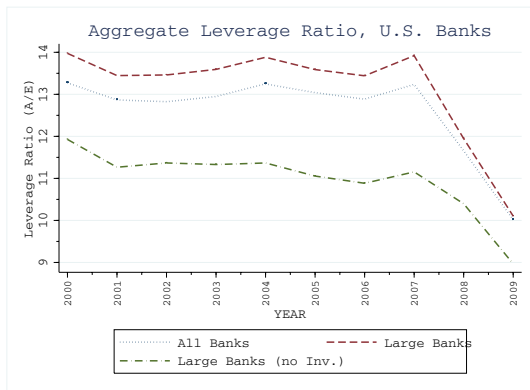
U.S. Banks and Financial Firms, Leverage: Aggregated BANKSCOPE

“Aggregated” data shows a similar pattern



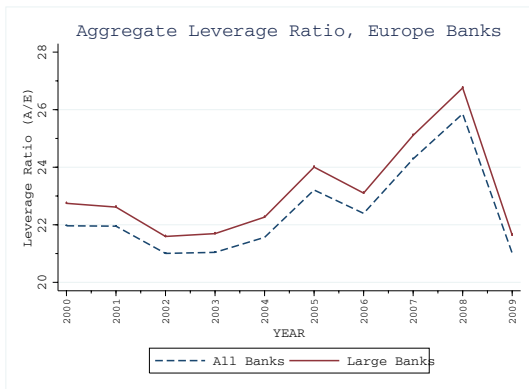
U.S. Banks and Financial Firms, Leverage excluding Investment Banks: Aggregated BANKSCOPE

De-leveraging is visible for large banks although leverage did not increase in the run-up to crisis



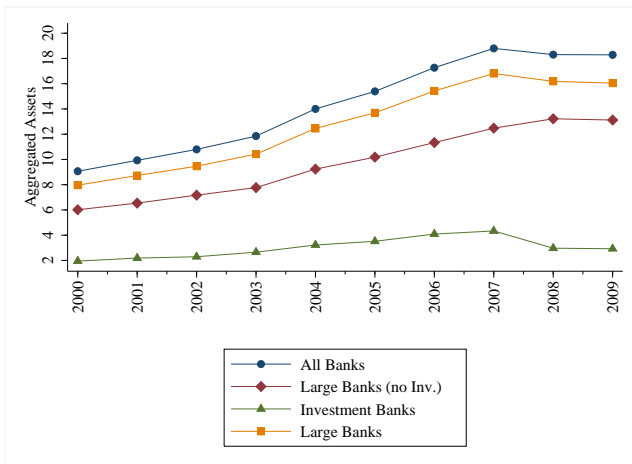
Europe Banks and Financial Firms, Leverage: Aggregated BANKSCOPE

In Europe, large banks increase leverage in the run-up and then a sharp de-leveraging (includes investment banks)



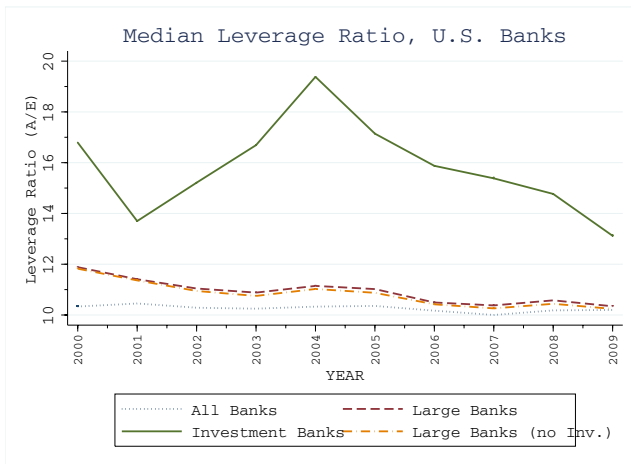
U.S. Banks Assets: Aggregated BANKSCOPE

De-leveraging is due to decrease in assets compared to equity in the U.S., especially for investment banks



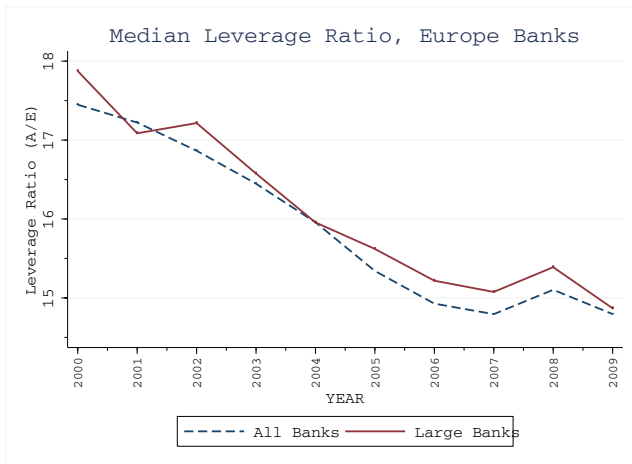
U.S. Banks and Financial Firms, Leverage: Typical Bank

Median U.S. bank has a declining leverage ratio in general



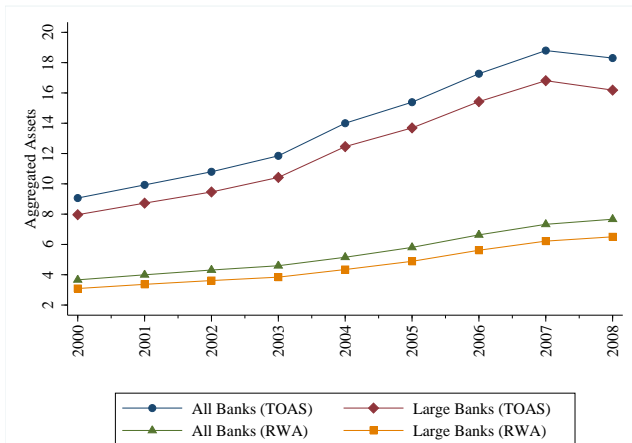
Europe Banks and Financial Firms, Leverage: Typical Bank

Same in Europe with a higher leverage ratio to start with



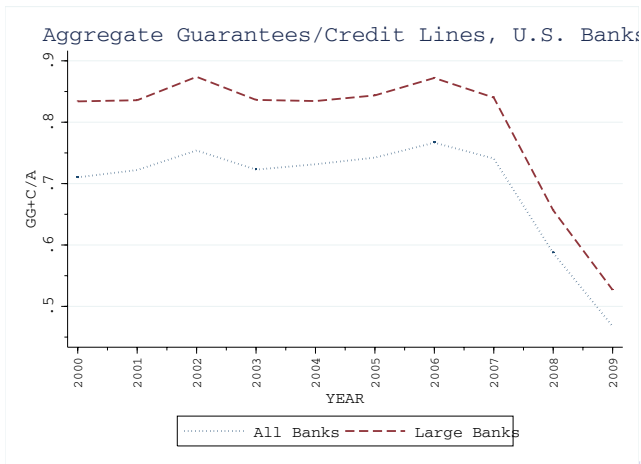
Did growth of risk weighted assets signal recession? No.

Regulation is based on risk-weighted assets. Weight 0 for government assets, low for liabilities of other banks and collateralized mortgages. High for personal and industrial loans.



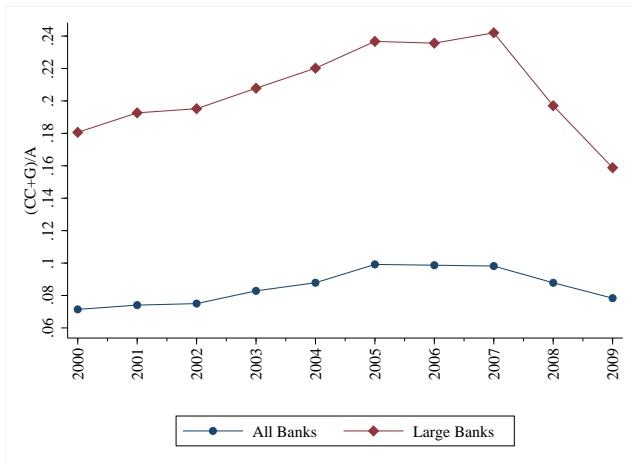
U.S. Banks and Financial Firms, Off-Balance Sheet Leverage: Aggregated BANKSCOPE

Guarantees and credit lines large—but not increasing before crisis



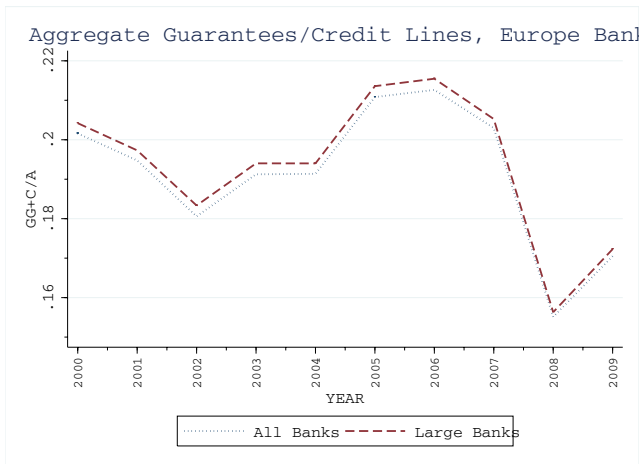
Financial Sector Off-Balance Sheet Items: Typical Bank

Bankscope Micro Data, Median: US



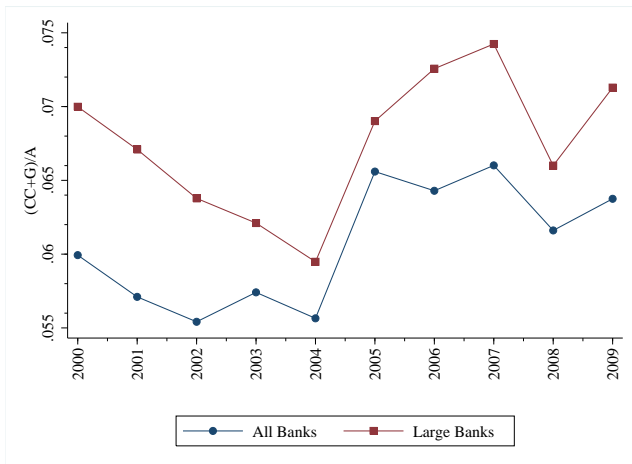
European Banks and Financial Firms, Off-Balance Sheet Leverage: Aggregated BANKSCOPE

Total guarantees and credit lines were much smaller in Europe



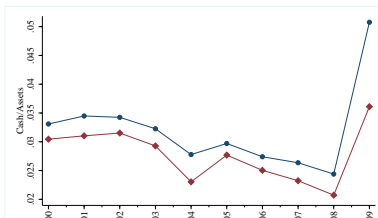
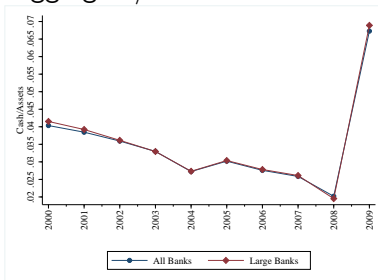
Financial Sector Off-Balance Sheet Items: Typical Bank

Bankscope Micro Data, Median: Europe

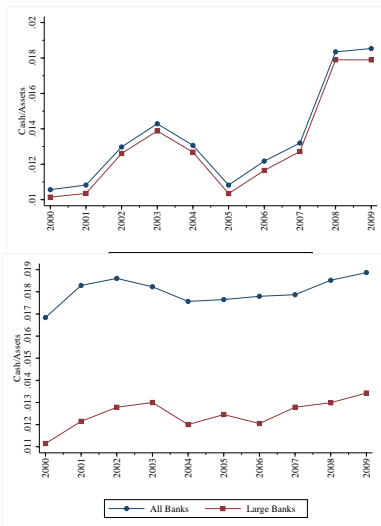


Cash holdings: Interbank lending broke down in crisis

ORBIS Data, Aggregate/Median Cash Holdings, US Banks



Europe, Aggregate/Median Cash to Assets



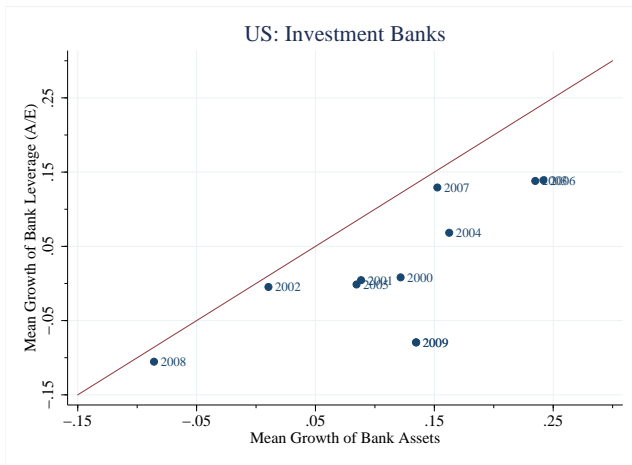
Is Leverage Procyclical?

Adrian and Shin points out that increase in asset values automatically leads to decline in leverage, but banks may target leverage. They find that investment banks have procyclical leverage.

We found no pattern in leverage for smaller banks. (Not plotted.)

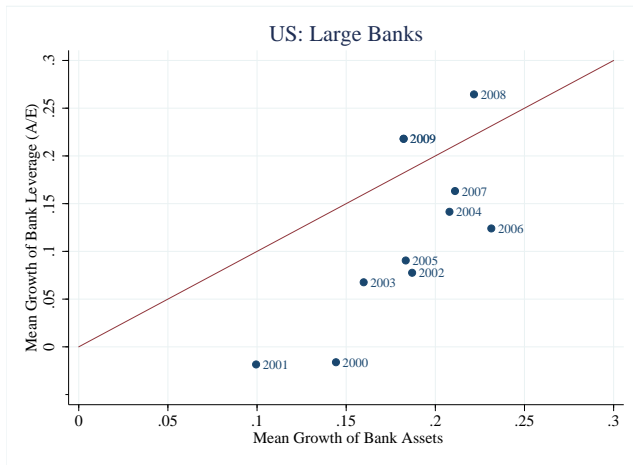
Procyclical Leverage: Average U.S. Investment Bank

Positive correlation between average growth of leverage and average growth of assets (Adrian-Shin finding)



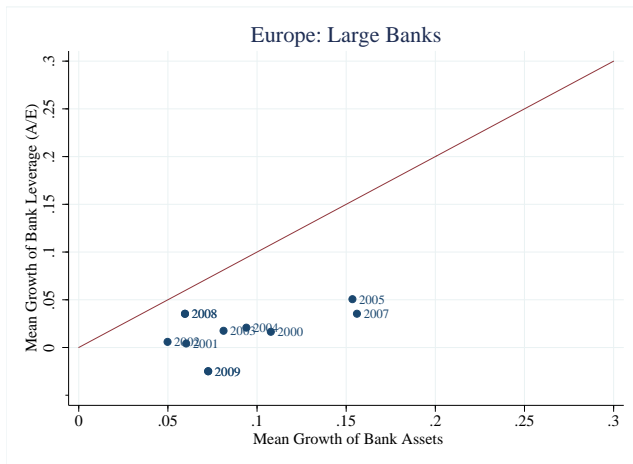
Procyclical Leverage: Average U.S. Large Bank

Similar positive correlation also for large banks excluding investment banks!



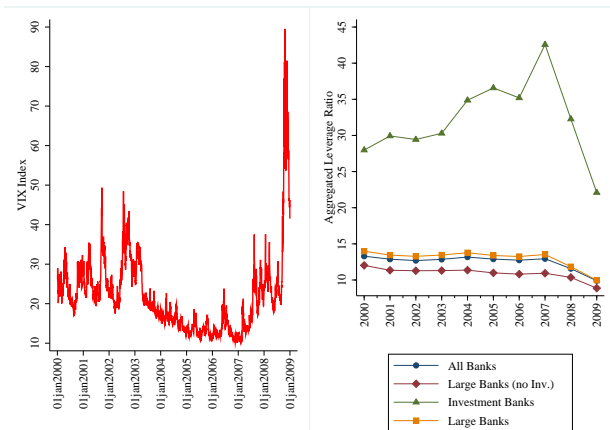
Procyclical Leverage: Average European Large Bank

Weaker pattern in Europe



Some evidence that investment banks targeted constant risk exposure (Adrian-Shin argue)

Figure: Financial Sector Leverage and VIX



International Comparison

We estimate the relation using 200,000 bank level observations

$$\text{Leverage}_{it} = \mu_i + \sum_t \gamma_t D_t + \sum_t \beta_t D_t * X_{c(i)}$$

Permanent differences and country-level policy changes absorbed through bank, and country-time fixed effects

- Previous version included lagged size, collateral, and profitability—what is exogenous?
- β coefficient captures different dynamics in leverage in different regulatory environments
 - ★ Better Supervision
 - ★ Monitoring

Bank Leverage, 2000–2008, World Sample

Dependent Variable:	Bank Leverage		
Bank Sample Regulatory/Institutional (R/I) Framework	All Supervision Index	All Monitoring Index	Large Monitoring Index
2001 × R/I Framework	0.012** (0.005)	-0.005* (0.003)	-0.007 (0.005)
2002 × R/I Framework	0.006 (0.006)	-0.011*** (0.003)	-0.006 (0.006)
2003 × R/I Framework	-0.010 (0.007)	-0.014*** (0.004)	0.001 (0.006)
2004 × R/I Framework	-0.003 (0.007)	-0.011*** (0.004)	-0.002 (0.007)
2005 × R/I Framework	-0.013* (0.008)	-0.011** (0.004)	-0.009 (0.009)
2006 × R/I Framework	-0.048*** (0.009)	-0.021*** (0.005)	-0.017 (0.011)
2007 × R/I Framework	-0.054*** (0.009)	-0.024*** (0.005)	-0.016 (0.011)
2008 × R/I Framework	-0.011 (0.01)	-0.009 (0.007)	0.007 (0.012)
2009 × R/I Framework	0.291*** (0.056)	0.140*** (0.051)	0.073*** (0.019)
Bank dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
R^2	0.008	0.008	0.015
N	172344	136360	22116

Conclusion: Non-Financial Firms

- There was no increase in leverage for non-financial firms in the run-up to the crisis.
- There was no visible de-leveraging until end of 2009.
- Leverage was acyclical for these firms (no relation between asset growth and leverage growth)
- Typical empirical models of leverage fit well before and during the crisis; size and collateral are positively significant determinants and profitability is a negatively significant determinant (not shown)

Conclusion: Banks and Financial Firms

- In the U.S., investment banks increased leverage in the run-up to the crisis and show a procyclical pattern
- In the U.S., large non-investment banks did not seem to increase leverage in the run-up but show strong procyclicality on average (some big banks did increase leverage)
- In Europe, large banks increased leverage in the run-up but do not exhibit strong procyclicality on average (giant banks drive the aggregate)

Conclusion: International Comparison

- Banks in countries with tighter regulation decreased leverage much less after the crisis hit than countries with loose regulation
- Interpretation: Assets values did not tank as much in tightly regulated countries
- A lot of risk were related to asset quality rather than quantity and only became visible during the crisis
- This evidence is more tentative (sample sizes, robustness)