What have we learned from the data about constraints of financial intermediaries?

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Introduction

- Most banking models: banks max equity value s.t. leverage constraints
  - Literature evolution
    - Bernanke-Gertler / Kiyotaki-Moore (net-worth and/or collateral matters)
    - Debt financing constraints motivated by special roles of banks: e.g., Gorton & Pennacchi (1990)
    - Intermediary AP w/ constraints on equity issuance: e.g., He & Krishnamurthy (2012, 2013), Brunnermeier & Sannikov (2014)
  - Regulation: e.g., Begenau (2020); Begenau and Landvoigt (Forthcoming); Begenau, Bigio, Majerovitz, and Vierya (WP); Corbae and D'Erasmo (2021); Davydiuk (WP)

- Bank leverage levels stand out by being very high
  - Lack of market discipline due to gov. guarantees/ deposit insur.
  - Synergies between assets and liabilities
  - Bank liabilities ≈ safe assets that carry convenience yield

This talk

- Which constraints matter for banks and for which banking activities?
  - Informs us about how to set up bank problem
- Where I am heading:
  - Measurement of book vs market values matters
  - Implications for
    - bank leverage dynamics
    - what risks we can infer from banking data
    - improving design of regulatory constraints

Banks issue equity - especially during crises

- Many models assume that banks cannot issue equity → data: banks issue

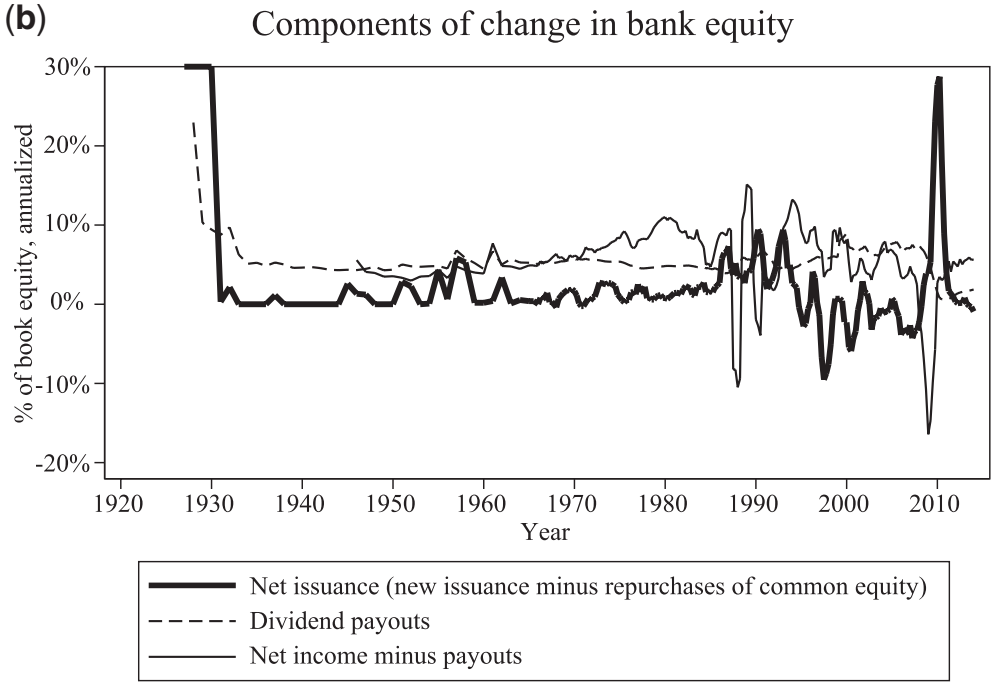


Figure 3
Credit expansion and bank equity
Panel A plots bank credit expansion (defined as the previous year's change in the ratio of bank credit to GDP) over time, along with alternative measures of the credit cycle, such as the change in total credit to GDP and change in aggregate bank loans to GDP. Panel B plots net issuance of common equity, dividends, and net income minus payouts (as a percentage of book equity), aggregated over the twenty largest U.S. commercial banks.

Baron (2020)

Which bank constraints matter for asset prices?

- Empirical AP facts consistent w/ intmd. AP interpreting "equity" as inside capital s.t. "slow-moving capital" dynamics (e.g., Duffie, 2010)
  - E.g., He, Kelly, and Manela (2017), Siriwardane (2019), Haddad and Muir (2021)
- Banks' trading activities and asset prices affected by post-crisis regulation
  - e.g., Anderson, Duffie, and Song (2019), Copeland, Duffie, and Yan (2021), Du, Tepper, and Verdelhan (2018), Du, Hebert, and Huber (2019), Falato, Iercosan, Zikes (2021), Siriwardane, Sunderam, and Wallen (2021)

Which constraints matter for traditional banking activities

- What explains depository banks' lending and leverage decisions?
- Most banking models:
  - bank maximizes shareholder value choosing leverage (and loans) subject to constraint
- Market leverage $\frac{D+ME}{ME}$ constraint

$$\text{Market Equity} \geq \xi^M \text{Assets}$$

$$\Leftrightarrow$$

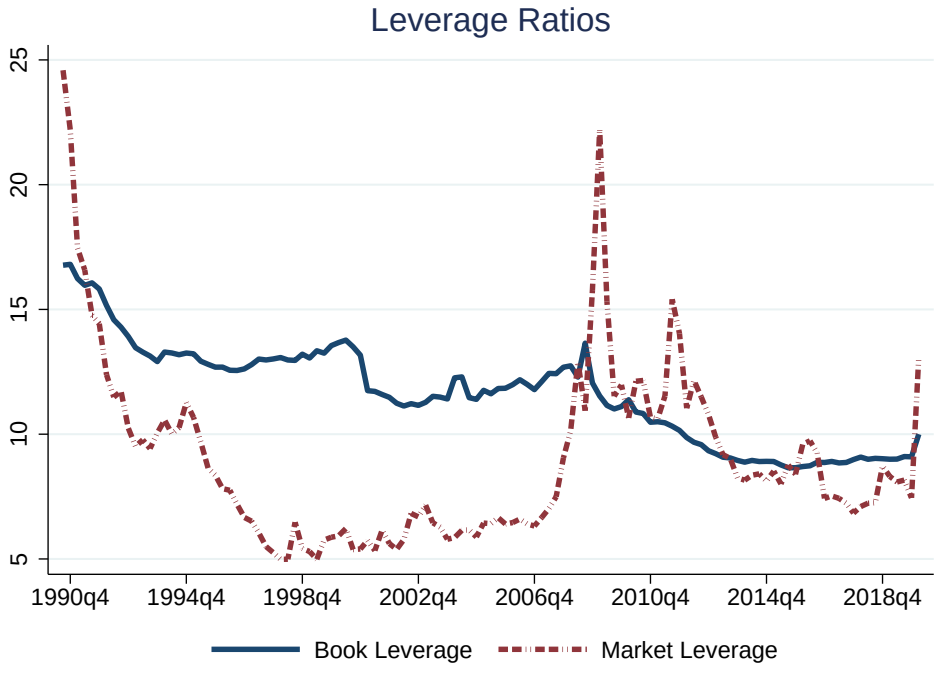
$$\frac{1}{\xi^M} \geq \text{Market Leverage}$$

(market equity includes insides + outside equity)

- Or book leverage $\frac{D+BE}{BE}$ constraint

$$\frac{1}{\xi^B} \geq \text{Book Leverage}$$

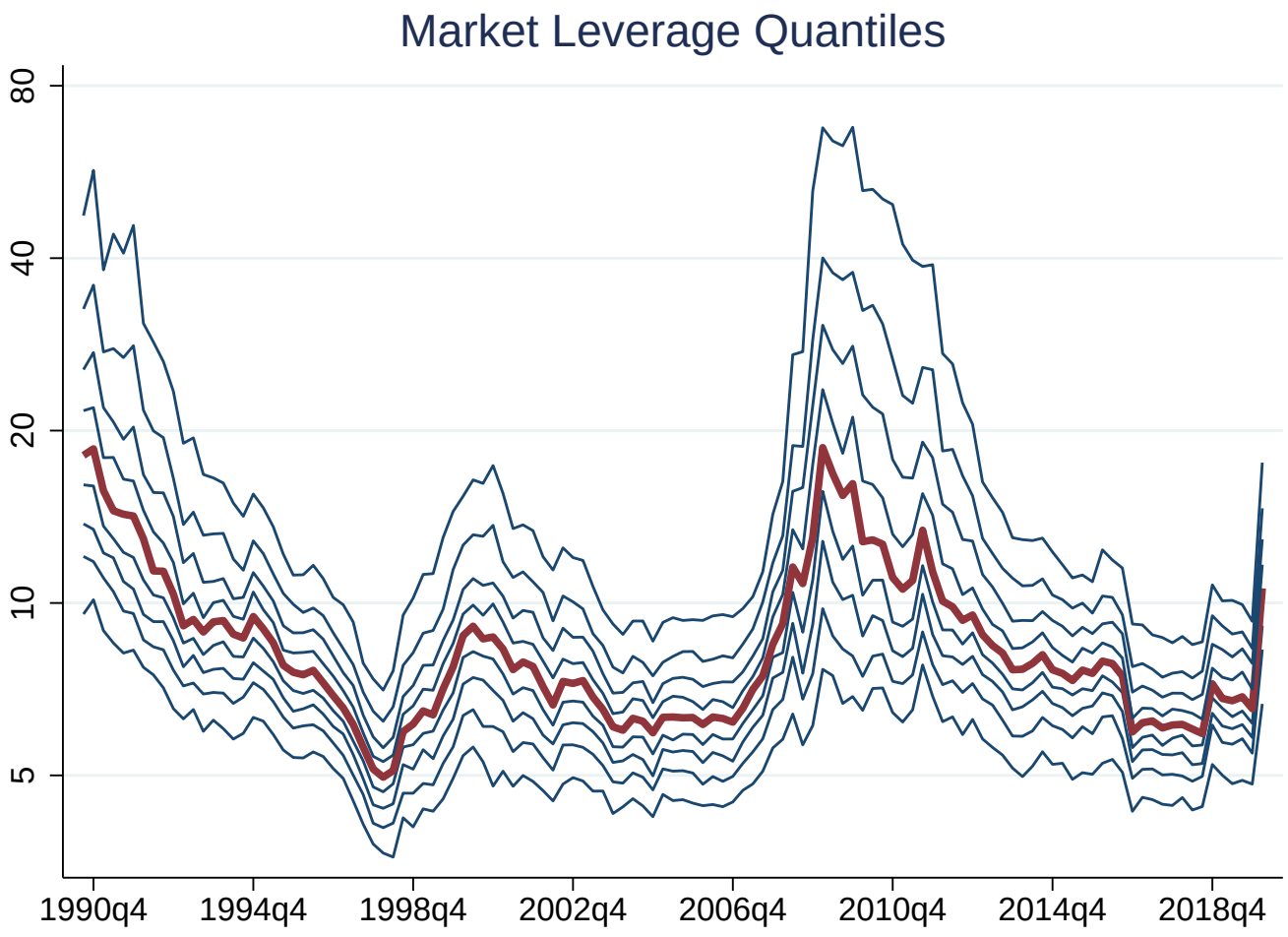
Aggregate bank leverage



Begenau, Bigio, Majerovitz, and Vieyra (WP 2021)

- Data from bank holding company filings
- Countercyclical market leverage
- Weakly procyclical book leverage

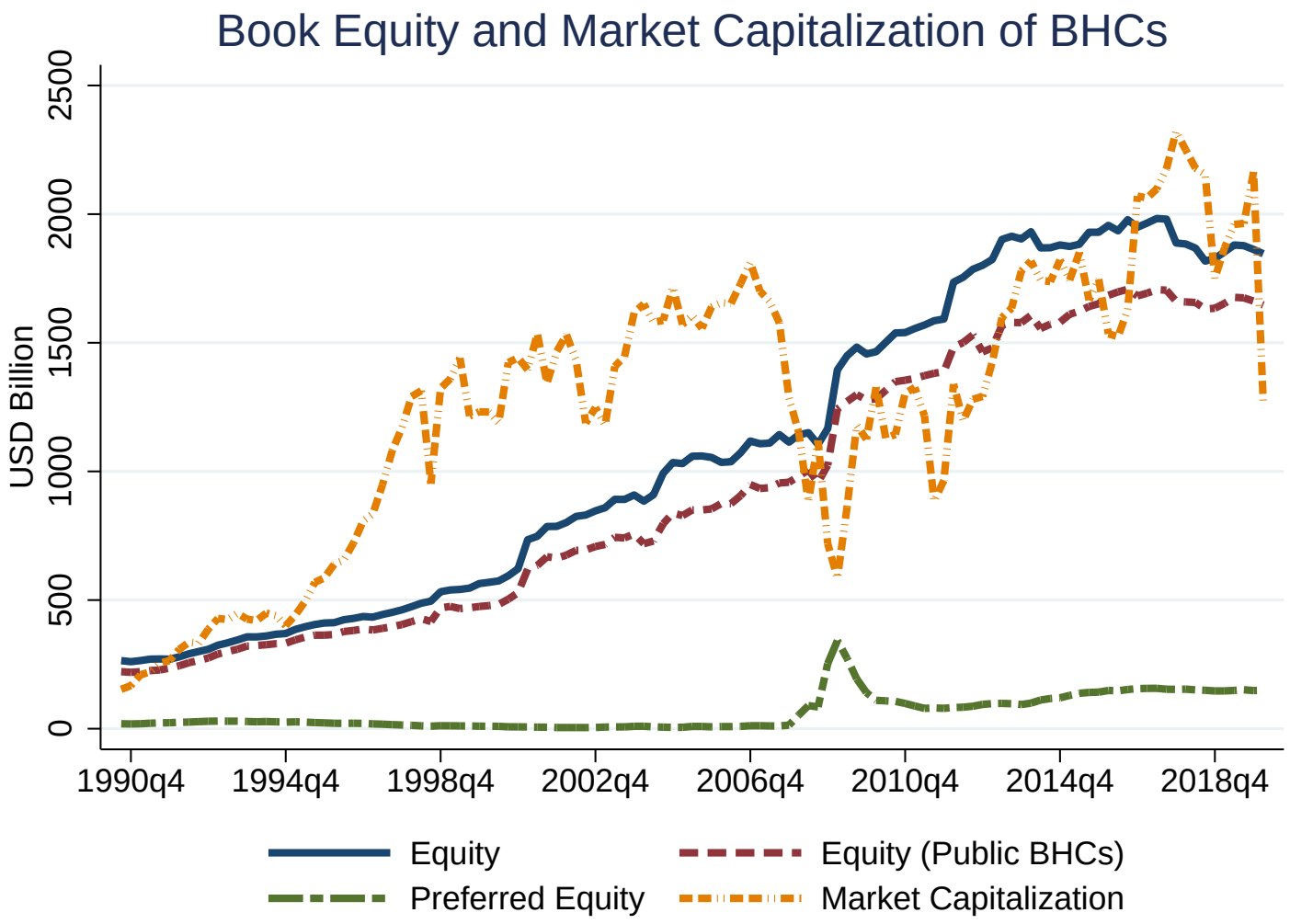
Countercyclical XS market-leverage dispersion



Begenau, Bigio, Majerovitz, and Vieyra (WP 2021)

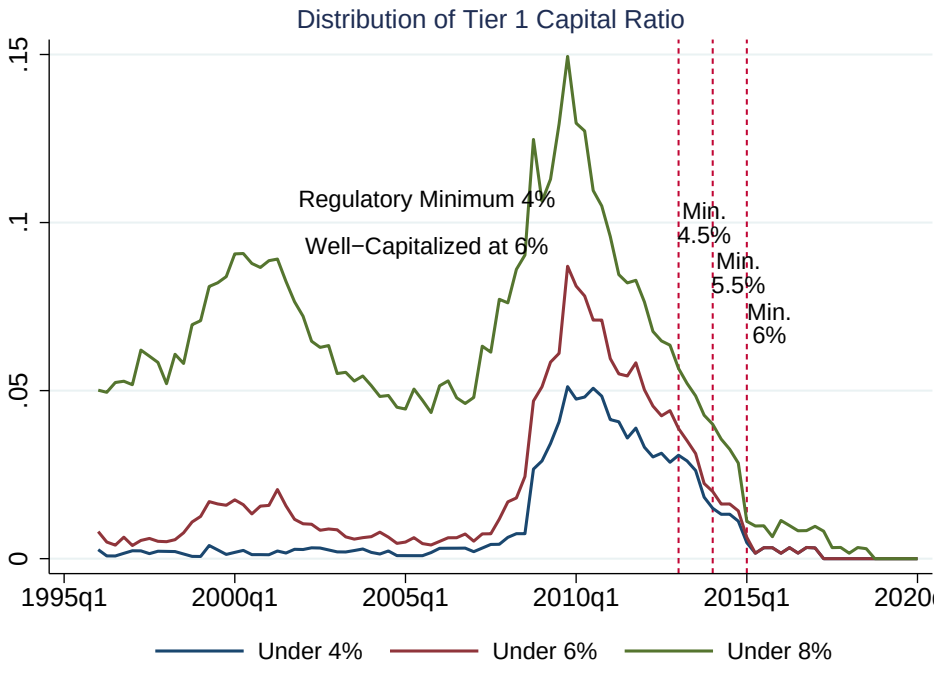
- Binding market leverage constraints unlikely → predict procyclical XS

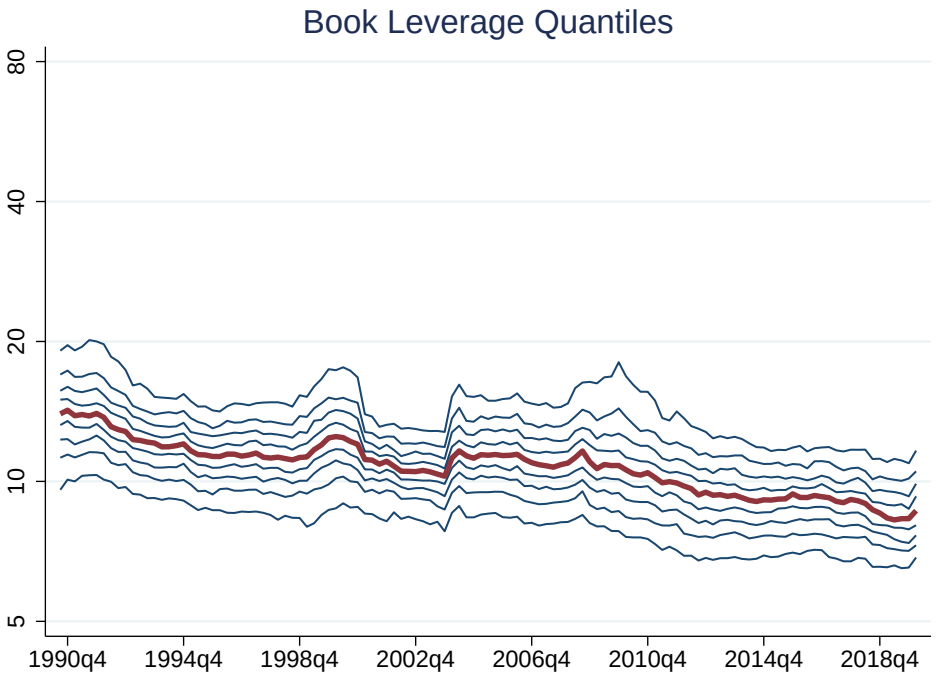
Most regulatory constraints rely on book equity



- Suggests difficult to discern risk exposure + realizations from book values (as implied by book value reg. constraints)

Few banks came close to violate reg. constraints





Begenau, Bigio, Majerovitz, and Vieyra (WP 2021)

- Few banks violated their regulatory Tier 1 capital constraint
- XS leverage distribution compressed compared to ME

Regulatory constraints are mostly slack, do they not matter?

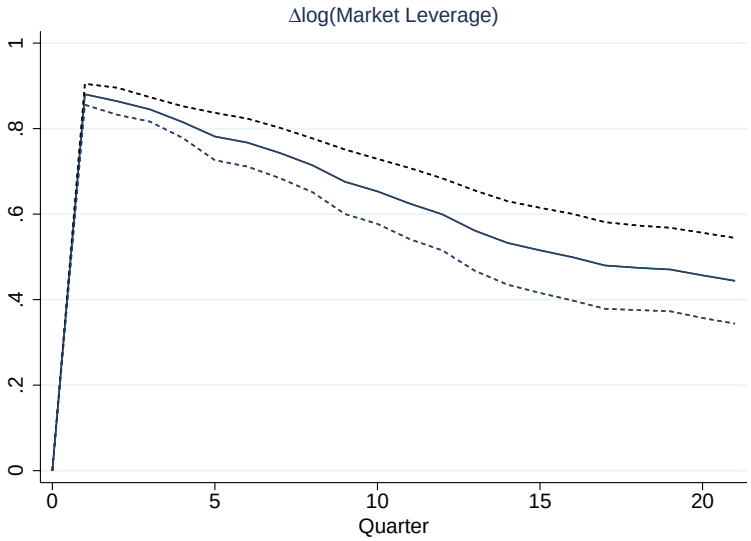
- Trading activity & asset prices sensitive to reg. constraints
  - E.g., Anderson, Duffie, and Song (2019), Copeland, Duffie, and Yan (2021), Du, Tepper, and Verdelhan (2018), Du, Hebert, and Huber (2019), Falato, Iercosan, Zikes (2021), Siriwardane, Sunderam, and Wallen (2021)
  - Trading constraints in market values & s.t. leverage constraints

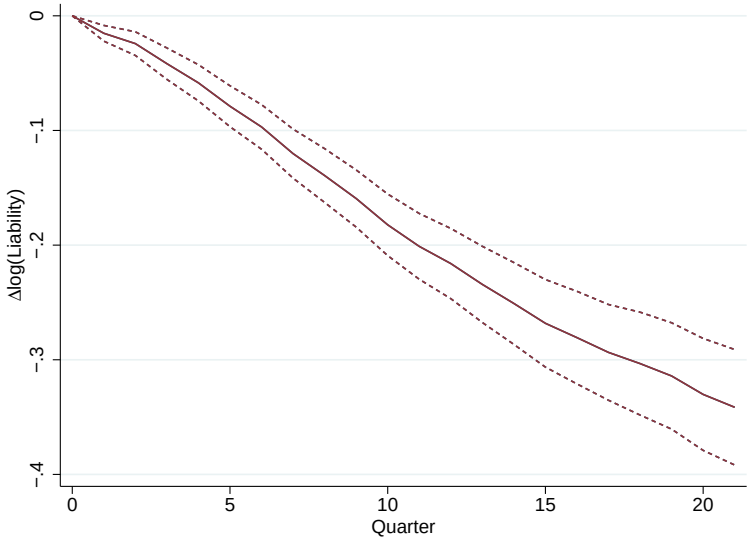
- Most other bank activities (e.g., loans + htm sec) s.t. book reg. constraints
  - Not-marking to market & discretion in valuation allow banks to evade constraint
    E.g,. Blattner, Farinha, and Rebelo (Forthcoming)
  - Reg. constraints shape bank lending decision ("extend and pretend")
    E.g,. Acharya, Eisert, Eufinger, and Hirsch (2019)

How book value constraints shape banks' leverage dynamics

Begenau, Bigio, Majerovitz, and Vieyra: "A Q-Theory of Banks"

- Prior literature: banks have target leverage (e.g., Gropp & Heider, 2010)
- Stylized facts about bank dynamics to i.i.d neg. net-worth shocks (IRF)
  - Market leverage increases mechanically on impact & reverts slowly
  - Balance sheet size responds very slowly





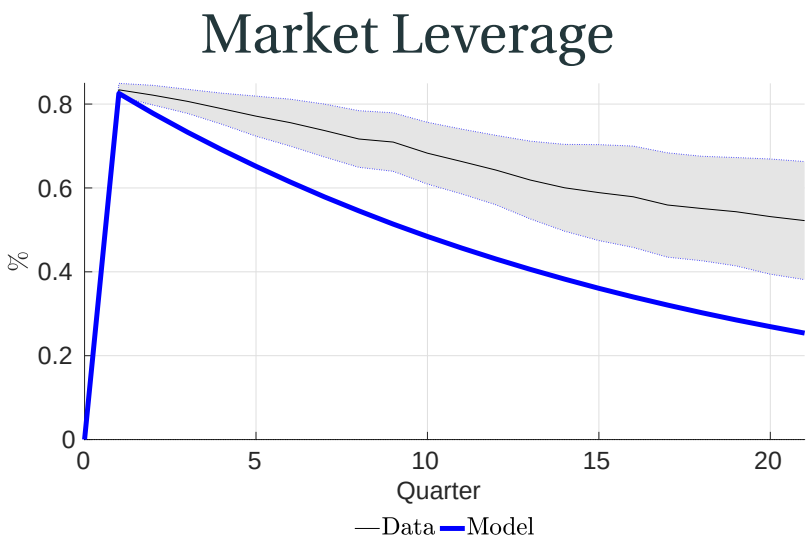
Regulatory constraints + not-marked-to-market accounting shape banks' leverage dynamics

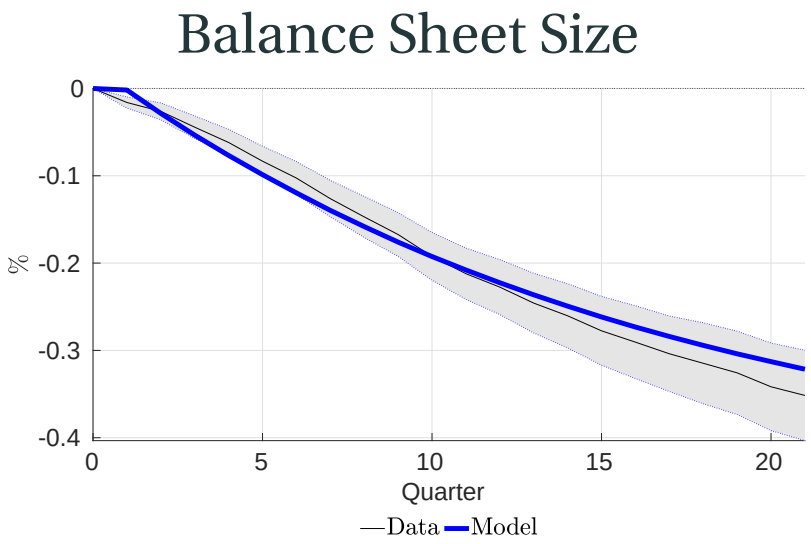
Begenau, Bigio, Majerovitz, and Vieyra: "A Q-Theory of Banks"

- Interpret facts through bank optimization model
  - Key assumption: differences b/w market value and book value accounting
  - Lending and leverage s.t. book & market leverage constraints
  - Loans risky due to default shocks that are not marked to market
- Model mechanism for slow leverage adjustment:
  - banks keep equity buffer above reg. constraint
  - default shocks push banks towards constraint
  - banks can "return to safety" by selling off loans, reducing leverage
  - by hiding defaults from regulators, less loans need to be sold off to avoid violating constraint
  - leads to slower delevering process in response to bad news
- Estimate model parameters with panel of bank holding companies (1990-2020)

Regulatory constraints + not-marked-to-market accounting account for banks' leverage dynamics

Begenau, Bigio, Majerovitz, and Vieyra: "A Q-Theory of Banks"





- Model accounts for slow adjustment w/ only accounting friction + reg. constraint

What are better approaches to measure risk for reg. constraints?

- Combine bank position data w/ price data to create a synthetic bank (e.g,. Begenau, Schneider, and Piazzesi, 2020)
- Standard valuation tool in asset pricing (replicating portfolio)
- Assumes *close* alternative to bank position exists
- Helpful: factor structure in various financial products
- Factors capture common variation across a range of securities
    - E.g., 93% of bond yield variation is explained by a single factor
    - Single factor could be any bond, say 2-year U.S. Treasury
- A replicating portfolio is a (e.g,. linear) combination of factors that results in the same cash flows (payoffs) and risk-profiles as the position that is to be replicated

Steps - Begenau, Piazzesi and Schneider 2020

1. Study and classify balance sheet positions, i.e., how many $ of 3-year term AAA-rated business loan does the bank hold?

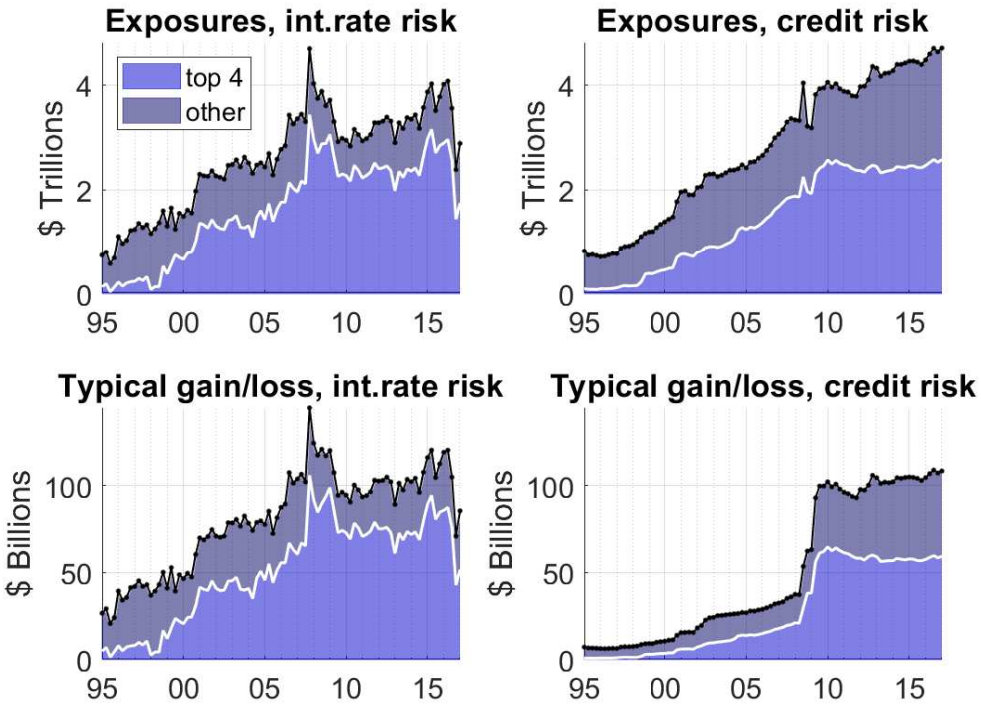
2. What are the associated expected payoffs at each future quarter? This maps balance sheet item into positions of zero-coupon portfolios

3. Decide with which factors to represent each position in the zero-coupon portfolio (e.g., interest rate risk, credit risk)

4. Find factor loadings on various fixed income securities, i.e., if I had 1$ of 10-year zero-coupon U.S. treasury bond, how many dollars of the interest rate and credit factor do I need to replicate the position's expected value change

5. Find dollar position amount in replicating portfolio by multiplying $ position in zero-coupon portfolios with factor loadings

Aggregate exposures across banks

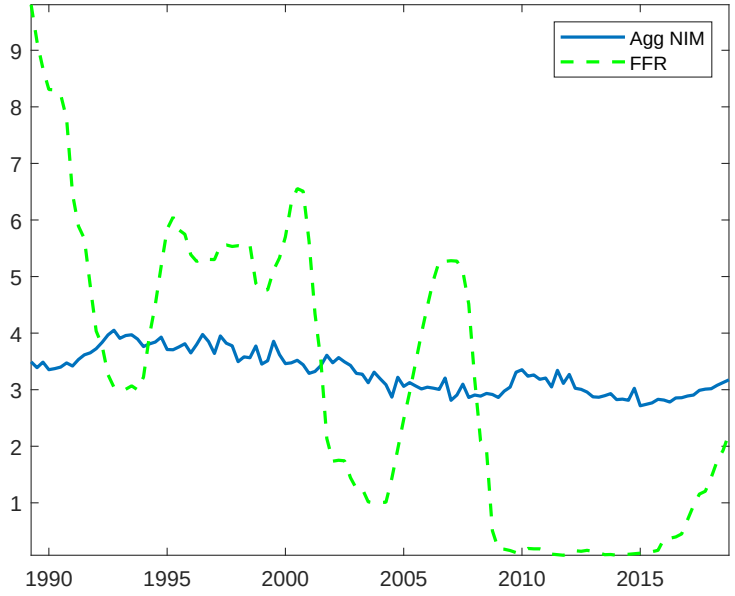


Begenau, Schneider, and Piazzesi (2020)

- Replicating portfolio approach is
  - aggregates across position and institutions
  - more transparent as it's benchmarked against commonly observable factors
  - highly flexible, i.e., can extend by factors, improve with better data

Income rates are not useful measures of risks

- Few studies use income based measures to assess bank risk exposure
- Ex: Net interest margin = $\frac{\text{Interest Income - Interest Expense}}{\text{Book Assets}}$ very stable in Agg. & XS



- Stable NIM ≠ no interest rate risk exposure (Begenau & Stafford, 2021)
  - bank income mainly from fixed-income position → predictable & stable
  - risk source for interest rate sensitive instruments are discount rate shocks

Key points

- Evidence consistent w/ importance of reg. constraints for market & consumer facing banking activities
- Market based activities constrained by market value reg. constraints & inside equity
- Banks appear not constrained by book value based constraints but not-marking to market gives banks discretion to obfuscate exposures
- Regulatory constraints + not-marking to market
  - alter banks' loan issuance decisions
  - slow down banks' leverage adjustment to shocks
  - imply dubious risk inferences from book values

Implication for Future Research

- Risk measurement of banks
  - combining market data with positions data to improve risk assessment
  - better data can improve precision of replicating portfolio approach
- Models in which intermediaries are not marking-to-market
  - Interaction of regulatory constraints and reporting incentives
  - Quantitative assessement of effects from different reporting standards
  - Not just important for banks, also for private equity firms
    private equity funds share some of the risk-measurement issues as banks
  - Optimal regulatory design
- Do investors value when intermediaries don't mark their assets to market?
  - And if yes why?
  - Lustig & Ghandi (2015): neither credit nor interest rate risk exposures matter economically in bank stock return regressions