The Limits of Shadow Banks

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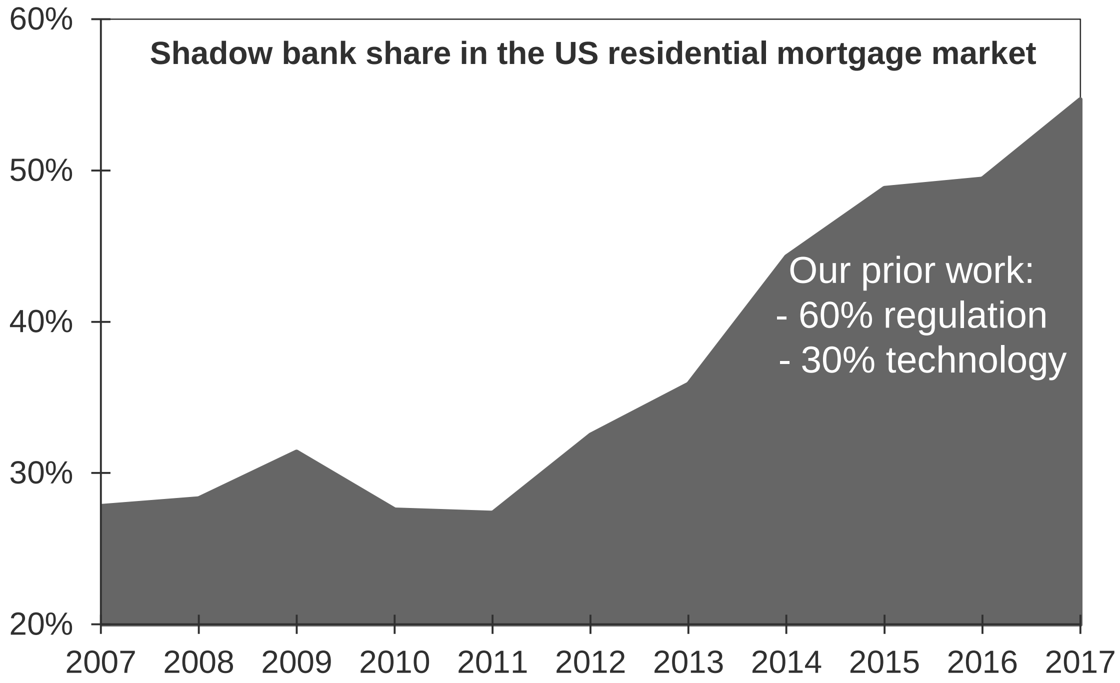
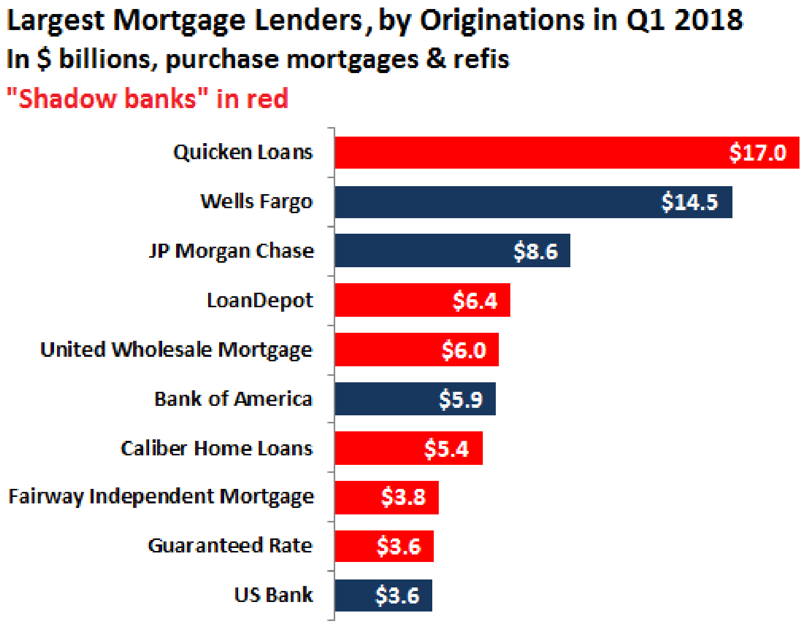
Motivation

- Regulatory framework and research: Banks are key suppliers of loans to household & firms
- Overlooks entry of shadow banks and changes to traditional bank business model

FIGURE 1: ENTRY OF SHADOW BANKS





Objective

- ❑ Understand changes across different markets
  - IO of lending markets: banks vs. shadow banks
  - Business model choice of banks
  - Differences in conforming vs. jumbo segments

- ❑ Implications for regulation? (quantitative importance)
  - Shadow bank migration margin
  - Balance sheet retention margin
  - These channels dampen or amplify the impact of regulation

- ❑ Broader implications outside US residential mortgage market
  - Importance of understanding IO of financial markets
  - Regulations targeting banks versus secondary markets

This Paper

- Present motivating facts
  - TB vs. SB in conforming versus jumbo markets
  - TB’s capitalization and endogenous business model
  - TB’s capitalization and jumbo / conforming volumes and prices

- Build parsimonious quantitative framework to study counterfactuals
  - Rich demand framework (income, mortgage size, product differentiation)
  - TB and SB
    - Differences in costs, regulations, ability to lend from balance sheet
    - Bank choice of financing on / off balance sheet
    - Competition

- Broader Insights
  - Important to consider IO FIRST, then equilibrium
  - Ignoring this can possibly misstate (by a large amount) the impact of various regulations

Institutional Setting

- US residential mortgage market
  - Largest consumer finance market in the world (~ $10 T of outstanding loans)
  - Focus on two main market segments: conforming and jumbo (~ 80% of the market)

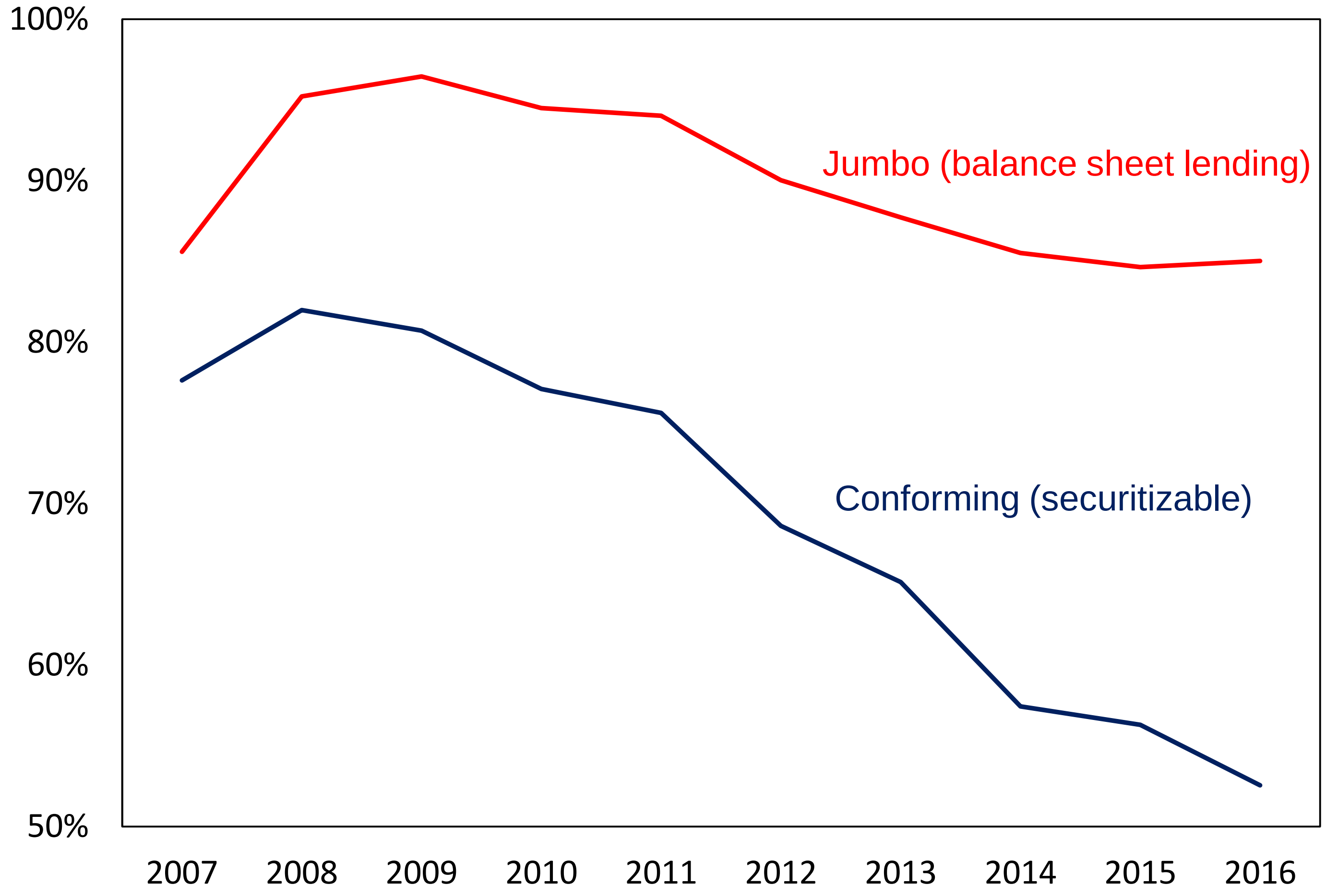
- Conforming market segment: ~50-60% of loans issued in our sample period
  - Loans issued with balances below "conforming loan limit" ($417K in 2010 in most areas)
  - Eligible for GSE (Fannie Mae, Freddie Mac) guarantees/financing
  - Relatively easy to sell in the secondary market (agency RMBS)

- Jumbo market segment: ~10-20% of loans issued in our sample period
  - Loans issued with balances above the conforming loan limit
  - <u>Hard to securitize during our sample period</u> (mainly retained on lender's balance sheet)

Motivating Facts

Shadow Bank Migration Channel

FIGURE 2A: TRADITIONAL BANK MARKET SHARE



Shadow Bank Migration Channel

Figure 2B: Bank Market Share

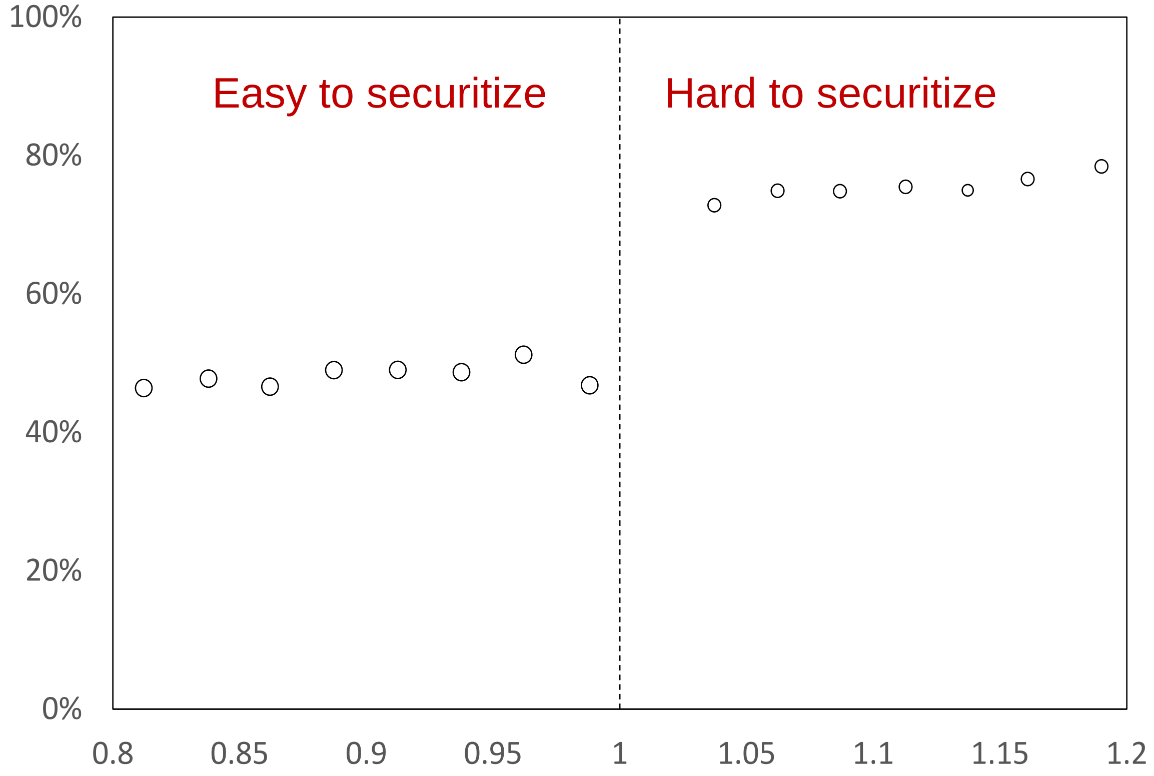
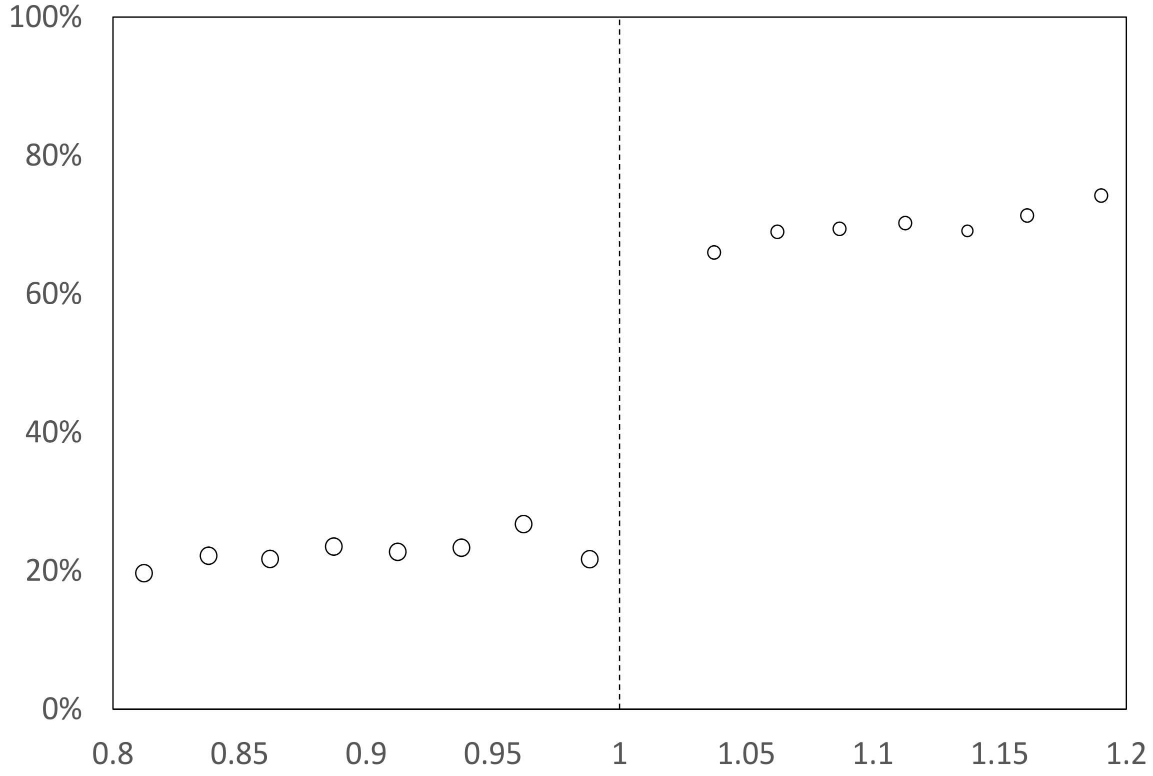


Figure 2C: Originations Retained on Balance Sheet



Balance Sheet Retention Channel

Figure 3A: Across Lenders

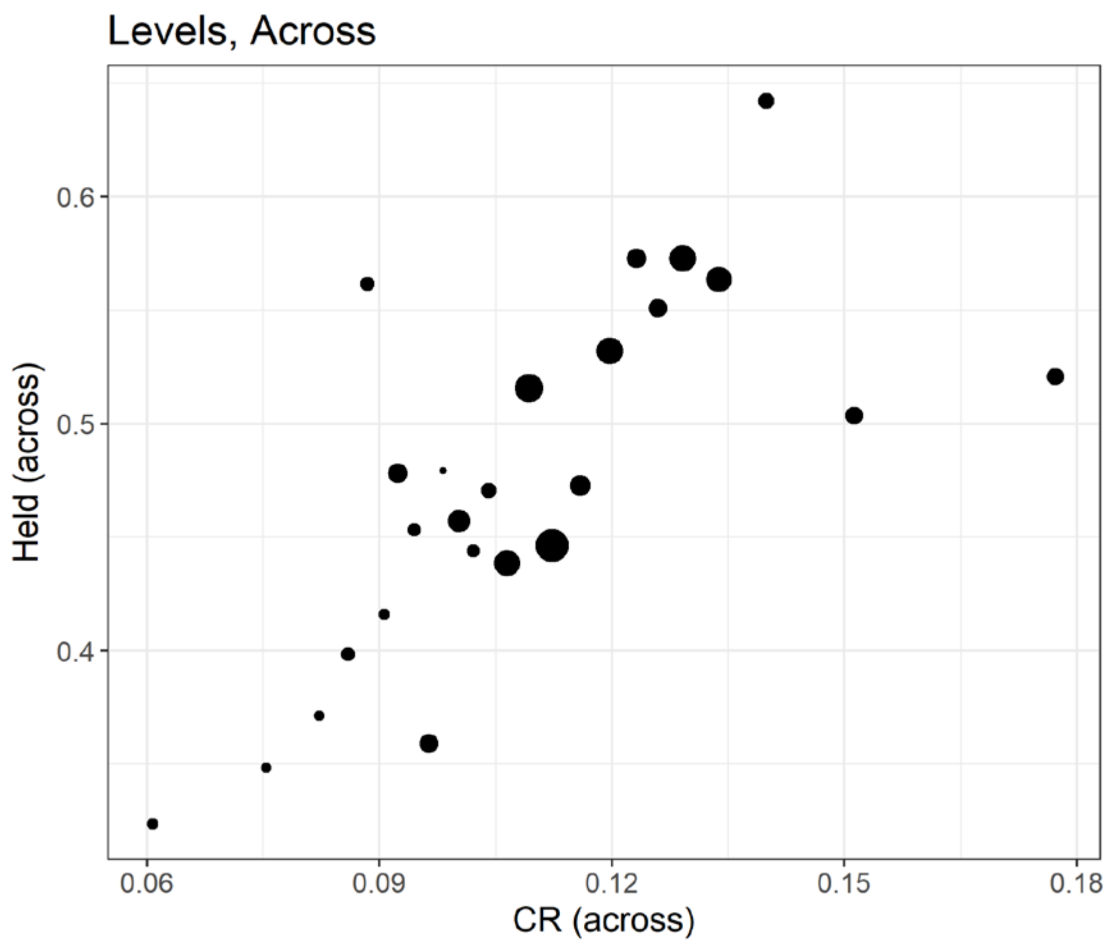
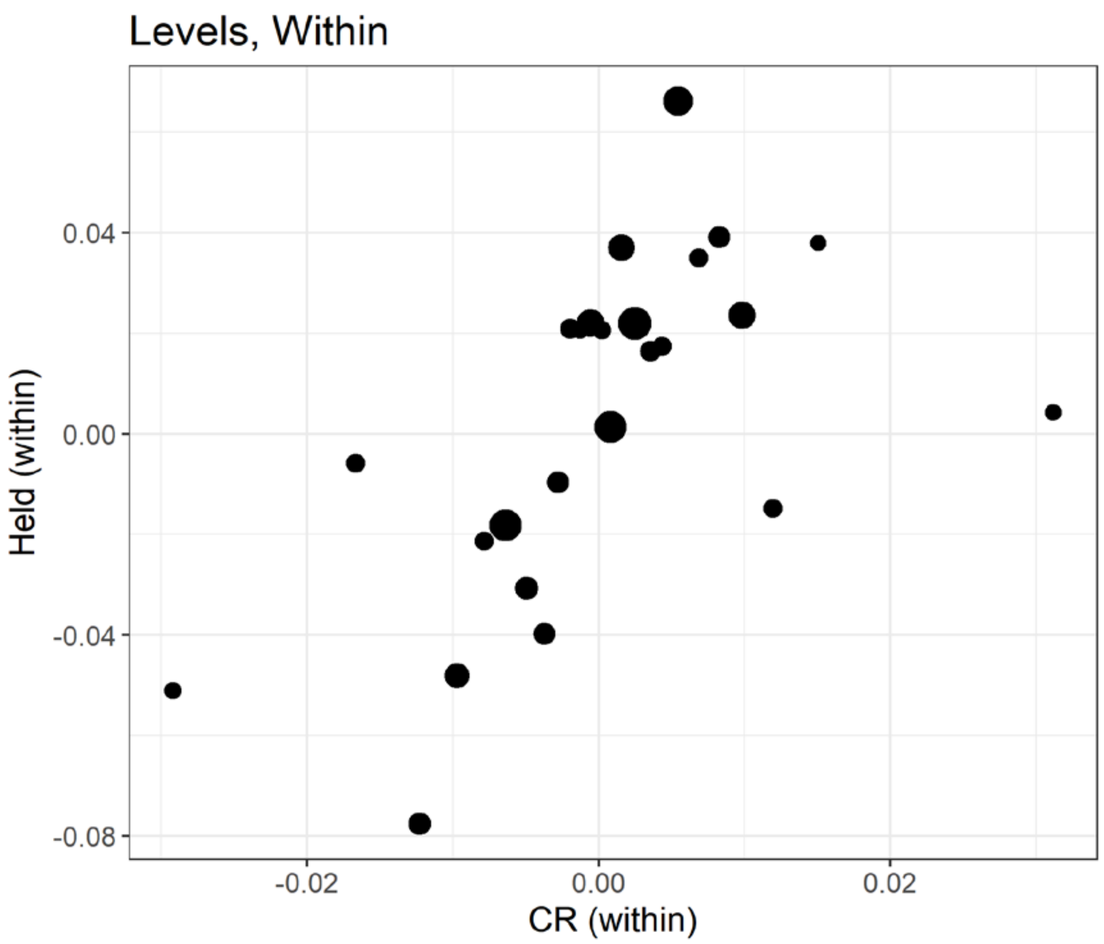
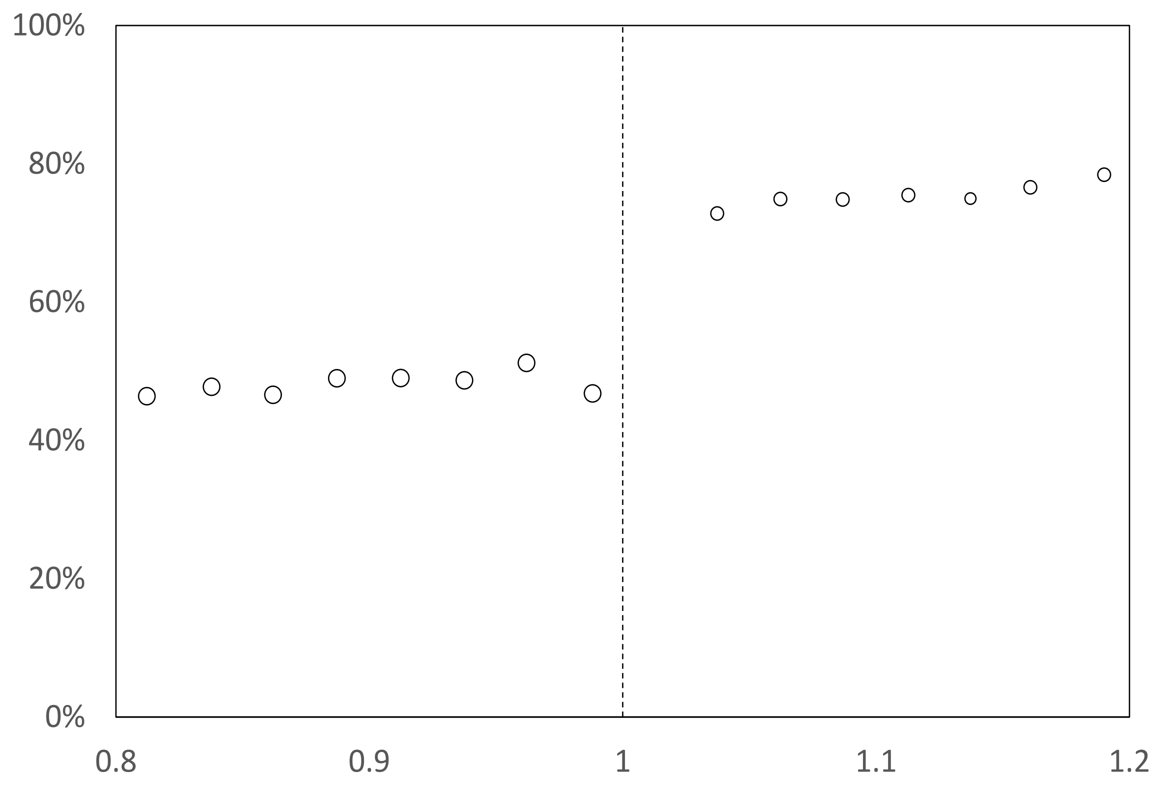


Figure 3B: Within Lenders



Balance Sheet Retention Channel

FIGURE 3C: MARKET SHARE OF WELL CAPITALIZED BANKS



Jumbos: Cannot Adjust on these Margins

Figure 4A: Conforming – Jumbo Spread

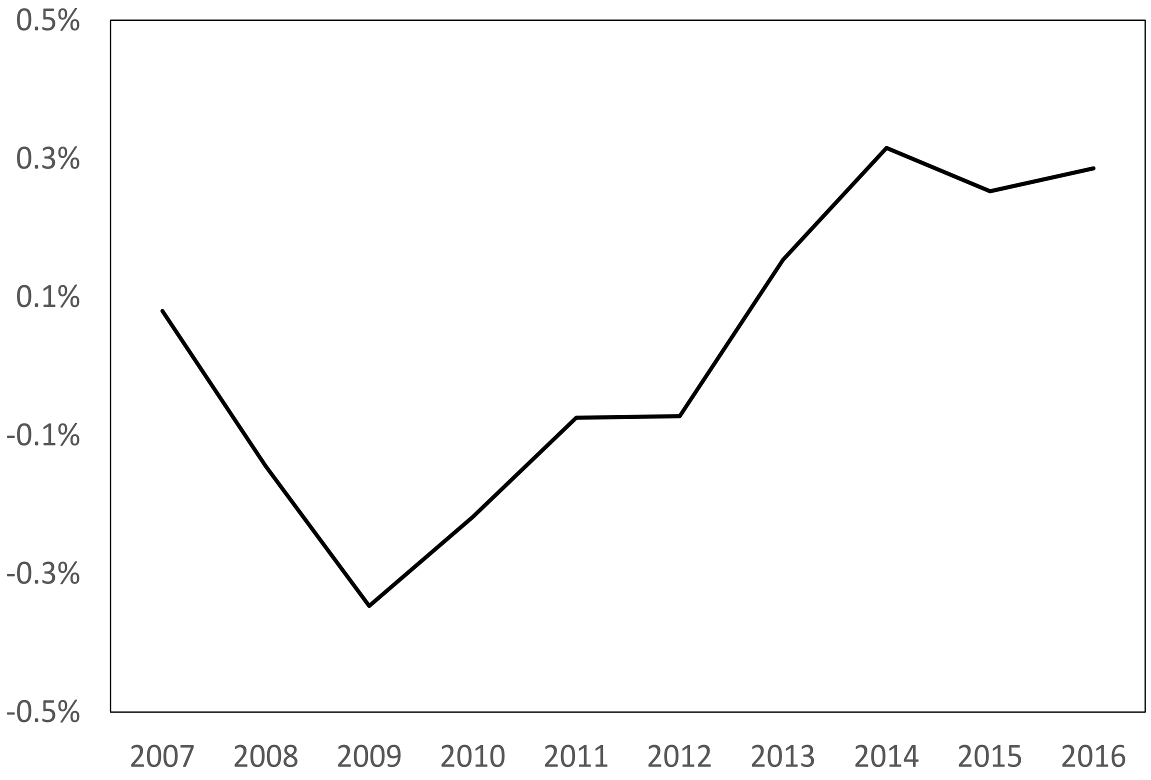
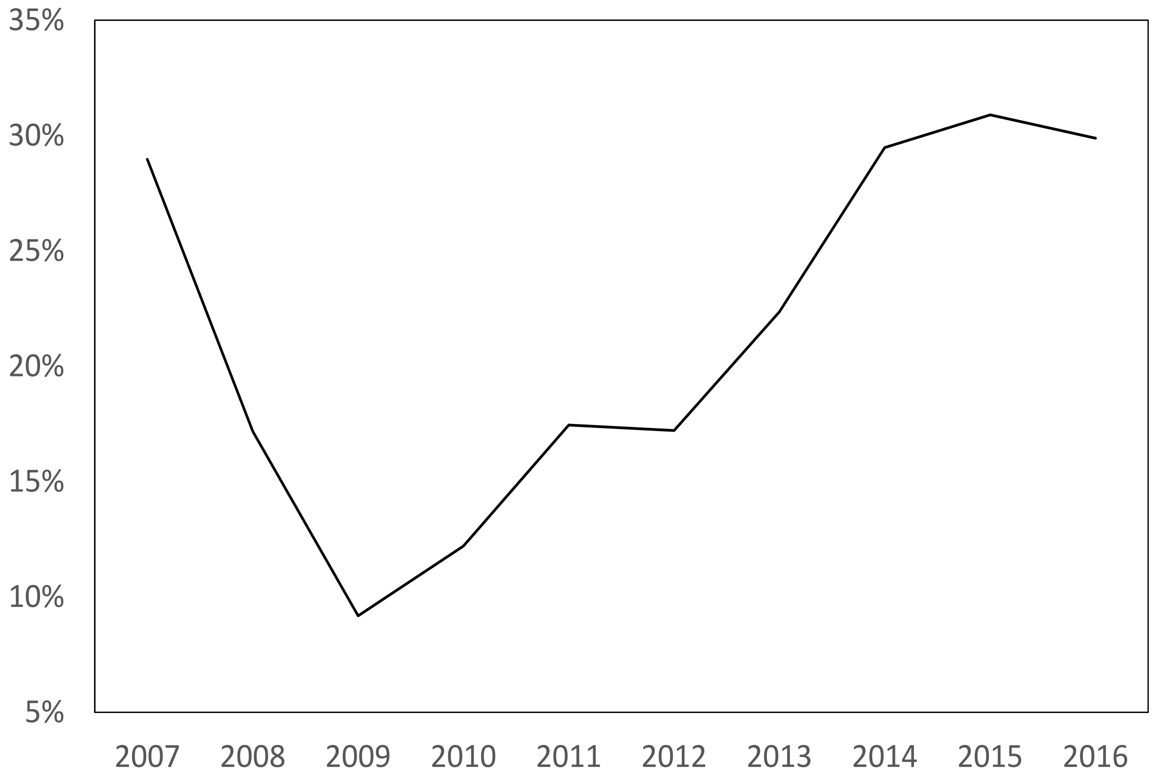
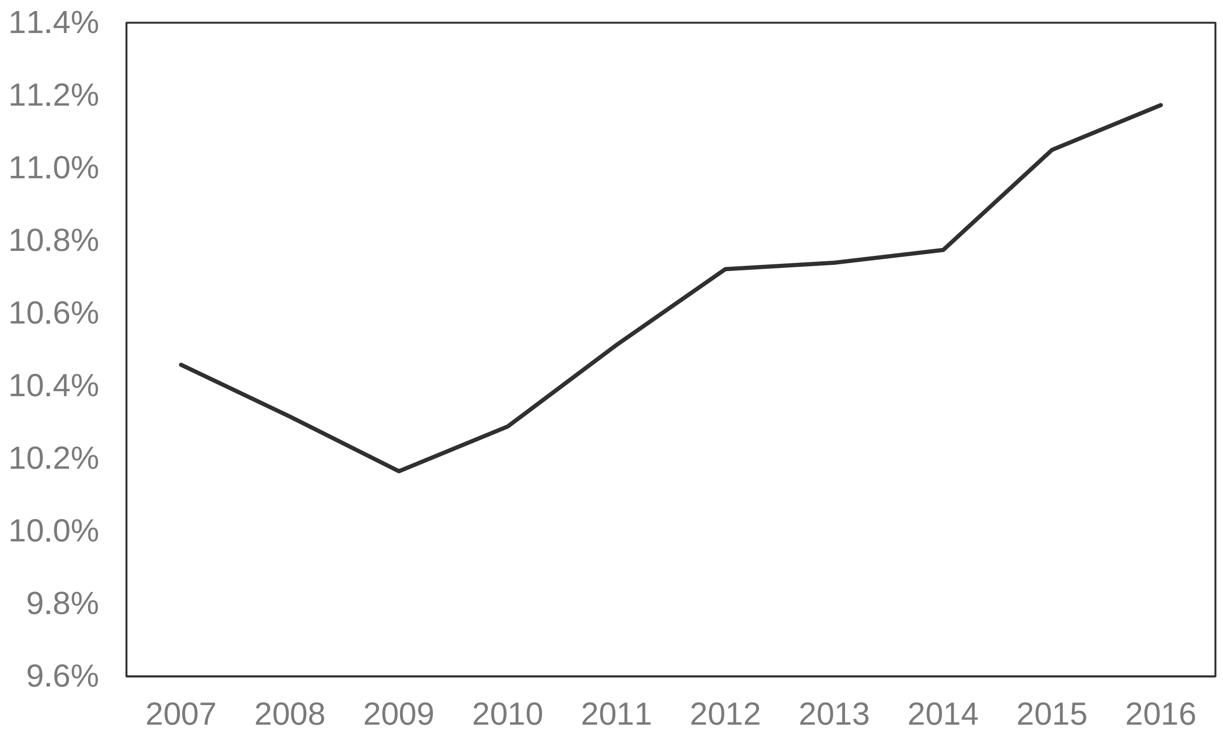


Figure 4B: Jumbo Share of Originations



Jumbos: Cannot Adjust on these Margins

FIGURE 4C: AVERAGE BANK CAPITALIZATION RATIO (CR)



Demand & market segmentation

Figure 5A: Distribution of Loan Sizes

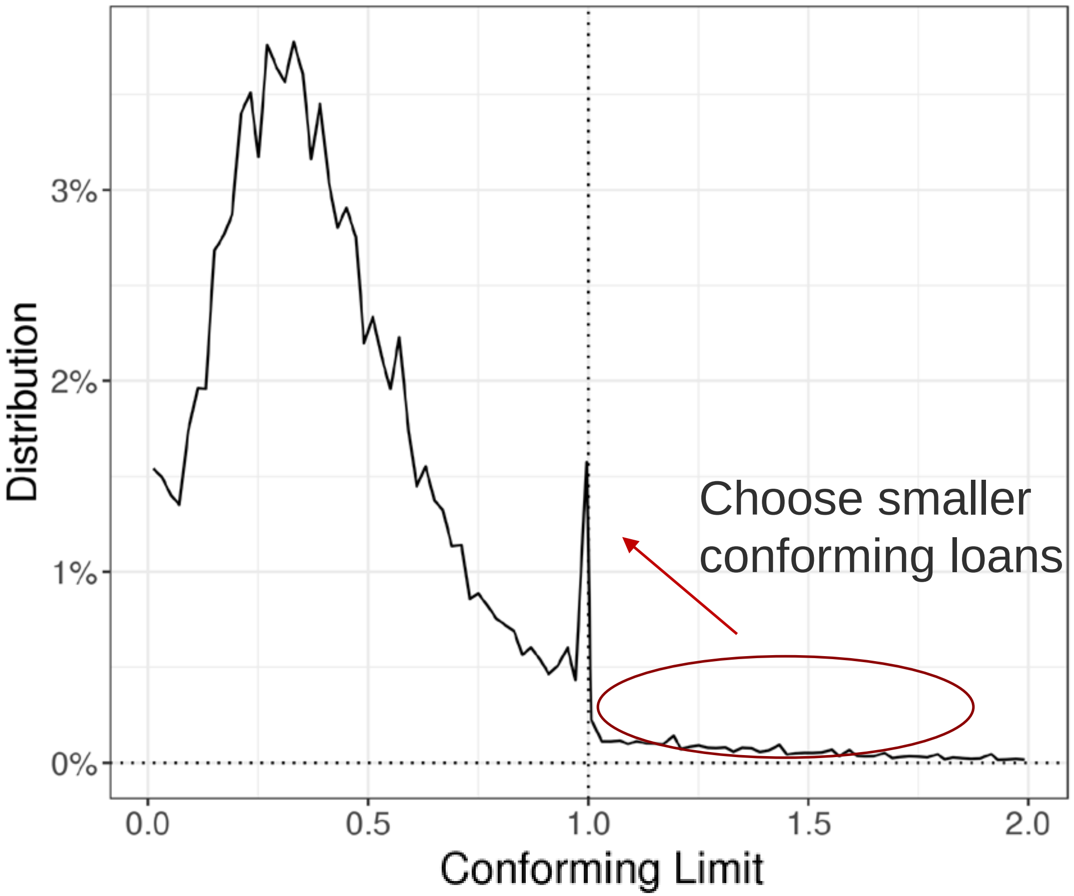
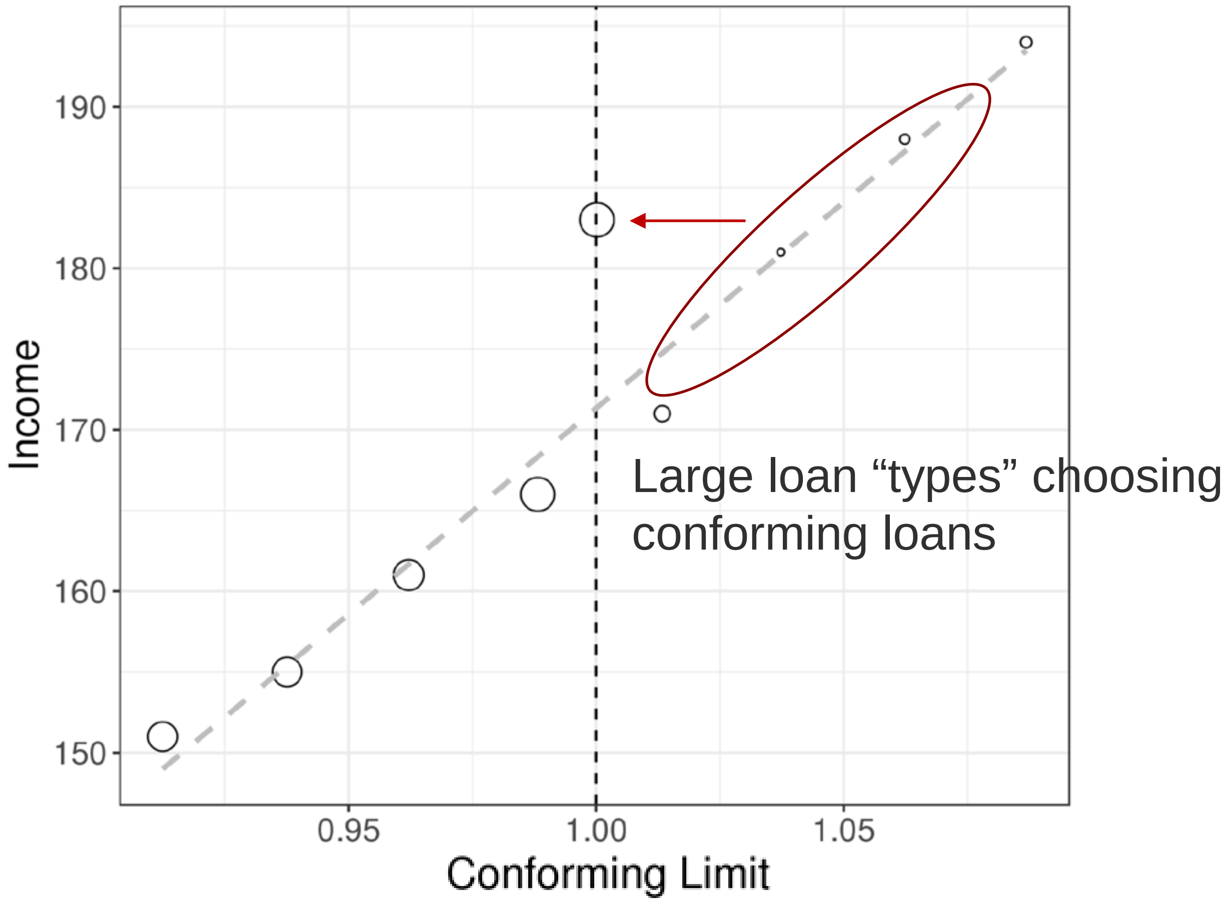


Figure 5B: Applicant Income



Model and Estimation

Essential Features

- Demand
  - Rich demand system
    - Heterogeneous consumers---income, house price, desired loan size
  - Choose mortgage size (implications for jumbo versus conforming)

- Supply
  - Products:
    - Price
    - Loan types
    - Non-price attributes
  - Financing (Balance sheet versus securitization)
    - Subject to capital requirements
  - Regulatory differences

Demand: Consumer Utility

- Consumer has:
  - Price coefficient: α_i
  - Ideal loan size: F_i
  - Disutility from smaller than ideal mortgage: β_i
  - Non-price characteristics: γ_i, ϵ_{ijctg}
  - LTV constraint

- Consumer utility:

$$u_{ijctg} = \underbrace{-\alpha_i r_{jctg}}_{rate} - \underbrace{\beta_i I(F_i^* < F_i)}_{size} + \underbrace{\gamma_i I(F_i^* < \overline{F_{ict}}) + q_{jt} + \xi_{jct} + \epsilon_{ijctg}}_{service}$$

- Link to data: Random Coefficients

Supply: Lender and Loan Types

- Three lender types in each market:
  - Traditional banks
  - Non-fintech SB
  - Fintech SB

- TB can lend on balance sheet or originate to sell
  - Retention cost decreases w/ regulatory capital (risk weighted assets)

- SB must originate to sell but face different regulatory regime

- Mortgage types
  - Conforming can be securitized or held on bank balance sheet
  - Jumbo must be held on balance sheet

Equilibrium

- Mortgage demand:
  - Consumers max utility across mortgages
  - Choose mortgage size, type, lender

- Mortgage supply:
  - Lenders max profits (MR = MC)
  - Choose rates on all mortgages across all markets
  - Choose retention

Estimation

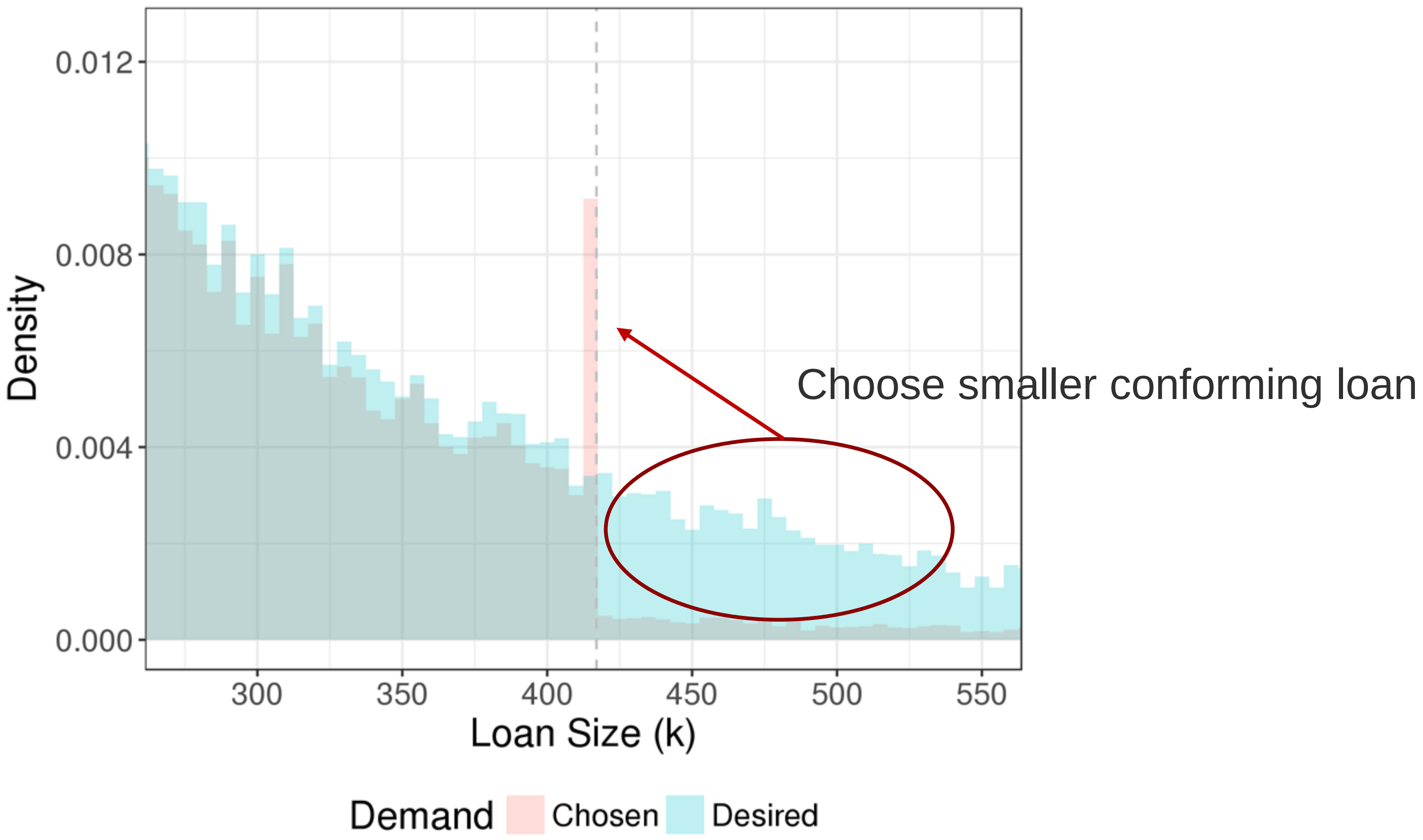
- Demand: Augmented BLP
  - BLP
    - Price instruments: GSE geographic pricing quirks
  - Non-standard moments:
    - Bunching at conforming limit
    - Borrower income at conforming limit
    - Mean and variance of loan sizes

- Supply: MR = MC
  - From bank profit maximization
    - Pricing
    - Financing choices

- Data
  - Millions of individual loan records (covers almost 100 percent of loan origination activity)
    - Sources: HMDA, Fannie Mae, Fredie Mac+ Call Reports

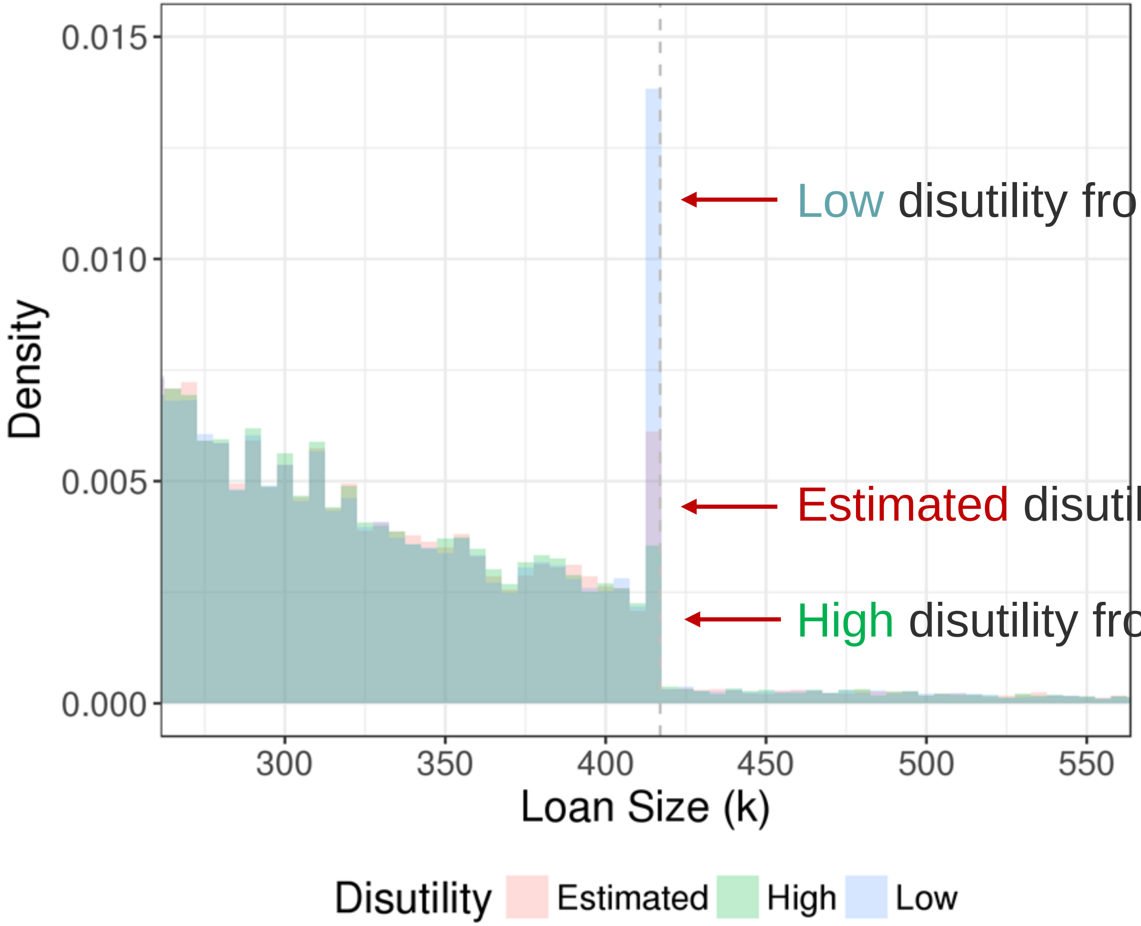
Estimation Intuition: Disutility from “too small”

FIGURE 6: DESIRED AND CHOSEN LOAN SIZES



Model Intuition: Preference for Jumbo Loans

FIGURE 7: DISUTILITY FROM CHOOSING A SMALLER LOAN



Low disutility from “wrong” size

Estimated disutility from “wrong” size

High disutility from “wrong” size

Matching Moments in the Data

FIGURE 8A: BUNCHING AT CONFORMING LIMIT

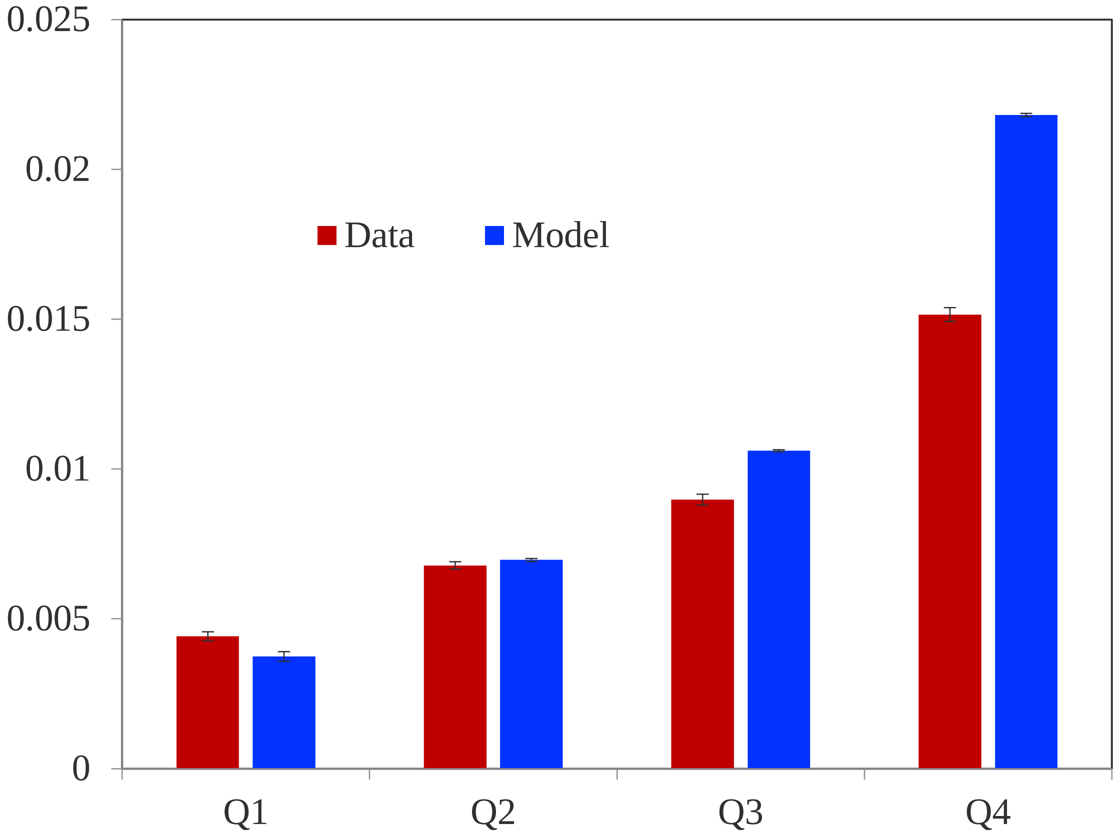
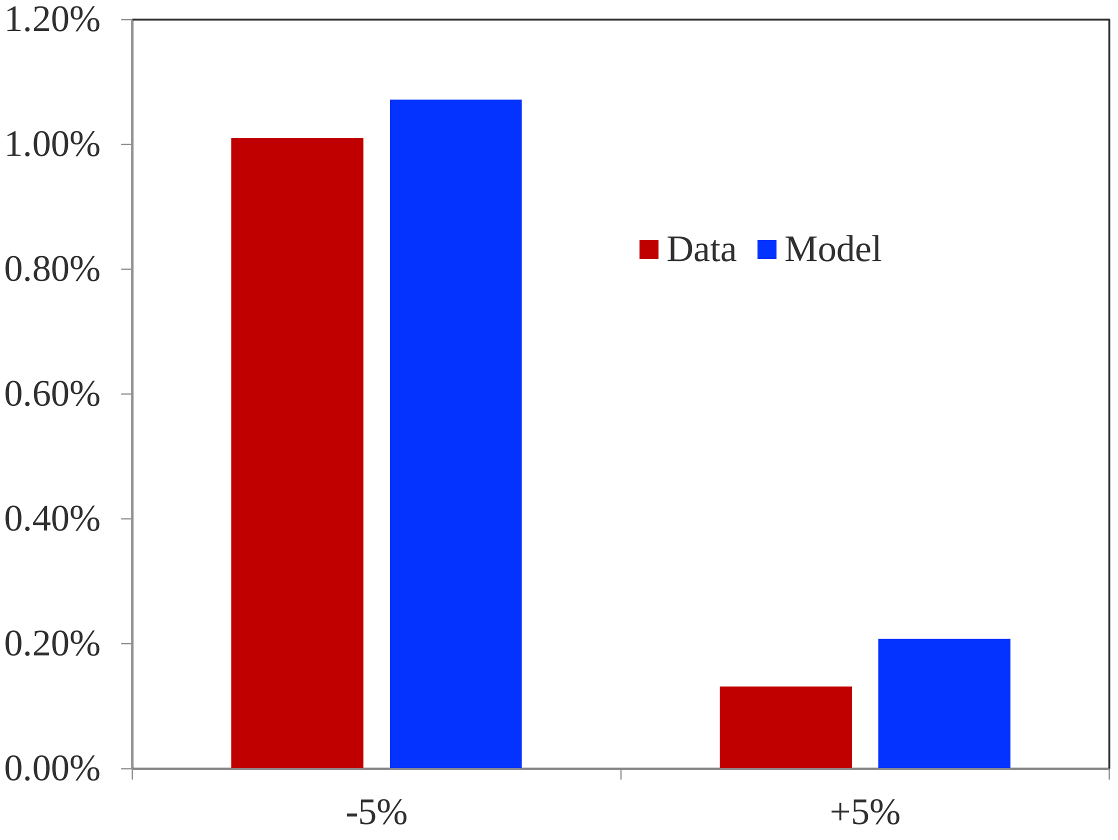


FIGURE 8B: % LOANS AROUND CONFORMING LIMIT



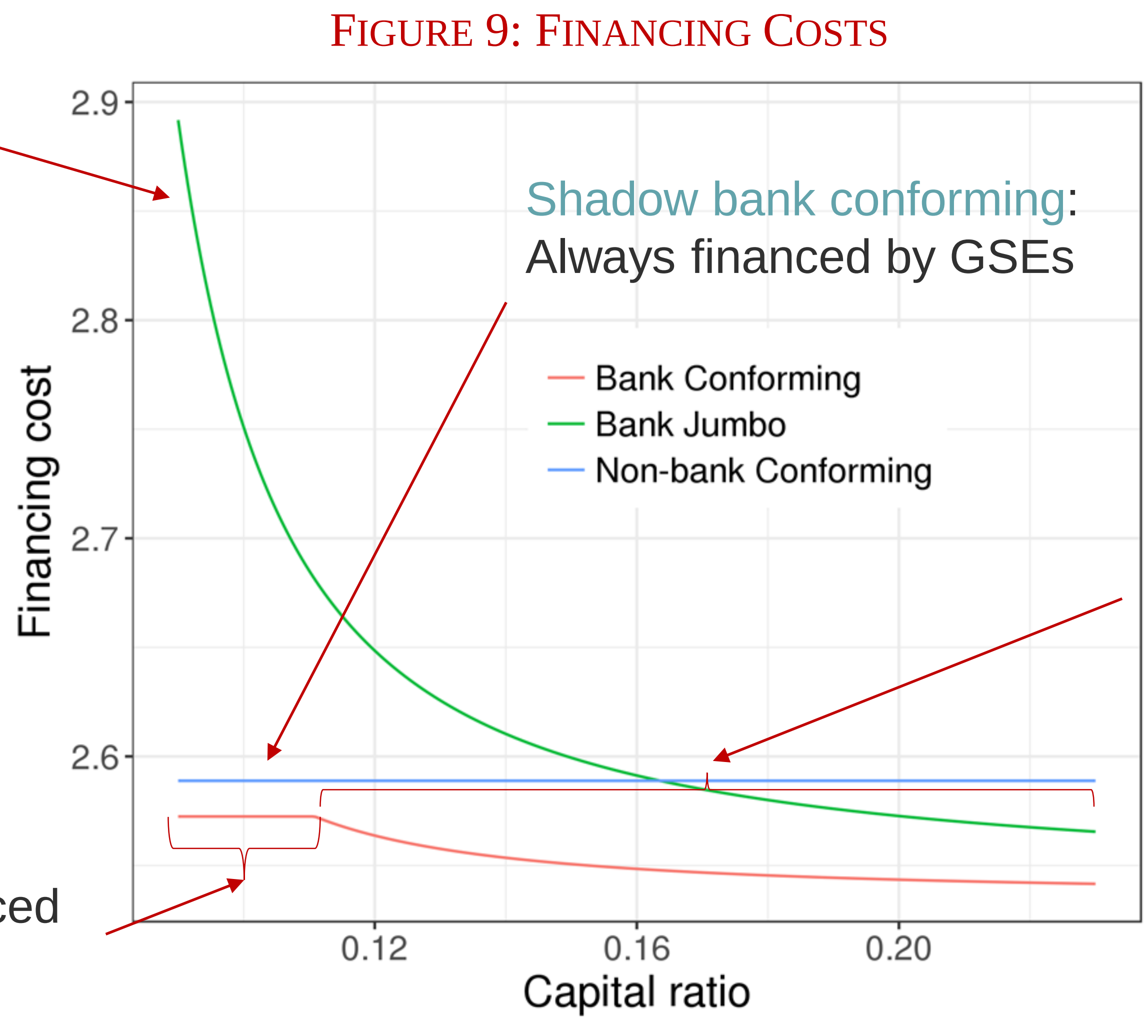
Key Demand Parameter Estimates

- Price elasticity
  - $\bar{\alpha} = 1.14$, Corresponds to elasticity of 4.4, similar to DeFusco and Paciorek (2017)
  - α_i decreases with house price
- Loan sizes
  - Mean desired loan size of about 220k
  - F_i increases with house prices
- Disutility from a loan that is too small:
  - $\bar{\beta} = 5.79$,
  - Corresponds to 5.1% difference in rate

Supply: Total Origination Costs

Jumbo loans: Always financed on balance sheet

Bank conforming: GSE financed when poorly capitalized



Bank conforming: Balance sheet financed when well capitalized

Policy Counterfactuals

Counterfactuals

- Capital Requirements
  - One of the main tools of policy makers to regulate banks
  - Baseline: 2015, CR = 6%.

- Secondary Market Intervention
  - FED purchases (sells) GSE mortgages thus influencing GSE financing costs

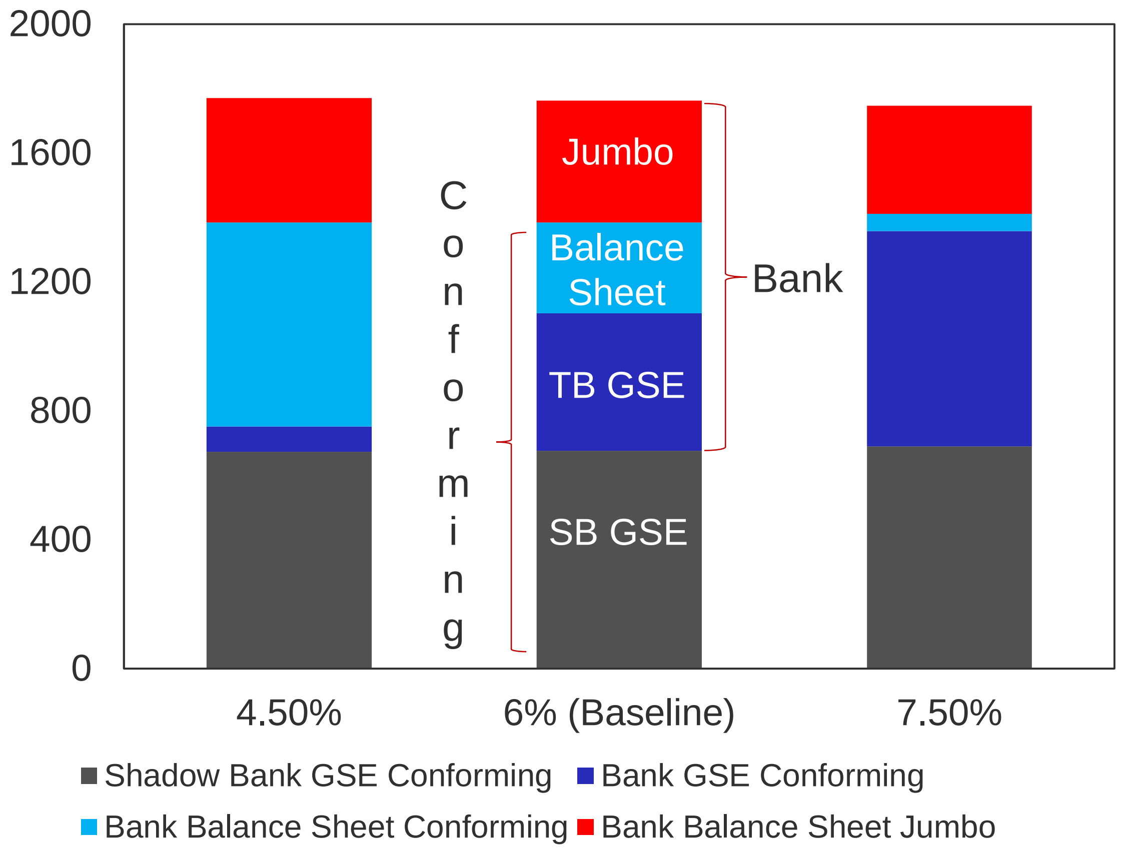
- Conforming Loan Limits
  - Active area of policy
    - Changes since crisis
  - Baseline: 2015, $417k in most markets, higher elsewhere
  - Provides out-of-sample model validation

Counterfactual I: Capital Requirements

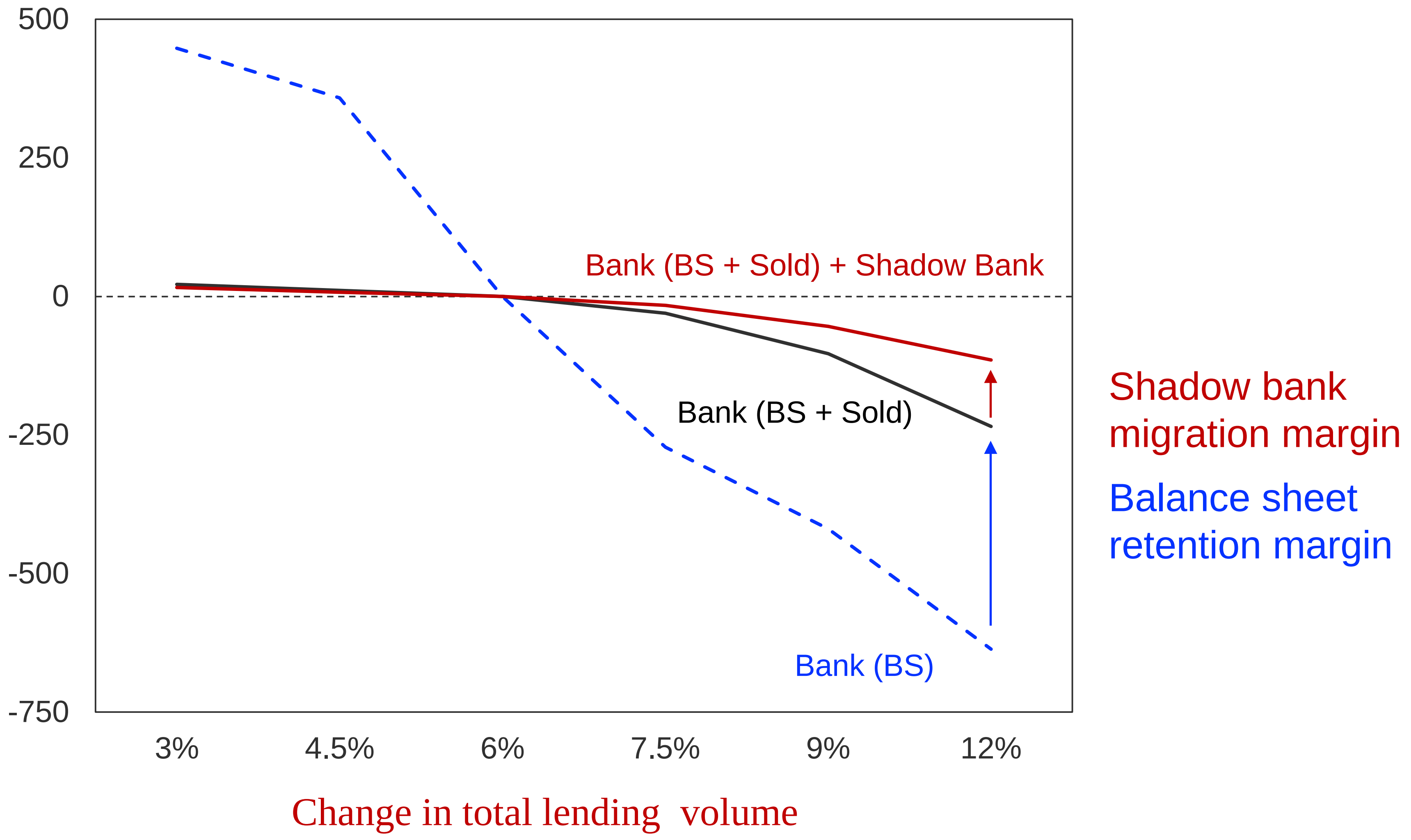
Capital Requirements 6% → 7.5%

Lender	Loan Type	Financing Source	Change
Total	-	-	-$16b
Bank	Jumbo	Portfolio	-$43b
Bank	Conforming	Portfolio	-$229b
Bank	Conforming	GSE	+$242b
Shadow Bank	Conforming	GSE	+$14b

Figure 13: Lending Volumes ($b)



Counterfactual I: Capital Requirements

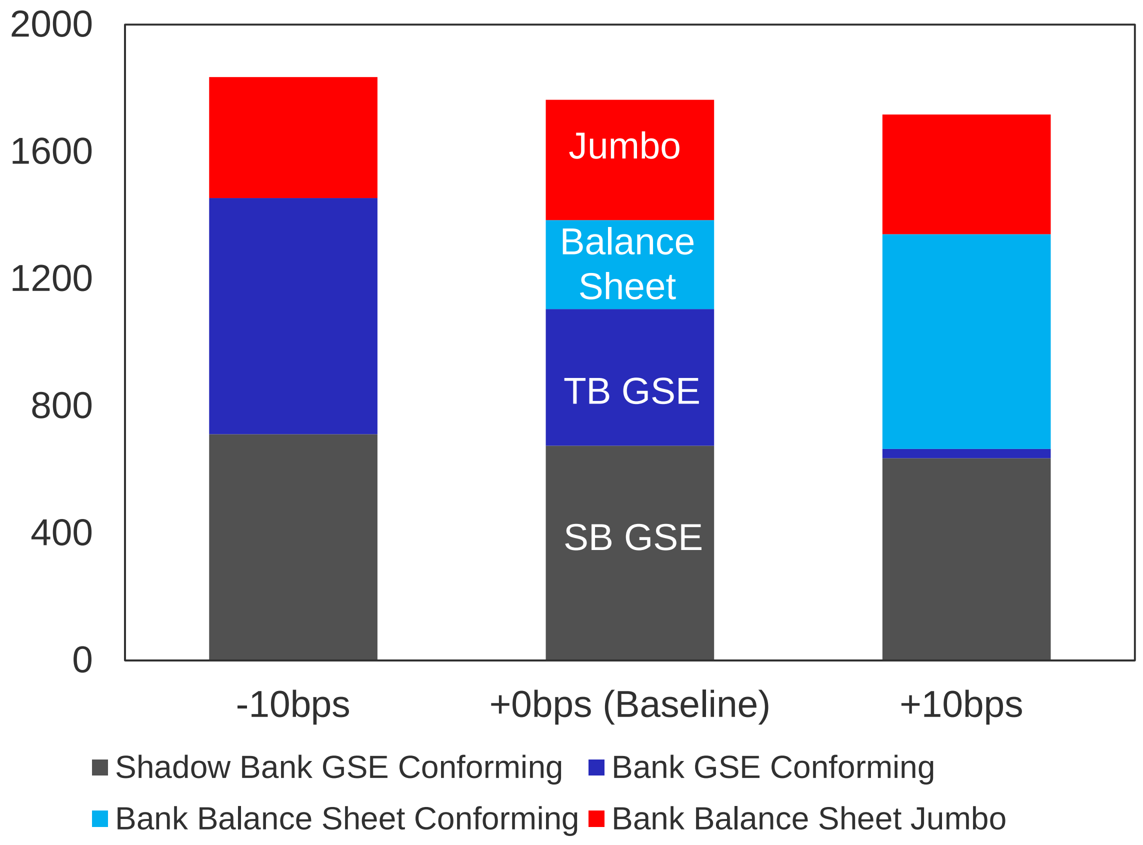


Counterfactual II: Secondary Market Intervention

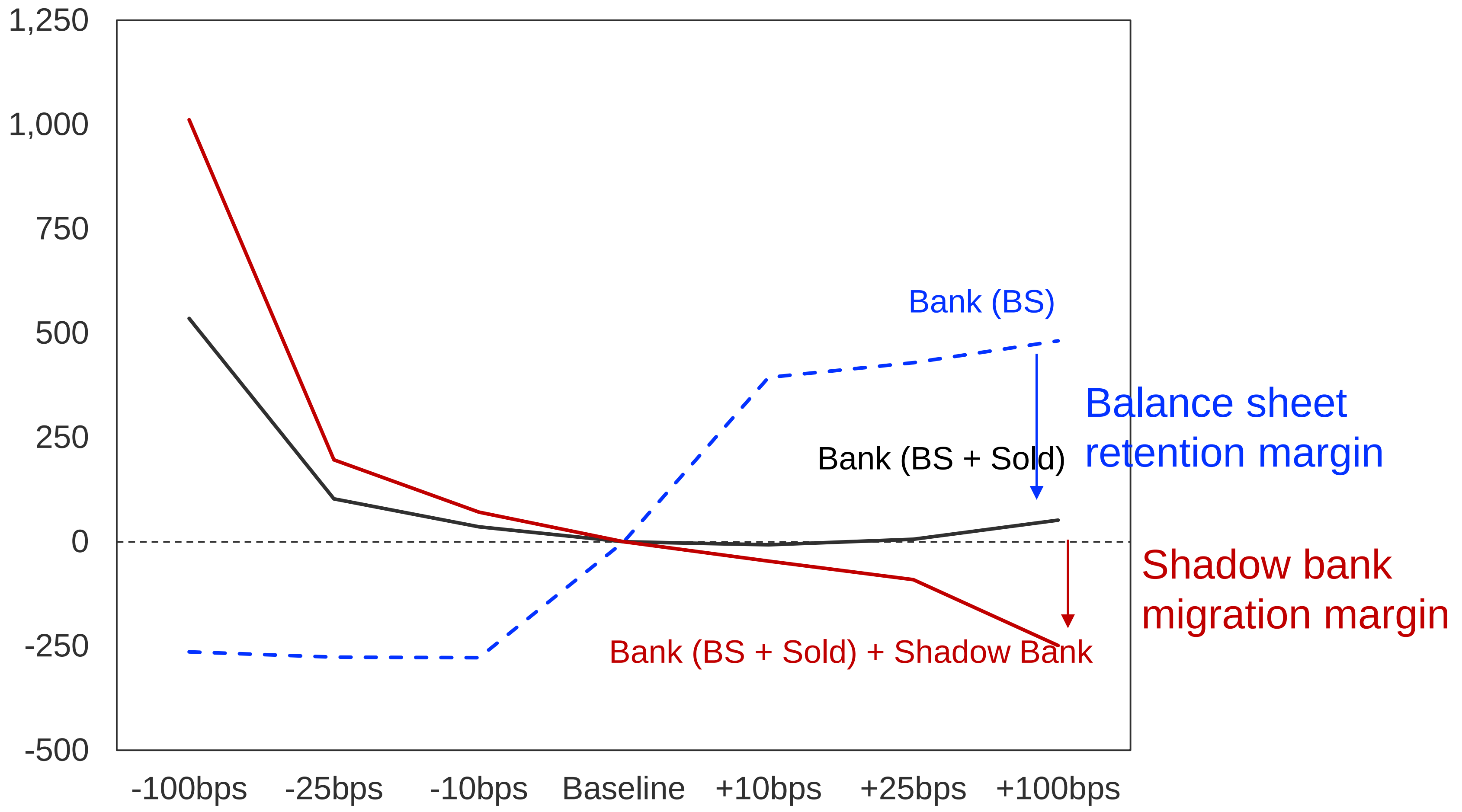
GSE Financing Cost -10bps

Lender	Loan Type	Financing Source	Change
Total	-	-	+$71b
Bank	Jumbo	Balance Sheet	+$2b
Bank	Conforming	Balance Sheet	-$280b
Bank	Conforming	GSE	+$313b
Shadow Bank	Conforming	GSE	+$36b

Figure 15: Lending Volumes ($b)



Counterfactual II: Secondary Market Intervention



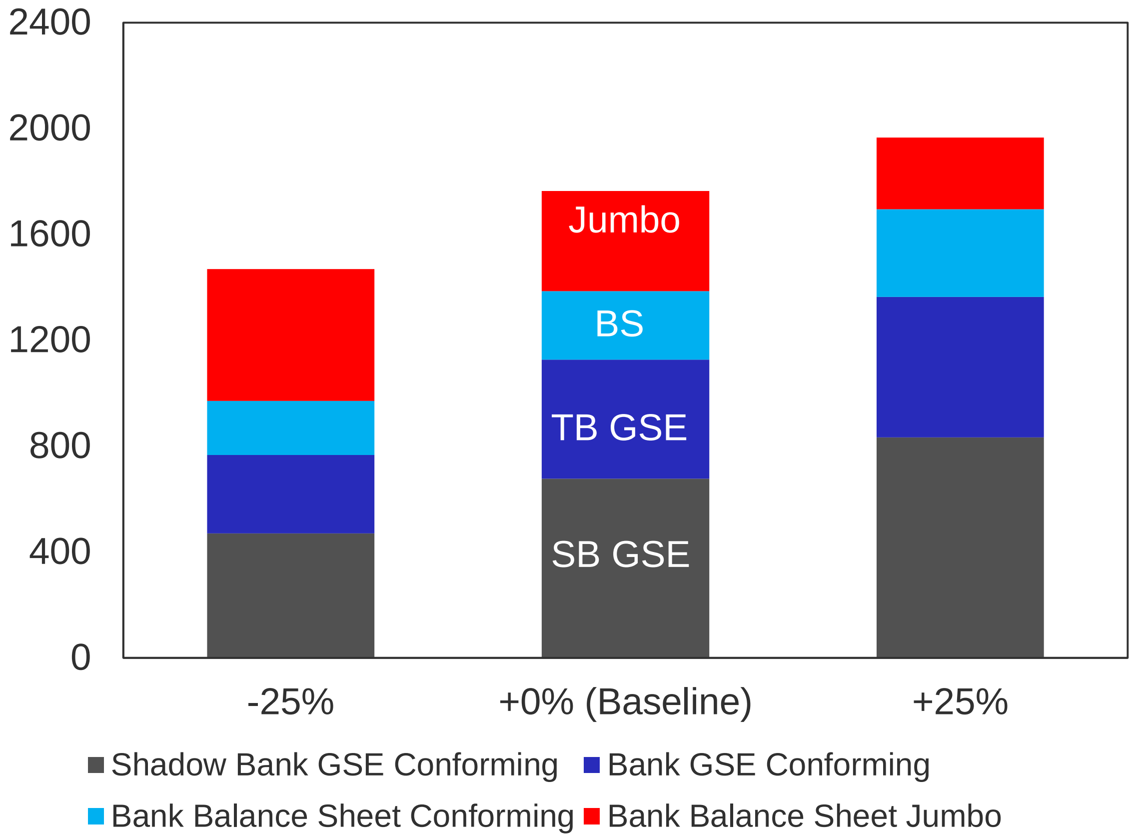
Change in total lending volume

Counterfactual III: Conforming Loan Limits

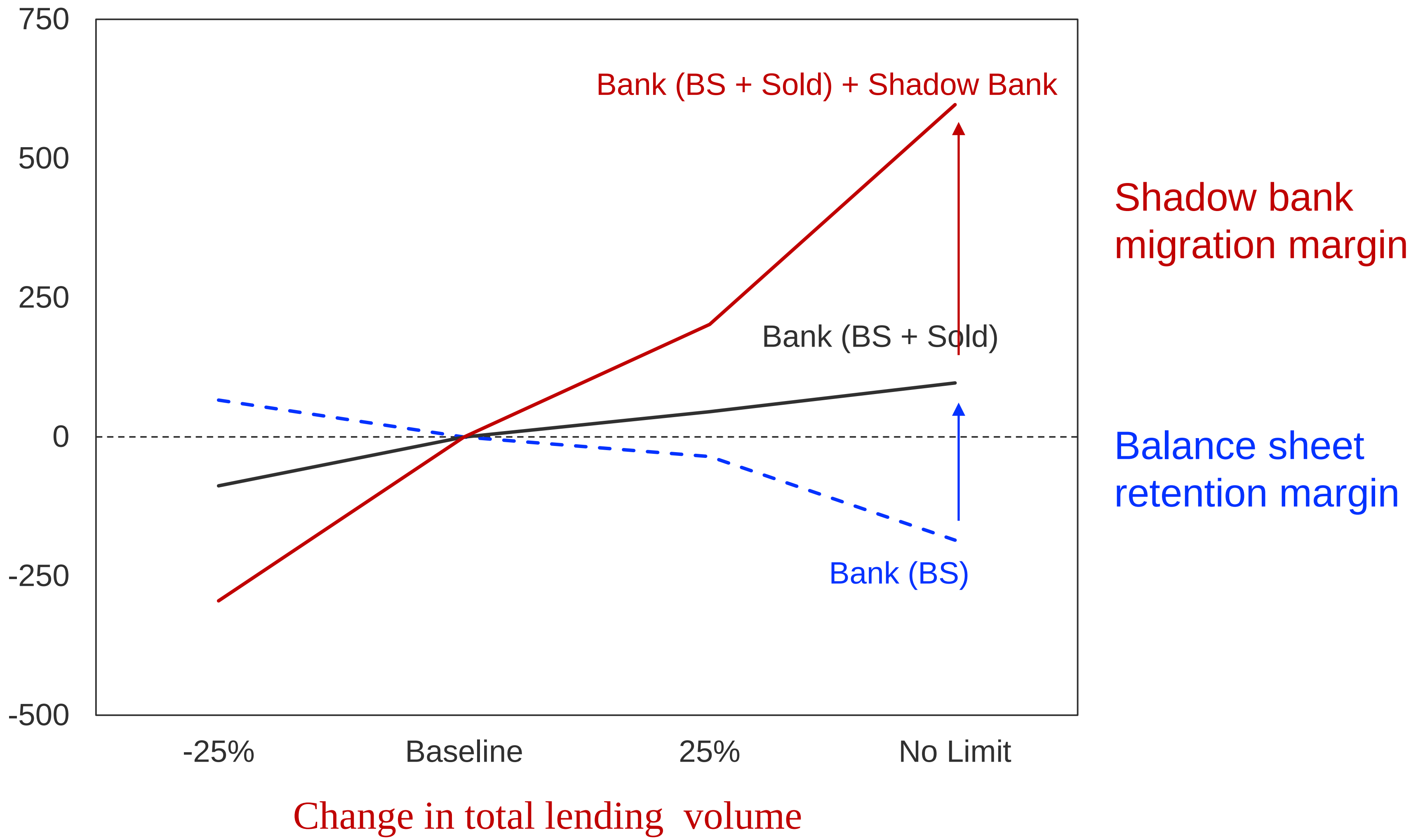
Conforming Loan Limit - 25%

Lender	Loan Type	Financing Source	Change
Total	-	-	-$294b
Bank	Jumbo	Balance Sheet	+$120b
Bank	Conforming	Balance Sheet	-$54b
Bank	Conforming	GSE	-$154b
Shadow Bank	Conforming	GSE	-$207b

Figure 17: Lending Volumes ($b)



Counterfactual III: Conforming Loan Limits



Out of Sample: Model Meets Evidence

TABLE: CONFORMING LIMIT INCREASES AND JUMBO AND BANK SHARE

	Jumbo Share	Bank Share
	(1)	(2)
Limit Increase	-0.356	-0.029
	(0.003)	(0.003)
Year FE	Yes	Yes
County FE	Yes	Yes
Observations	32,147	32,147
R^2	0.874	0.901

- Empirical Evidence consistent with counterfactual response to conforming limit changes…
  - Limit increases associated with decline in jumbo share
  - Limit increases associated with decline in bank share (expansion of SB)

Conclusion

- Evidence on relative comparative advantage of TB and SB
  - TB benefit from greater balance sheet capacity, dominate portfolio lending
  - SB benefit from lower regulatory burden, specialize in OTD
  - Relative prices, quantities and financing moves with both of these forces

- Estimate a structural model with heterogeneous consumer demand and interplay of TB and SB
  - Quantity, price, and distribution of credit as well as bank stability
  - Quantify SB migration channel and TB business model channel
    - "Dampen": Polices targeting TB (e.g., capital ratios)
    - "Amplify": Polices targeting secondary market (e.g., GSE limit changes)

  - Tighter capital requirements mainly affect higher income borrowers from higher house price regions
  - Access to securitization rather than capital requirements matter more for aggregate lending

Broader Implications

- Current financial regulation framework mainly focused on TB
  - May be inadequate given a recent expansion and dominance of SB in lending

- Policy implications for SB
  - SBs issue hundreds of billions of loans with implicit taxpayer guarantees
  - SBs (including “fintech”) very reliant on GSEs
  - SBs dominate market (+80% market share) for least creditworthy

- Need complete picture of lending IO to study financial regulation more broadly
  - Competitive interaction of TB and SB
  - Endogenous response of TB business model
  - Quantitatively different (perhaps wrong sign) predictions if ignored