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**

Our prior work:
- 60% regulation
- 30% technology

**Largest Mortgage Lenders, by Originations in Q1 2018**
In $ billions, purchase mortgages & refis

- Quicken Loans: $17.0
- Wells Fargo: $14.5
- JP Morgan Chase: $8.6
- LoanDepot: $6.4
- United Wholesale Mortgage: $6.0
- Bank of America: $5.9
- Caliber Home Loans: $5.4
- Fairway Independent Mortgage: $3.8
- Guaranteed Rate: $3.6
- US Bank: $3.6

Shadow bank share in the US residential mortgage market
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
  - Hard to securitize during our sample period (mainly retained on lender’s balance sheet)
Motivating Facts
Shadow Bank Migration Channel

**Figure 2A: Traditional Bank Market Share**

- **Jumbo (balance sheet lending)**
- **Conforming (securitizable)**
Shadow Bank Migration Channel

**Figure 2B: Bank Market Share**

- Easy to securitize
- Hard to securitize

**Figure 2C: Originations Retained on Balance Sheet**
Balance Sheet Retention Channel

**Figure 3A: Across Lenders**

**Levels, Across**

**Figure 3B: Within Lenders**

**Levels, Within**
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)**

![Average Bank Capitalization Ratio (CR) Chart](chart.png)
Demand & market segmentation

**Figure 5A: Distribution of Loan Sizes**

Choose smaller conforming loans

**Figure 5B: Applicant Income**

Large loan “types” choosing conforming loans
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: $\alpha_i$
  - Ideal loan size: $F_i$
  - Disutility from smaller than ideal mortgage: $\beta_i$
  - Non-price characteristics: $\gamma_i, \epsilon_{ijctg}$
  - LTV constraint

- Consumer utility:

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

- 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 with 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, Freddie Mac+ Call Reports
Estimation Intuition: Disutility from “too small”
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)
  - $\alpha_i$ 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

Figure 9: Financing Costs

- **Jumbo loans**: Always financed on balance sheet.
- **Shadow bank conforming**: Always financed by GSEs.
- **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% \(\rightarrow\) 7.5%

<table>
<thead>
<tr>
<th>Lender</th>
<th>Loan Type</th>
<th>Financing Source</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>-</td>
<td>-</td>
<td>-$16b</td>
</tr>
<tr>
<td>Bank</td>
<td>Jumbo</td>
<td>Portfolio</td>
<td>-$43b</td>
</tr>
<tr>
<td>Bank</td>
<td>Conforming</td>
<td>Portfolio</td>
<td>-$229b</td>
</tr>
<tr>
<td>Bank</td>
<td>Conforming</td>
<td>GSE</td>
<td>+$242b</td>
</tr>
<tr>
<td>Shadow Bank</td>
<td>Conforming</td>
<td>GSE</td>
<td>+$14b</td>
</tr>
</tbody>
</table>

### Figure 13: Lending Volumes ($B)

- **Total**
  - Bank Conforming GSE: +$242b
  - Shadow Bank Conforming GSE: +$14b
  - Bank Jumbo Portfolio: -$43b
  - Bank Conforming Portfolio: -$229b
  - Total: -$16b

- **Bank**
  - Conforming Portfolio: -$229b
  - Jumbo Portfolio: -$43b

- **Shadow Bank**
  - Conforming GSE: +$14b

- **TB GSE**
  - Conforming
  - Balance Sheet

- **SB GSE**
  - Conforming
  - Balance Sheet

- **Bank**
  - Conforming
  - Balance Sheet

- **Joint**
  - Conforming
  - Balance Sheet
Counterfactual I: Capital Requirements

![Graph showing changes in total lending volume for different capital requirements. The graph plots the change in total lending volume against capital requirements, with lines representing different scenarios: Bank (BS + Sold) and Bank (BS). The y-axis represents the change in total lending volume, ranging from -750 to 500, and the x-axis represents capital requirements from 3% to 12%. The graph highlights the impact of capital requirements on the balance sheet retention margin and migration margin, with arrows indicating a decrease in lending volume as capital requirements increase.](image-url)
Counterfactual II: Secondary Market Intervention

**GSE Financing Cost -10bps**

<table>
<thead>
<tr>
<th>Lender</th>
<th>Loan Type</th>
<th>Financing Source</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>-</td>
<td>-</td>
<td>+$71b</td>
</tr>
<tr>
<td>Bank</td>
<td>Jumbo</td>
<td>Balance Sheet</td>
<td>+$2b</td>
</tr>
<tr>
<td>Bank</td>
<td>Conforming</td>
<td>Balance Sheet</td>
<td>-$280b</td>
</tr>
<tr>
<td>Bank</td>
<td>Conforming</td>
<td>GSE</td>
<td>+$313b</td>
</tr>
<tr>
<td>Shadow Bank</td>
<td>Conforming</td>
<td>GSE</td>
<td>+$36b</td>
</tr>
</tbody>
</table>

**Figure 15: Lending Volumes ($B)**

- Shadow Bank GSE Conforming
- Bank GSE Conforming
- Bank Balance Sheet Conforming
- Bank Balance Sheet Jumbo
Counterfactual II: Secondary Market Intervention

Change in total lending volume

-100bps -25bps -10bps Baseline +10bps +25bps +100bps

-500 -250 0 250 500 750 1,000 1,250

Balance sheet retention margin
Shadow bank migration margin
# Counterfactual III: Conforming Loan Limits

## Conforming Loan Limit - 25%

<table>
<thead>
<tr>
<th>Lender</th>
<th>Loan Type</th>
<th>Financing Source</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>-</td>
<td>-</td>
<td>-$294b</td>
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<tr>
<td>Bank</td>
<td>Jumbo</td>
<td>Balance Sheet</td>
<td>+$120b</td>
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<td>Bank</td>
<td>Conforming</td>
<td>Balance Sheet</td>
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<tr>
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<td>Conforming</td>
<td>GSE</td>
<td>-$154b</td>
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<tr>
<td>Shadow Bank</td>
<td>Conforming</td>
<td>GSE</td>
<td>-$207b</td>
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</tbody>
</table>

**Figure 17: Lending Volumes ($B)**

The diagram shows the lending volumes for different types of loans under three scenarios: -25%, 0% (baseline), and +25%. The legend indicates the different sources of financing, including Shadow Bank GSE Conforming, Bank GSE Conforming, Bank Balance Sheet Conforming, and Bank Balance Sheet Jumbo.
Counterfactual III: Conforming Loan Limits

Graph showing the change in total lending volume for different scenarios:

- Baseline
- 25% Baseline + Sold
- No Limit

Lines represent:
- Bank (BS + Sold) + Shadow Bank
- Bank (BS + Sold)
- Bank (BS)

Margins indicated:
- Shadow bank migration margin
- Balance sheet retention margin
Out of Sample: Model Meets Evidence

<table>
<thead>
<tr>
<th></th>
<th>Jumbo Share</th>
<th>Bank Share</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Limit Increase</strong></td>
<td>-0.356</td>
<td>-0.029</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.003)</td>
</tr>
<tr>
<td><strong>Year FE</strong></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>County FE</strong></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td>32,147</td>
<td>32,147</td>
</tr>
<tr>
<td><strong>R^2</strong></td>
<td>0.874</td>
<td>0.901</td>
</tr>
</tbody>
</table>

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”: Policies targeting TB (e.g., capital ratios)
    - “Amplify”: Policies 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