The Time-Varying Price of Financial Intermediation in the Mortgage Market

Andreas Fuster\textsuperscript{1}  Stephanie Lo\textsuperscript{2}  Paul Willen\textsuperscript{3}

\textsuperscript{1}Federal Reserve Bank of New York  \\ \textsuperscript{2}Harvard  \\ \textsuperscript{3}Federal Reserve Bank of Boston and NBER

June 2017

Disclaimer: The views expressed in this paper are solely those of the authors and not necessarily those of the Federal Reserve Banks of Boston or New York, or the Federal Reserve System.
We study intermediation in the U.S. mortgage market, which connects borrowers with capital market investors through mortgage-backed securities (MBS).

A large and important market: Over 2000-2014, residential mortgage originations in U.S. averaged about $2.2 trillion per year.

- Since 2008: 80% of mortgages securitized through “agency” MBS (Fannie Mae, Freddie Mac, Ginnie Mae).

One of the main activities of the U.S. financial sector and a principal driver of its growth in recent decades (Greenwood and Scharfstein, 2013).

Direct impact on households: mortgage borrowers implicitly pay financial intermediaries for originating and servicing the loan.

Policy implications: Fed MBS purchases (“QE”) have been an important monetary policy tool post-crisis.

- Affect MBS prices – how much passes through to borrowers?
Summary

1. Develop a new methodology, using a novel dataset, to measure *price of intermediation* in mortgage market over 2008-2014

2. Characterize high-frequency pass-through of price changes in secondary (MBS) market to primary market
   - Of particular interest: QE case studies

3. Study the time-variation in the price of intermediation and investigate its economic drivers
Measuring the price of intermediation

- Compare
  - Note rate on mortgage
  - Cost of funds

**Conventional "A Paper" Interest Rate Trends 1/1/2016 through Present**

Green = Freddie Mac Weekly Survey of Locked Loans (Measures Interest Rates Real People Actually Got)

Blue = FNMA 60-Day Yield (Drives Mortgage Rates)

Red = 10-Year U.S. Treasury Bonds (Easiest index to track; mortgage rates tend to follow)

Prepared by Casey Fleming, Author of The Loan Guide: How to Get the Best Possible
Measuring the price of intermediation

- Compare
  - Note rate on mortgage
  - Cost of funds
- *Flow* of payments of

*Conventional "A Paper" Interest Rate Trends 1/1/2016 through Present*

- Green = Freddie Mac Weekly Survey of Locked Loans (Measures Interest Rates Real People Actually Got)
- Blue = FNMA 60-Day Yield (Drives Mortgage Rates)
- Red = 10-Year U.S. Treasury Bonds (Easiest index to track; mortgage rates tend to follow)

Prepared by Casey Fleming, Author of The Loan Guide: How to Get the Best Possible
Measuring the price of intermediation

- Compare
  - Note rate on mortgage
  - Cost of funds

- Flow of payments of
- Profit is PDV of flow
  - Uncertain timing
  - Stochastic discount factor
Measuring the price of intermediation

- Compare
  - Note rate on mortgage
  - Cost of funds

- Flow of payments of
- Profit is PDV of flow
  - Uncertain timing
  - Stochastic discount factor

- Hard problem – need a model
Measuring the price of intermediation

- Compare
  - Note rate on mortgage
  - Cost of funds

- *Flow* of payments of
- Profit is PDV of flow
  - Uncertain timing
  - Stochastic discount factor

- Hard problem – need a model
- Alternative: Do what lenders actually do!
Intermediation in the mortgage market

- Individual mortgage borrower
Intermediation in the mortgage market

- Individual mortgage borrower
- Gets quotes from intermediary
**Intermediation in the mortgage market**

- **Individual mortgage borrower**
- **Gets quotes from intermediary**
- **Intermediary then sells loan to investors**
**Intermediation in the mortgage market**

- Individual mortgage borrower
- Gets quotes from intermediary
- Intermediary then sells loan to investors
- In reality, borrowers receive quotes through loan officer, who gets commission from intermediary
Intermediation in the mortgage market

- Individual mortgage borrower
- Gets quotes from intermediary
- Intermediary then sells loan to investors

In reality, borrowers receive quotes through loan officer, who gets commission from intermediary

Focus on LOs working with multiple intermediaries ("TPO")
**Introduction**

**Intermediation**

**Passthrough**

**Impact on borrowers**

---

**Intermediation in the mortgage market**

**Primary Market**

- **Borrower**
- **Loan Officer**
- **Intermediary 1** e.g. Wells Fargo
- **Intermediary 2** e.g. JP Morgan
- **Intermediary 3** e.g. Provident Funding
- **MBS Investors**

- Individual mortgage borrower
- Gets quotes from intermediary
- Intermediary then sells loan to investors
- In reality, borrowers receive quotes through loan officer, who gets commission from intermediary
- Focus on LOs working with multiple intermediaries (“TPO”)
Intermediation in the mortgage market

Borrower

Loan Officer

Intermediary 1
e.g. Wells Fargo

Intermediary 2
e.g. JP Morgan

Intermediary 3
e.g. Provident Funding

MBS Investors

Primary Market

Secondary Market

Individual mortgage borrower

Gets quotes from intermediary

Intermediary then sells loan to investors

In reality, borrowers receive quotes through loan officer, who gets commission from intermediary

Focus on LOs working with multiple intermediaries ("TPO")
Individual mortgage borrower
- Gets quotes from intermediary
- Intermediary then sells loan to investors

In reality, borrowers receive quotes through loan officer, who gets commission from intermediary
- Focus on LOs working with multiple intermediaries ("TPO")
Rates and Yield Spread Premia (YSPs)

Intermediary pays: \( p^n_{\text{YSP}} = 100 + \text{YSP}(r^n) \)

<table>
<thead>
<tr>
<th>Rate</th>
<th>15 day</th>
<th>30 day</th>
<th>45 day</th>
<th>60 day</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.500</td>
<td></td>
<td></td>
<td></td>
<td>(7.757)</td>
</tr>
<tr>
<td>5.375</td>
<td>(7.618)</td>
<td>(7.560)</td>
<td>(7.498)</td>
<td>(7.436)</td>
</tr>
<tr>
<td>5.250</td>
<td>(7.293)</td>
<td>(7.234)</td>
<td>(7.173)</td>
<td>(7.110)</td>
</tr>
<tr>
<td>5.000</td>
<td>(6.089)</td>
<td>(6.015)</td>
<td>(5.939)</td>
<td>(5.861)</td>
</tr>
<tr>
<td>4.875</td>
<td>(5.884)</td>
<td>(5.811)</td>
<td>(5.734)</td>
<td>(5.656)</td>
</tr>
<tr>
<td>4.750</td>
<td>(5.454)</td>
<td>(5.381)</td>
<td>(5.305)</td>
<td>(5.226)</td>
</tr>
<tr>
<td>4.625</td>
<td>(4.908)</td>
<td>(4.835)</td>
<td>(4.758)</td>
<td>(4.680)</td>
</tr>
<tr>
<td>4.375</td>
<td>(3.807)</td>
<td>(3.728)</td>
<td>(3.650)</td>
<td>(3.572)</td>
</tr>
<tr>
<td>4.250</td>
<td>(3.461)</td>
<td>(3.373)</td>
<td>(3.287)</td>
<td>(3.201)</td>
</tr>
<tr>
<td>4.125</td>
<td>(2.859)</td>
<td>(2.771)</td>
<td>(2.684)</td>
<td>(2.598)</td>
</tr>
<tr>
<td>4.000</td>
<td>(2.209)</td>
<td>(2.121)</td>
<td>(2.035)</td>
<td>(1.949)</td>
</tr>
<tr>
<td>3.875</td>
<td>(1.482)</td>
<td>(1.394)</td>
<td>(1.307)</td>
<td>(1.221)</td>
</tr>
<tr>
<td>3.750</td>
<td>(0.839)</td>
<td>(0.765)</td>
<td>(0.689)</td>
<td>(0.611)</td>
</tr>
<tr>
<td>3.625</td>
<td>(0.131)</td>
<td>(0.058)</td>
<td>0.019</td>
<td>0.097</td>
</tr>
</tbody>
</table>
Rates and Yield Spread Premia (YSPs)

- Intermediary pays: \( p_{YSP}^n = 100 + YSP(r^n) \)
- Intermediary receives: \( p_{TBA}^n = 100 + TBA(r^n) \)
**Rates and Yield Spread Premia (YSPs)**

Intermediary pays: $p^n_{\text{YSP}} = 100 + \text{YSP}(r^n)$

Intermediary receives: $p^n_{\text{TBA}} = 100 + \text{TBA}(r^n)$

Definition: price of intermediation

$\phi^n \equiv p^n_{\text{TBA}} - p^n_{\text{YSP}}$

- Dollar margin per $100$ principal
- Market measure of PDV of flow
Measuring the price of a loan in the primary market

- YSPs aka rebates are hard to measure
  - Generally not publicly disclosed and not included in any standard loan level dataset
Measuring the price of a loan in the primary market

- YSPs aka rebates are hard to measure
  - Generally not publicly disclosed and not included in any standard loan level dataset
- We obtain digitized versions from a company called “Optimal Blue” over Oct 2008 – Dec 2014
  - End-of-day snapshots from the point of view of actual loan officers
  - On average 22 intermediaries per day (63 unique ones in data overall)
  - Anonymized but know that contains largest players
Measuring the price of a loan in the primary market

- YSPs aka rebates are hard to measure
  - Generally not publicly disclosed and not included in any standard loan level dataset

- We obtain digitized versions from a company called “Optimal Blue” over Oct 2008 – Dec 2014
  - End-of-day snapshots from the point of view of actual loan officers
  - On average 22 intermediaries per day (63 unique ones in data overall)
  - Anonymized but know that contains largest players

- Mostly focus on (interpolated) rate that gets YSP of 1: “Rate101”
  - Taking median across lenders (i.e. no x-sectional analysis in this paper)
  - Fixed, plain-vanilla loan characteristics
Measuring the value of a loan in the MBS market

- After buying the loan from the borrower (and paying $p_{YSP}$), the intermediary sells the loan in the forward ("To-Be-Announced" or TBA) market
  - Highly liquid OTC market; >$100bn trading vol./day
  - Settlement 1-3 months in the future

- Several coupons traded at increments of 50 bps; price per $100 principal is $p^n_{TBA}$ (obtained from JPM):

<table>
<thead>
<tr>
<th>Coupon</th>
<th>$p_{TBA}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.50%</td>
<td>100.510</td>
</tr>
<tr>
<td>4.00%</td>
<td>102.732</td>
</tr>
<tr>
<td>4.50%</td>
<td>104.698</td>
</tr>
</tbody>
</table>

- To go from mortgage note rate to MBS coupon, we subtract "g-fees" (22-42 bps over sample) and required upfront payments to agency insuring the credit risk (e.g. Fannie Mae)
Quantitative easing case studies

- Holding rate fixed, what was passthrough after major monetary policy announcements?

**QE1, November 2008**

![Graph showing passthrough in % over time]

- Event Date
- $P_{TBA}$

<table>
<thead>
<tr>
<th>Price</th>
<th>Appls. (thous./day)</th>
<th>Passthrough in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>101</td>
<td>75</td>
<td>25</td>
</tr>
<tr>
<td>102</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>103</td>
<td>125</td>
<td>75</td>
</tr>
<tr>
<td>104</td>
<td>150</td>
<td>100</td>
</tr>
</tbody>
</table>
Quantitative easing case studies

- Holding rate fixed, what was passthrough after major monetary policy announcements?

**QE1, November 2008**

- Both primary and secondary market prices increased; passthrough 75-100%
Quantitative easing case studies

- Holding rate fixed, what was passthrough after major monetary policy announcements?

**QE1, November 2008**

- Both primary and secondary market prices increased; passthrough 75-100%
Quantitative easing case studies

Holding rate fixed, what was passthrough after major monetary policy announcements?

QE1, November 2008

Both primary and secondary market prices increased; passthrough 75-100%
Quantitative easing case studies

- Holding rate fixed, what was passthrough after major monetary policy announcements?

**QE1, November 2008**
- Both primary and secondary market prices increased; passthrough 75-100%

**QE1 Expansion, March 2009**
- QE1 Expansion: Passthrough much lower
Quantitative easing case studies

- Holding rate fixed, what was passthrough after major monetary policy announcements?

**QE1, November 2008**
- Both primary and secondary market prices increased; passthrough 75-100%

**QE1 Expansion, March 2009**
- QE1 Expansion: Passthrough much lower
- Volume higher (from HMDA)
Passthrough

\[ \Delta p_{\text{OP}}, \text{ in } \$ \text{ per 100$ principal} \]

\[ \Delta p_{\text{TBA}}, \text{ in } \$ \text{ per 100$ principal} \]

Willen (Boston Fed)

Mortgage Intermediation

June 2017
Passthrough

- Regressions of primary market change on secondary
  - Average pass-through 0.92; high $R^2$
  - Significant asymmetry: decreases fully passed through, increases “only” 0.8 on day 1, 0.87 over two days
  - Pass-through of price increases smaller when applications$_{t-1}$ higher. E.g. 2 SD above average: pass-through 0.59
    $= 0.78 - 2 \times 0.096$
Monthly average price of intermediation $\phi$

- $\phi = p_{TBA} - p_{YSP}$ varies substantially over sample: from 0 to 3 ($ per 100$ principal) – this range corresponds to $9k$ on $300k$ mortgage.
Monthly average price of intermediation $\phi$

- $\phi = p_{TBA} - p_{YSP}$ varies substantially over sample: from 0 to 3 ($ per 100$ principal) – this range corresponds to $9k$ on $300k$ mortgage
- Strong upward trend & large variation around trend
Monthly average price of intermediation $\phi$

- $\phi = p_{TBA} - p_{YSP}$ varies substantially over sample: from 0 to 3 ($ per 100$ principal) – this range corresponds to $9k$ on $300k$ mortgage
- Strong upward trend & large variation around trend
- Note: level in late 2008 not unusually low vs. prior years
Monthly average price of intermediation $\phi$

- $\phi = p_{TBA} - p_{YSP}$ varies substantially over sample: from 0 to 3 ($ per 100$ principal) – this range corresponds to $9k$ on $300k$ mortgage
- Strong upward trend & large variation around trend
- Note: level in late 2008 not unusually low vs. prior years
- Next: what explains this?
What drives the price of intermediation?

\( \phi \) vs. Loan Applications

\( \phi \) highly correlated with level of new mortgage applications
- suggests increasing marginal costs of originating loans / limited capacity

\( \phi \) time trend consistent with increase in wages for R.E. credit employees
What drives the price of intermediation?

φ vs. Interest Volatility

φ vs. Concentration

- φ seems unrelated to MOVE index (implied Treasury volatility), which proxies for hedging costs
- φ time trend not driven by increase in concentration (measured as share of top 4 lenders in HMDA, as in Scharfstein and Sunderam 2016)

Willen (Boston Fed)
### Determinants of the price of intermediation

<table>
<thead>
<tr>
<th></th>
<th>$\phi$, OLS</th>
<th></th>
<th>$\phi$, IV</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Applications</td>
<td>0.199*</td>
<td>0.357***</td>
<td>0.331***</td>
<td>0.407***</td>
</tr>
<tr>
<td></td>
<td>(0.108)</td>
<td>(0.042)</td>
<td>(0.049)</td>
<td>(0.058)</td>
</tr>
<tr>
<td>Time Trend</td>
<td>0.026***</td>
<td>0.016**</td>
<td>0.025***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.008)</td>
<td>(0.007)</td>
<td></td>
</tr>
<tr>
<td>Volatility</td>
<td>-0.094</td>
<td></td>
<td>-0.027</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.077)</td>
<td></td>
<td>(0.074)</td>
<td></td>
</tr>
<tr>
<td>Lender Conc.</td>
<td>0.060</td>
<td></td>
<td>0.148**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.085)</td>
<td></td>
<td>(0.069)</td>
<td></td>
</tr>
<tr>
<td>R.E. Payroll</td>
<td>0.199***</td>
<td>0.154**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.063)</td>
<td>(0.063)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>1.398***</td>
<td>-14.485***</td>
<td>-8.725*</td>
<td>-14.263***</td>
</tr>
<tr>
<td></td>
<td>(0.124)</td>
<td>(1.319)</td>
<td>(4.981)</td>
<td>(4.578)</td>
</tr>
<tr>
<td>Obs.</td>
<td>73</td>
<td>73</td>
<td>73</td>
<td>73</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>0.10</td>
<td>0.84</td>
<td>0.87</td>
<td></td>
</tr>
<tr>
<td>1st st. F-stat</td>
<td></td>
<td></td>
<td></td>
<td>38</td>
</tr>
</tbody>
</table>

Newey-West standard errors (4 lags) in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
## Determinants of the price of intermediation

<table>
<thead>
<tr>
<th></th>
<th>$\phi$, OLS</th>
<th>$\phi$, IV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Applications</td>
<td>0.199***</td>
<td>0.357***</td>
</tr>
<tr>
<td></td>
<td>(0.108)</td>
<td>(0.042)</td>
</tr>
<tr>
<td>Time Trend</td>
<td>0.026***</td>
<td>0.016**</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>Volatility</td>
<td>-0.094</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.077)</td>
<td></td>
</tr>
<tr>
<td>Lender Conc.</td>
<td>0.060</td>
<td>0.148**</td>
</tr>
<tr>
<td></td>
<td>(0.085)</td>
<td>(0.069)</td>
</tr>
<tr>
<td>R.E. Payroll</td>
<td>0.199***</td>
<td>0.154**</td>
</tr>
<tr>
<td></td>
<td>(0.063)</td>
<td>(0.063)</td>
</tr>
<tr>
<td>Constant</td>
<td>1.398***</td>
<td>-14.485***</td>
</tr>
<tr>
<td></td>
<td>(0.124)</td>
<td>(1.319)</td>
</tr>
<tr>
<td>Obs.</td>
<td>73</td>
<td>73</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>0.10</td>
<td>0.84</td>
</tr>
<tr>
<td>1st st. F-stat</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes:
- Newey-West standard errors (4 lags) in parentheses
- * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

- **High correlation with applications**
- **More or less consistent with figures**
Determinants of the price of intermediation

<table>
<thead>
<tr>
<th></th>
<th>φ, OLS</th>
<th></th>
<th>φ, IV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Applications</td>
<td>0.199**</td>
<td>0.357***</td>
<td>0.331***</td>
</tr>
<tr>
<td></td>
<td>(0.108)</td>
<td>(0.042)</td>
<td>(0.049)</td>
</tr>
<tr>
<td>Time Trend</td>
<td>0.026***</td>
<td>0.016**</td>
<td>0.025***</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.008)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Volatility</td>
<td>-0.094</td>
<td>-0.027</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.077)</td>
<td>(0.074)</td>
<td></td>
</tr>
<tr>
<td>Lender Conc.</td>
<td>0.060</td>
<td>0.148**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.085)</td>
<td>(0.069)</td>
<td></td>
</tr>
<tr>
<td>R.E. Payroll</td>
<td>0.199***</td>
<td>0.154**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.063)</td>
<td>(0.063)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>1.398***</td>
<td>-14.485***</td>
<td>-14.263***</td>
</tr>
<tr>
<td></td>
<td>(0.124)</td>
<td>(1.319)</td>
<td>(4.578)</td>
</tr>
<tr>
<td>Obs.</td>
<td>73</td>
<td>73</td>
<td>73</td>
</tr>
<tr>
<td>Adj. R²</td>
<td>0.10</td>
<td>0.84</td>
<td>0.87</td>
</tr>
<tr>
<td>1st st. F-stat</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Newey-West standard errors (4 lags) in parentheses

* p < 0.10, ** p < 0.05, *** p < 0.01

- High correlation with applications
- More or less consistent with figures
More direct evidence of capacity constraints

- HMDA: when applications increase by 1 S.D., time to process new applications increases 3-4 days

- Upward trend in processing time is consistent with increase in labor intensity of underwriting over this period
 Implicit cost to borrowers

- Over 73-month period in our paper:
  - $6.4T in refinancing and $3.5T in new mortgage debt
  - Households implicitly paid $147B to intermediaries ($\approx$ $25B/year)
Implicit cost to borrowers

- Over 73-month period in our paper:
  - $6.4T in refinancing and $3.5T in new mortgage debt
  - Households implicitly paid $147B to intermediaries ($\approx$ $25B/year)
- How much would borrowers have paid if $\phi$ did not react to applications or time trend? ($holding \ Q \ fixed$)
Implicit cost to borrowers

- Over 73-month period in our paper:
  - $6.4T in refinancing and $3.5T in new mortgage debt
  - Households implicitly paid $147B to intermediaries (≈ $25B/year)
- How much would borrowers have paid if $\phi$ did not react to applications or time trend? (*holding $Q$ fixed*)

**Borrower Costs**

*Monthly expenditure on intermediation in billions of $*

- Actual (Total=$147B)
- No effect of apps (Total=$101B)
- No time trend (Total=$85B)
- No effect of apps, no time trend (Total=$12B)
Implicit cost to borrowers

- Over 73-month period in our paper:
  - $6.4T in refinancing and $3.5T in new mortgage debt
  - Households implicitly paid $147B to intermediaries ($\approx$ $25B/year)
- How much would borrowers have paid if $\phi$ did not react to applications or time trend? *(holding $Q$ fixed)*

**Borrower Costs**

**Borrower Rates**
Policy Implications

- Refinancing mortgages was a key instrument of policy
  - Extremely expensive for borrowers
  - Especially as costs explode precisely when people want to refinance
- Time trend
  - Typically blamed on regulation
  - More research to be done.