Comments
The Impact of Credit Risks Mispricing On Mortgage Lending During the Subprime Boom by James Kahn and Benjamin Kay

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These views are mine and do not reflect the views of the Federal Reserve Bank of Philadelphia or the Federal Reserve System.

Goals

1. First, I will summarize the main argument of the paper and its methodological approach.

2. Second, I will lay out some institutional features of the MI market in the US to clarify where mispricing and adverse selection did, and did not, take place. I will then use this to provide some specific comments about their model and empirical results.

3. Finally, I want to put the MI industry in the broader context of the financial crisis and point out its critical role in the losses suffered by Fannie Mae and Freddie Mac that led to the Large Scale Asset Purchase Program (LSAP), the precursor of the"quantitative easing" programs in the US.

Main Argument & Methodology

- Main argument: underpricing of mortgage insurance for high-risk loans prior to the crisis caused a big growth of the high-risk segment of the mortgage market, which contributed to the subprime boom and bust.

Methodology

1. Mispricing: MI premiums vary in the cross section (by LTV and FICO), but there is little variation in premiums with respect to FICO scores pre-crisis.
2. Adverse selection: K&K build an index of insurance premiums; premium increases were mostly in the "very high risk" category late in the crisis, and that changes in market shares in risk categories demonstrate a negative relation with the change in their premium.
3. Mispricing: calibrate a two-period lending/insurance model based on the 2013 premiums, and use the model to calculate the "correct" premium for loans in 2005. $\Delta(P_j - P_j^*)$ represents the extent of the mispricing.
4. Adverse selection and "rationing": Regress the change in the market share between 2005 and 2013 on the change of its "mispricing" and show a negative relation; the significance of their "non-pricing factor" (FICO<640) is evidence of "rationing."

What I Liked About the Paper

- K&K study the financial crisis through the lens of the MI industry, which is often neglected. I will argue that the MI industry had an outsized effect on the financial crisis, and this needs to be studied.

- They made a great effort to collect the MI premium data, which is quite complicated. By and large, they got this correct.

- The indexes they develop also helps us understand how insurance premiums changed over time, particularly during the crisis years.

Risk-Based Pricing Did Exist So Did Adverse Selection

Table V
Private Mortgage Insurance Rates, 2005 versus 2013

		minimum FICO Scores									
	Max LTV	760	740	720	700	680	660	640	620	600	575
2005	85	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.41	0.53	0.72
	90	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.68	0.90	1.22
	95	0.79	0.79	0.79	0.79	0.79	0.79	0.79	1.00	1.32	1.80
	97	0.98	0.98	0.98	0.98	0.98	0.98	0.98	1.42	1.88	2.57
	100	1.07	1.07	1.07	1.07	1.07	1.07	1.34	1.58	2.10	2.87

- Author's comments: "We are unable to rationalize insurers' disregard of meaningful information about credit risk."
- MIs delegated the underwriting decisions to GSEs' automated underwriting systems (AUS), which did risk-base price.
  - GSE automated underwriting systems (AUS) had fully specified credit risk models across all dimensions, especially on credit scores. "Refer" or "Caution" loans had to be manually underwritten, with requirements for compensating factors.
  - GSEs put in loan level pricing adjustments (LLPAs).
  - As a result, prior to 2007 many of the riskier loans went to the private market, i.e., subprime and "Alt A" securitizations. FHA was a very small part of the market before 2007.
- Adverse selection occurred because originators routed the safest borrowers to junior liens (e.g. 80/10/10s), which the paper does not consider.

Pre-Crisis Competition Came More From 2nd Liens

GSE Originations Firsts and Seconds Share of Originations in 2005						
Combined LTV at Origination	credit_score_orig					
	620	660	700	740	740+	Total
	620	660	700	740	740+	Total
90	0.1%	0.5%	1.2%	1.4%	2.6%	5.8%
95	0.0%	0.3%	1.0%	1.3%	2.2%	4.8%
100	0.0%	0.0%	0.2%	0.3%	0.5%	1.0%
Total	0.1%	0.8%	2.4%	3.0%	5.3%	11.6%
% by FICO band	1%	7%	21%	26%	45%	
Source: Fannie and Freddie Loan Level Database						

GSE Originations With Mortgage Insurance Share of Originations in 2005						
LTV at Origination	credit_score_orig					
	620	660	700	740	740+	Total
	620	660	700	740	740+	Total
90	0.4%	1.3%	2.0%	1.9%	2.6%	8.2%
95	0.3%	0.9%	1.2%	1.1%	1.7%	5.2%
100	0.1%	0.2%	0.3%	0.3%	0.3%	1.2%
Total	0.8%	2.5%	3.6%	3.3%	4.6%	14.7%
% by FICO band	5%	17%	24%	22%	31%	
Source: Fannie and Freddie Loan Level Database						

GSE Originations Firsts and Seconds 2013 Share of Originations in 2013						
Combined LTV at Origination	credit_score_orig					
	620	660	700	740	740+	Total
90	0.0%	0.0%	0.2%	0.5%	1.6%	2.3%
95	0.0%	0.0%	0.1%	0.1%	0.4%	0.6%
100	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Total	0.0%	0.0%	0.2%	0.7%	2.0%	3.0%
% by FICO band	0%	2%	8%	23%	68%	
Source: Fannie and Freddie Loan Level Database						

GSE Originations With Mortgage Insurance Share of Originations in 2013						
LTV at Origination	credit_score_orig					
	620	660	700	740	740+	Total
90	0.0%	0.1%	0.9%	2.1%	7.2%	10.3%
95	0.0%	0.1%	1.2%	3.0%	8.6%	13.0%
100	0.0%	0.0%	0.1%	0.5%	1.2%	1.8%
Total	0.0%	0.3%	2.3%	5.5%	17.0%	25.1%
% by FICO band	0%	1%	9%	22%	68%	
Source: Fannie and Freddie Loan Level Database						

- In 2005, lenders often steered higher quality borrowers to second liens for the portion of LTVs > 80%, holding the junior lien on balance sheet; 92% of loans had FICO scores of 700 or more.
- However, post-crisis, lenders largely exited the high-LTV junior lien market.

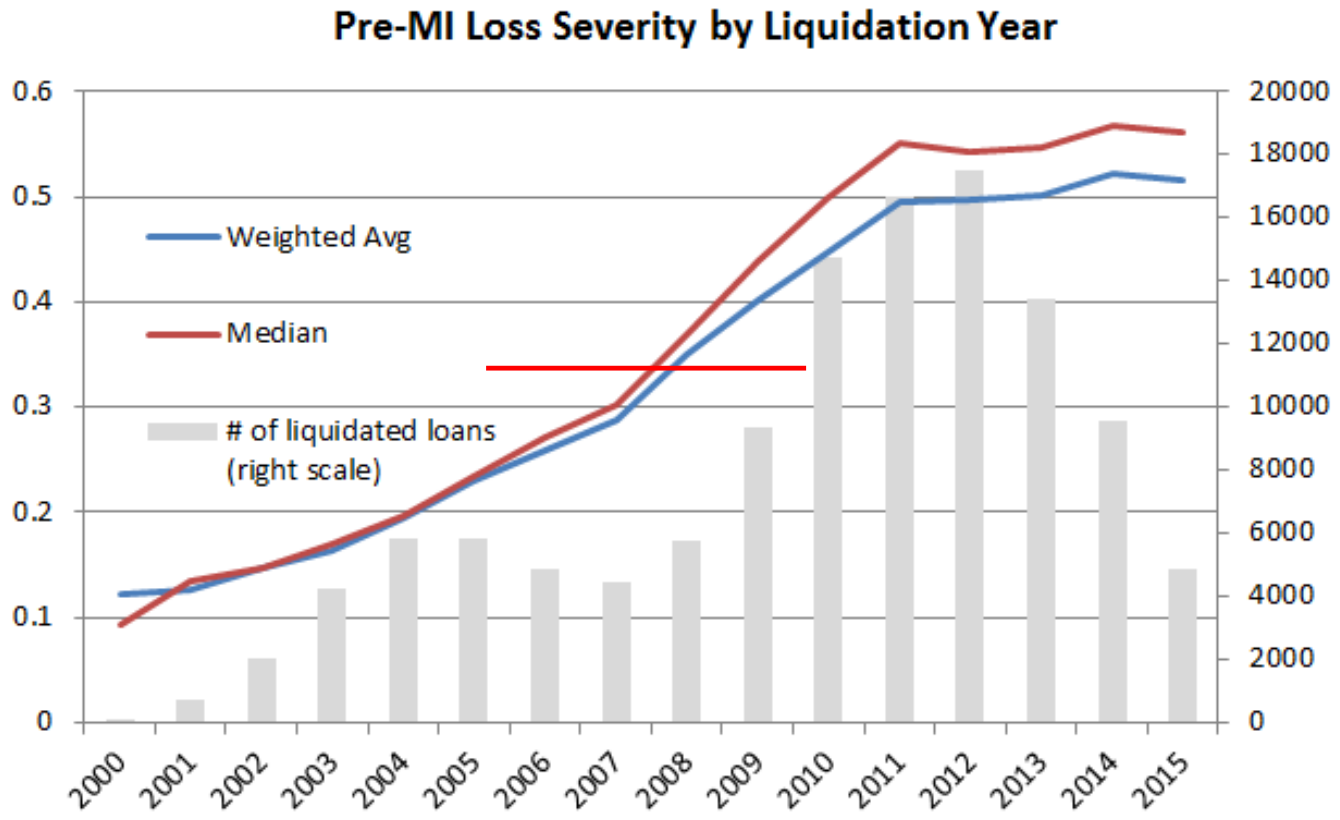
Average Pricing ≠ Mispricing

- Average pricing was predominant in the government and GSE parts of the housing market.
  - MIs received premiums of 32-107 bps per year for their insurance for loans with FICO scores of 660 or more.
  - GSEs generally negotiated 15-20 bps for their credit guarantees.
  - FHA had their own credit guarantees, which the authors' note were much less richly priced.

- *Ex* ante, MI credit guarantees were viewed as so rich that large banks had captive pool insurance contracts, gaining up to 40 percent of MI premiums for insuring a small "mezzanine" part of the credit risk.

MI Pricing ≠ FHA Pricing

- MIs only insure ≈35% of losses, while FHA insures all the losses.
  - An and Cordell (2017) show that losses exceeded 35% post-crisis.



Source: An and Cordell (2017)

What Exactly Does MI Cover?

- MIs only insure *default risk*. Natural disasters like flooding, wildfires in California and the 2017 hurricanes that struck Texas, Florida and Puerto Rico are not insured.

- MIs have the power to deny or rescind claims.
  - Bhutta and Keys: "PMI companies sharply increased their rescission rates, denying claims at a rate of 20-25% in 2008 and 2009. Elevated use of rescissions…were crucial for several PMIs to survive the Great Recession."
  - This figured prominently into GSE losses (later).

- The GSEs, private label MBS or FHA did not have this power.
  - They own the credit risk with some power to "put back" or sue, but these powers were not used nearly as extensively.

Use Black Knight McDash Data

Market Shares of 2005 GSE Originations For High LTV Products by FICO Score											
LTV	2005 Origination FICO										
	760	740	720	700	680	660	640	620	600	575	Grand Total
85	3.0%	1.7%	1.8%	1.9%	1.9%	1.8%	1.5%	1.1%	0.5%	0.3%	15.5%
90	7.3%	4.0%	4.5%	4.9%	4.8%	4.5%	3.7%	2.6%	1.1%	0.6%	38.0%
95	4.6%	2.4%	2.6%	2.8%	2.8%	2.6%	2.5%	2.0%	0.9%	0.6%	23.9%
97	0.4%	0.3%	0.3%	0.4%	0.5%	0.5%	0.5%	0.5%	0.2%	0.1%	3.7%
100	1.9%	1.4%	1.7%	2.0%	2.5%	2.6%	2.8%	2.4%	1.0%	0.6%	18.9%
Grand Total	**17.3%**	**9.8%**	**10.8%**	**12.0%**	**12.5%**	**12.0%**	**11.0%**	**8.7%**	**3.8%**	**2.2%**	**100.0%**

Market Shares	
Very High Risk	44%
High Risk	22%
Medium	22%
Low	12%
Totals	100%

Source: Black Knight McDash

- My cuts show a much smaller share of “Very High Risk” Loans, but there are still lots of high/very risk loans.
- I also did not do 80% LTV and 103%; MIs did almost no 103%.

RADAR Also Has the GSE Data

Market Shares of 2013 GSE Originations
For High LTV Products by FICO Score

LTV	2013 Origination FICO										
	760	740	720	700	680	660	640	620	600	575	Grand Total
85	18.8%	5.8%	4.6%	3.4%	1.8%	0.9%	0.4%	0.2%	0.0%	0.0%	35.8%
90	24.5%	7.9%	6.4%	4.3%	2.0%	0.9%	0.4%	0.2%	0.0%	0.0%	46.7%
95	7.7%	2.8%	2.3%	1.7%	1.1%	0.6%	0.2%	0.1%	0.0%	0.0%	16.4%
97	0.4%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%
100	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
Grand Total	**51.5%**	**16.7%**	**13.5%**	**9.5%**	**5.0%**	**2.4%**	**1.0%**	**0.4%**	**0.0%**	**0.0%**	**100.0%**

Market Shares	
Very High Risk	4%
High Risk	14%
Medium	33%
Low	49%
Totals	100%

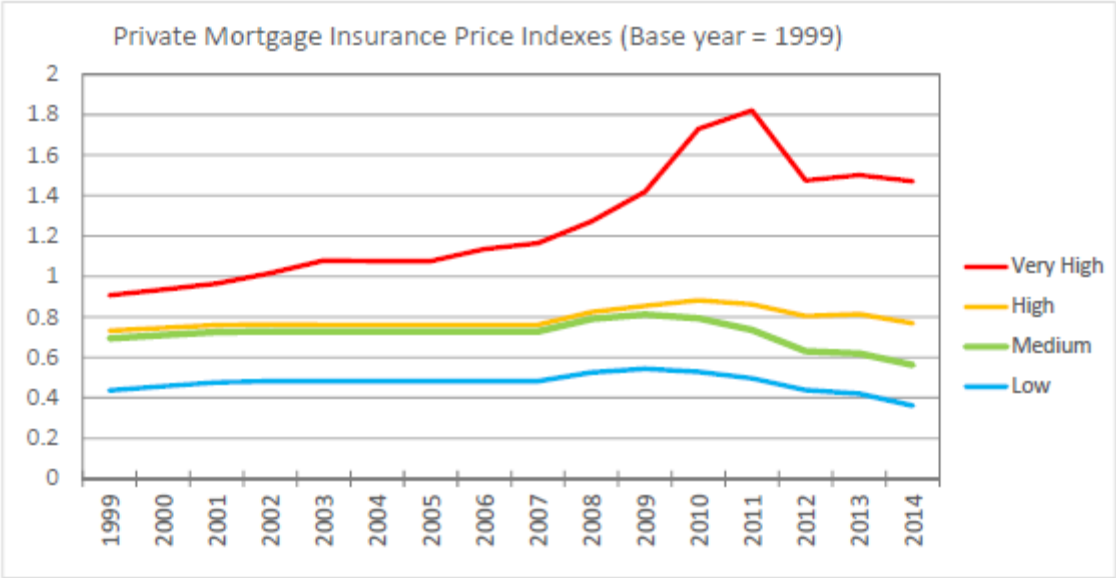
Source: Fannie Mae and Freddie Mac Loan-Level Dataset

- The GSE data more recently shows the Very High Risk loans have all but disappeared.
- FICO<640 all but disappears; K&K interpret this as “rationing” later.

MI Pricing Seems to Work For All But the Very Riskiest Group

Max LTV (%) \ Min FICO Score	760	740	720	700	680	660	640	620	600
103	4.98	6.43	8.30	10.16	11.84	13.51	16.64	19.77	23.49
100	4.48	5.80	7.52	9.24	10.77	12.30	15.23	18.16	21.66
97	3.97	5.17	6.74	8.31	9.70	11.08	13.82	16.55	19.83
95	3.22	4.20	5.49	6.77	7.91	9.05	11.36	13.66	16.43
90	2.64	3.44	4.49	5.53	6.47	7.41	9.32	11.22	13.51
85	2.20	2.85	3.70	4.54	5.32	6.10	7.65	9.20	11.06
80	1.39	1.79	2.30	2.81	3.30	3.79	4.72	5.65	6.76

Very High Risk
High
Medium
Low Risk



- Risk categories chosen from Lam et al (2013) show that for the "chain weighted" PMI indexes, the risk bands where the most MI activity took place even before 2007, appears to have been priced well, even a bit rich.

Change in Price ≠ Mispricing

Table XII
Product Share Regression Results†

variable	Model I	Model II	Model III
constant	0.952	0.523	0.426
	(0.293)	(0.186)	(0.167)
$\Delta(p_j - p_j^*)$	−1.703	−0.985	—
	(0.767)	(0.477)	
Δp_j^*	−5.176	−1.626	—
	(0.690)	(0.582)	
Δp_j	—	—	−1.189
			(0.445)
FICO < 640	—	−2.774	−2.983
		(0.312)	(0.256)
R^2	0.557	0.837	0.832

†The dependent variable is $\ln(y/(1-y))$, where $y \in [0,1] \equiv 1 + \Delta\hat{s}_j/2$ is the transformed change in product share. Standard errors are in parentheses.

Source: CoreLogic, WI and NC mortgage insurer regulatory filings, and authors' calculations.

- Coefficients in question $\Delta(P_j - P_j^*)$ is insignificant, not supporting the adverse selection hypothesis, even though adverse selection existed.
- "Model I results suggest that mortgages with FICO < 640 were in fact priced attractively in 2005, and that their near disappearance was…attributable to the increase in MI premiums."
  - Disappearance was attributable to the collapse of the subprime market!

What Happened in US Housing Markets?

- GSEs AUS set the standards on what was/was not insured.
  - GSEs did risk-base price, but there was some adverse selection from the fact that MI insured credit risk down to 65% LTV.
  - But prior to the shutdown of the private label market in 2007, many of the riskiest loans went to private markets (i.e. subprime and Alt A PLMBS).

- Adverse selection also occurred through second liens, since originators controlled the market at the point of sale.
  - Up until onset of the crisis, originators "skimmed off" the least risky, high FICO borrowers, using junior liens (e.g 80/10/10s or 80/20s).

- When PLMBS market shut down in 2007, the GSEs and FHA became the market.
  - Many risky loans went to the GSEs, creating huge losses.
  - Faulty underwriting prompted mass rescissions, escalating GSE losses.

- Post crisis, the low FICO/high LTV market largely disappeared, but some went to the government.

GSEs, MIs and the Financial Crisis

Market Shares of 2007:2008Q1 GSE Originations
For High LTV Products by FICO Score

LTV	2007:208Q1 Origination FICO										
	760	740	720	700	680	660	640	620	600	575	Grand Total
85	2.2%	1.2%	1.3%	1.5%	1.7%	1.4%	1.2%	1.1%	0.6%	0.5%	12.6%
90	5.6%	3.2%	3.5%	4.1%	4.4%	3.6%	3.0%	2.5%	1.2%	0.9%	32.0%
95	4.1%	2.3%	2.6%	3.1%	3.4%	2.4%	2.2%	1.8%	1.0%	0.7%	23.7%
97	0.4%	0.3%	0.3%	0.4%	0.5%	0.5%	0.5%	0.5%	0.3%	0.2%	3.9%
100	3.2%	2.2%	2.5%	3.0%	3.5%	3.7%	3.7%	3.4%	1.6%	1.1%	27.8%
Grand Total	15.5%	9.1%	10.2%	12.1%	13.4%	11.6%	10.7%	9.4%	4.7%	3.4%	100.0%

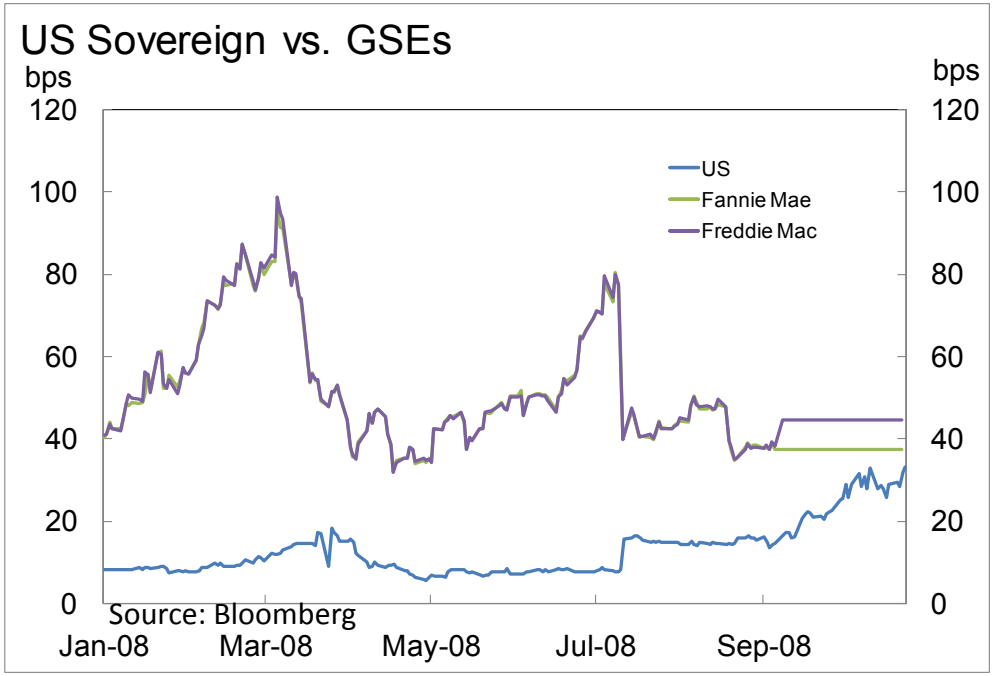
Market Shares	
Very High Risk	50%
High Risk	21%
Medium	19%
Low	9%
Totals	100%

Source: Black Knight McDash

- With the shutdown in the private label market, the GSEs and FHA became the market for first lien loans.
  - In 2007, over 70% of loans covered by MI were High/Very High Risk.
- In September 2008 the GSEs were put into conservatorship because of very large expected losses.
- The failure of Lehman Brothers and rescue of AIG and many large banks precipitated the Great Recession.

GSEs, MIs and the Financial Crisis

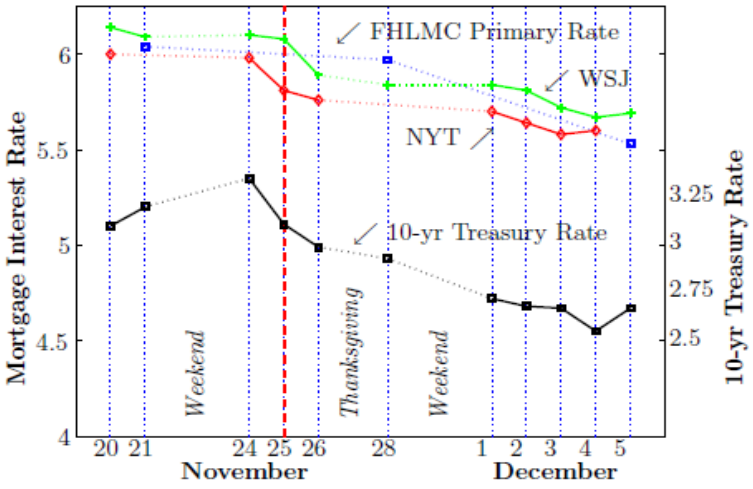
- Losses on GSEs mounted significantly, driven in part by MI rescissions that put losses directly back to the GSEs. It became clear the original infusion of $100 billion in preferred stock to the GSEs would not be enough.
- During this time, credit spreads on GSE debt rose, putting upward pressure on their debt and even on yields on GSE MBS.
- Even CDS spreads on the US sovereign increased.



GSEs, MIs and the Financial Crisis

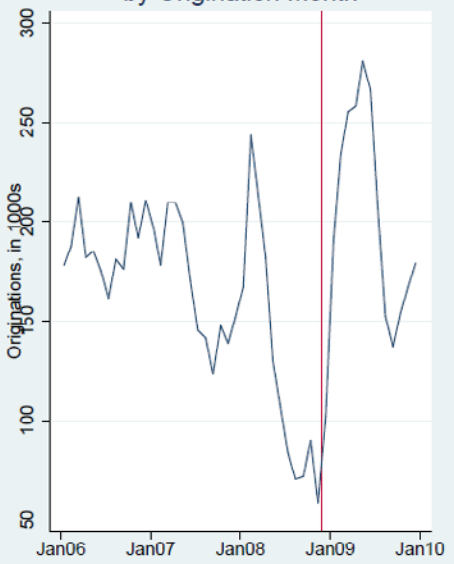
- On November 25, 2008 the Federal Reserve announced the Large Scale Asset Purchase Program (LSAP), initially $500 billion of MBS purchases, further supporting the Fed's purchase of long-term Treasuries.
- They also injected another $200 billion in preferred shares into the GSEs.
- The effects on credit markets were immediate and profound.

Figure 4: Interest Rates Over the Period Immediately Before and After the Initial Announcement of the LSAP Program on November 25, 2008



Source: Haver Analytics.

Source: Fuster and Willen (2010)



Conclusions

- Understanding micro credit markets are important because they can have profound effects on macroprudential policies and monetary policies.
  - Adverse selection in MI markets did lead to excessive risk-taking.
  - MI rescission policies elevated GSE losses, which caused mortgage rates to rise, prompting the LSAP of $500 billion of MBS, later expanded to "Quantitative Easing" Programs.

- The fundamental problem with the MI model is not mispricing per se, but rather adverse selection, primarily from second liens at lenders and partly due to GSEs' AUS.

- Bhutta and Keys (2017): "…there are few private markets capable of supporting catastrophe-style insurance, and the recent housing crisis has made it clear that PMI is, at its core, insurance against a national housing downturn, a form of systemic risk" (p. 23).