

Why did financial institutions sell RMBS at fire sale prices during the financial crisis?

Craig B. Merrill, Taylor D. Nadauld, Shane Sherlund, and
René M. Stulz

A Key Fact of the Financial Crisis is the Dramatic Drop in Value of Structured Finance Securities



Motivation

- It is often argued that the fall in RMBS prices was partly brought about by fire sales from financial institutions.
- Fire sales: forced sales at discount from fundamental value.
- Did financial institutions have RMBS fire sales? No systematic evidence, but many examples.
- Literature has focused on two mechanisms:
 - Collateralized borrowing.
 - Capital requirements.

The Collateral Mechanism

- Suppose that you buy \$99 million of RMBS financed through repos for \$90 million, so that you have to provide \$9 million of margin.
- If the value falls, you have to sell or provide more equity to keep the margin at 10%.
- With no additional equity, if RMBS value falls by 5%, you have to sell half of your holdings.
- You have to sell if margin increases as well.
- In illiquid markets, these sales take place at less than fundamental value, so that they are fire sales.

The Capital Requirements Mechanism

- In the simplest view, capital requirements have the same effect.
- Suppose you need capital of 10%.
- Your assets are RMBS for \$99 million.
- If you have \$9 million of equity and value falls by 5%, you need to raise more equity or cut your portfolio in half.
- If raising equity is not an acceptable solution, then you have to engage in a fire sale.

The puzzle with the capital requirement channel

- A financial institution has a diversified portfolio of securities.
- It can select which assets to sell when it does not have enough regulatory capital.
- With a leverage ratio, any sale that decreases assets without decreasing capital decreases leverage.
- Hence, why would financial institutions sell illiquid assets to restore capital ratios?

What we do

- Provide a theory of fire sales caused by capital requirements for financial institutions that hold a diversified portfolio of securities.
- We investigate whether insurance companies engaged in fire sales of RMBS and why.
- We have all open market RMBS transactions from 2006 to 2012.
- We have mortgage-level data for all RMBS.

What we find

- Fair value treatment is critical for capital requirements to lead to fire sales.
- Before 2009, fair value applied to P&C firms but not life firms; after 2009 it applies to all.
- P&C capital-constrained firms are more likely to sell RMBS at fire sale discounts than life firms before 2009.
- In 2009, there is no difference.
- The fire sale discounts are as large as 20% for high default-rate RMBS, which are those with the largest capital requirements.
- Evidence of dislocation in the RMBS market consistent with the existence and impact of fire sales.

Capital Requirements

- Two types:
 - Leverage ratio
 - Risk-based capital requirement
- With leverage ratio, a financial institution has incentives to sell the most liquid assets and avoid fire sales.
- With risk-based, assets are risk-weighted according to riskiness. Basel II standard approach allows risk-weighting to depend on credit ratings and internal models.
 - AAA or AA-rated assets = 20% risk weighting
 - A-rated assets = 50% risk weighting
 - BBB-rated assets = 100% risk weighting
 - BB-rated assets = 200% risk weighting

Implications of Risk-Based Capital Requirements

- As securities become more risky, capital requirements increase.
- A sale of \$100 million of RMBS releases 10 times more reg capital if the RMBS are BB instead of AAA.
- Hence, incentive to sell riskier securities even if they sell at a discount.

The Economic Implications of Accounting Treatment

- Securities can be valued on the balance sheet at either amortized cost (HTM and AFS securities) or fair value.
- If assets are not valued on the balance sheet at fair value and/or if fair value losses have not passed through earnings, selling assets that have lost considerable value is extremely costly for a financial institution.
- OTTI accounting requires amortized cost securities to be marked-to-market if permanently impaired.
- Under OTTI accounting, a financial institution does not postpone the realization of a loss in the event of a credit downgrade to the asset.
- While GAAP requires OTTI accounting, the treatment of OTTI for capital requirement purposes differs depending on Reg accounting.

Insurance Companies and OTTI Accounting

- The insurance industry broadened the implementation of fair value accounting during the financial crisis.
 - Prior to 2009, P&C companies were required to use fair value accounting for downgraded RMBS.
 - Effective in 2009, the NAIC modified SSAP 43, and issued SSAP 43R, requiring OTTI treatment of asset-backed securities for all insurance companies.

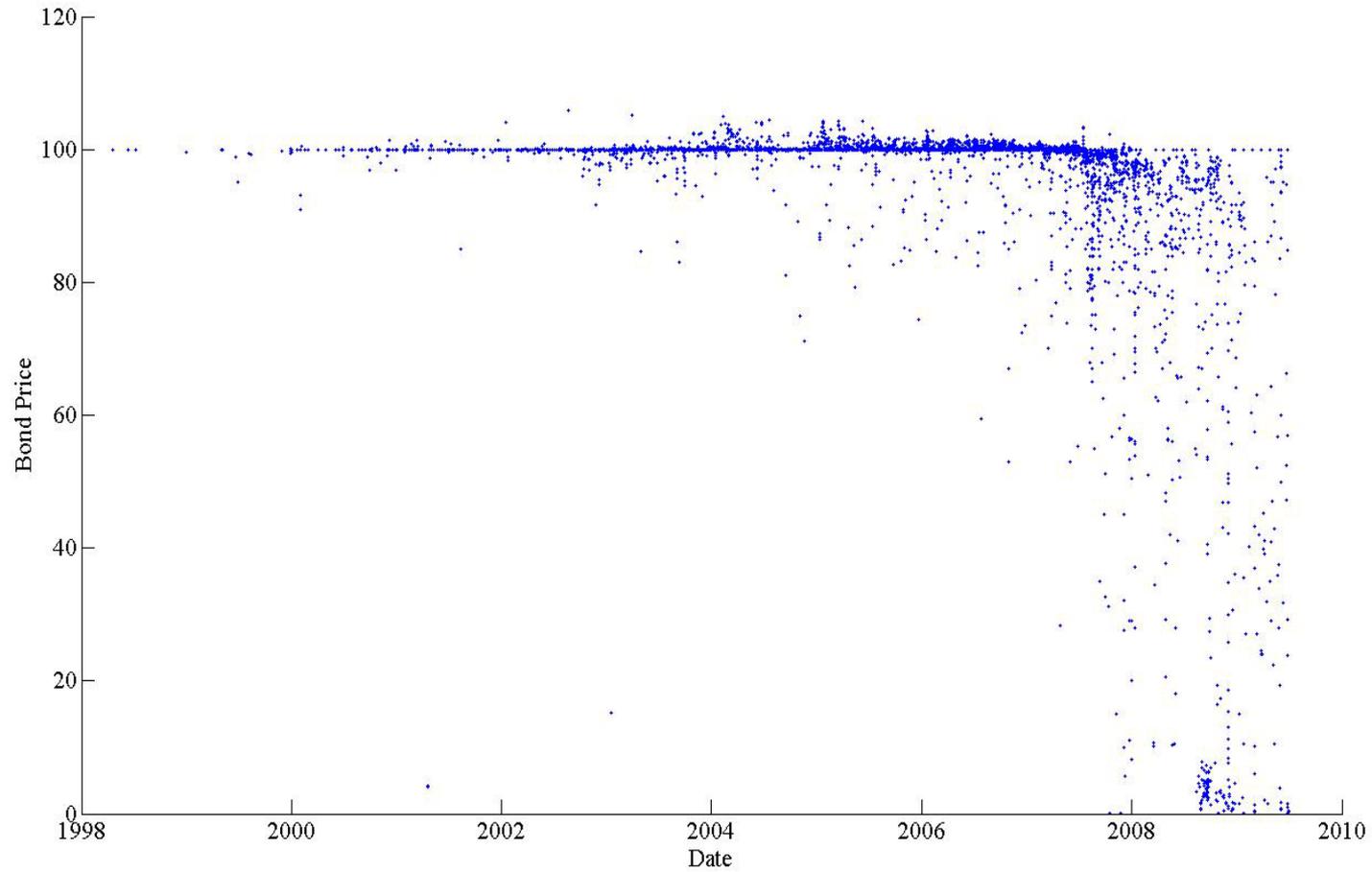
Capital Requirements in the Presence of OTTI Accounting

- Consider the following scenario:
 - A portion of non-agency RMBS portfolio gets downgraded from AAA rating to CCC rating.
 - Capital requirements increase substantially.
 - OTTI accounting forces recognition of the loss.
- Conditional on being forced to recognize the loss, as well as the substantial increase in capital requirements, the financial institution can be better off selling the asset even at a fire sale price
- Cost of selling the security is normal transaction costs plus fire sale discount.
- Cost of selling a more liquid security is normal transaction cost, but the financial institution has to sell perhaps ten times more of that security to achieve the same outcome in terms of regulatory capital.

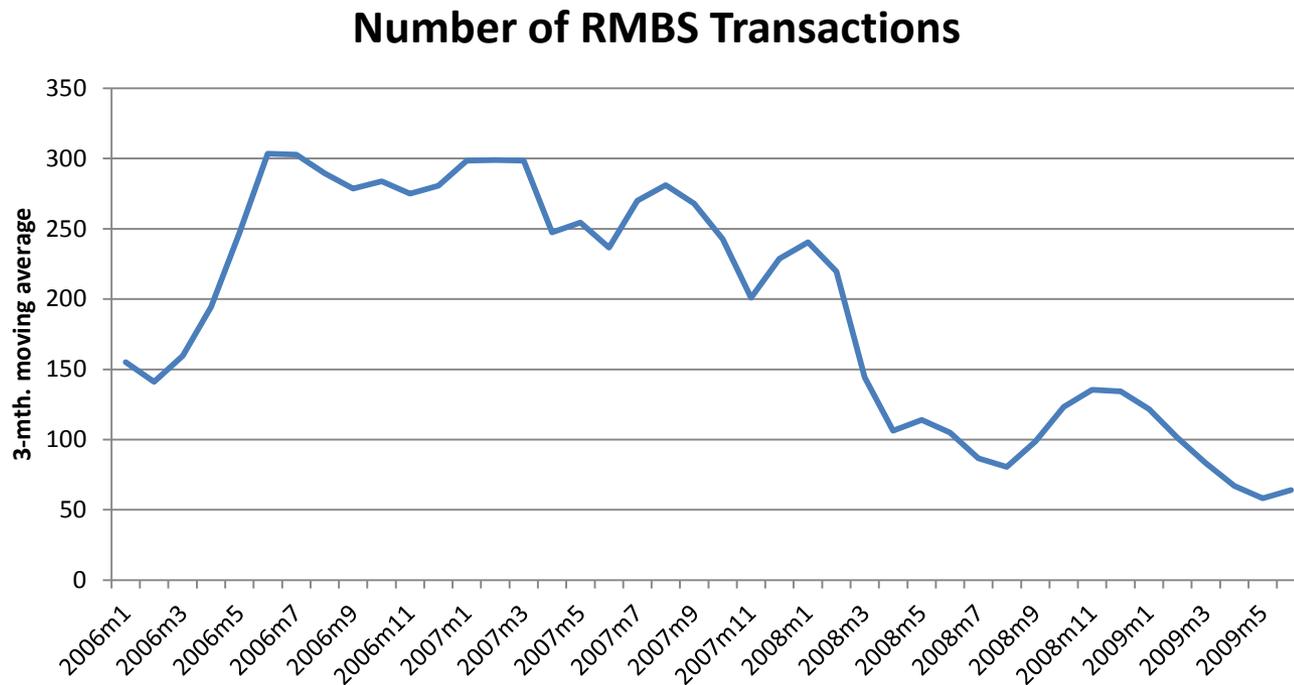
Hypotheses

- We should observe a dearth of liquidity in the market for credit-impaired securities.
- All else equal, capital constrained P&C firms are more likely than life insurance companies to sell downgraded securities in an illiquid market.
- RMBS sales of constrained firms that do occur in an illiquid market should occur at a discount in price relative to RMBS sales of non-constrained firms.
- Fire sale discounts should be most severe for the most credit-impaired securities.
- There should be evidence of dislocation in the RMBS market, in that we should see price reversals, high volatility of trade prices controlling for fundamentals, and natural buyers staying on the sidelines.

Prices in our Sample



Liquidity in Non-Agency RMBS Market



Are Constrained Firms More Likely to Sell?

- Estimate a Cox proportional Hazard model using a firm-RMBS panel data set.
 - Panel of monthly observations on the attributes of mortgage collateral supporting the RMBS as well as attributes of the insurance company which purchased the RMBS.
 - We track attributes of the RMBS beginning at the date of purchase through time until we observe the selling of the RMBS or the sample period ends.
 - In the estimation, “failure” is the sale of the RMBS while retention of the RMBS through the sample period represents “survival.”

Likelihood of selling RMBS (controls omitted)

Cox Proportional Hazard Model: Propensity to Sell RMBS Following Observed Purchase

Sample: 2006 - 2008

Note: Coefficients Reported (Not Hazard Ratios)

	P&C and Life Sample (1)	P&C Sample (2)	P&C Sample (3)	Life Sample (4)	Life Sample (5)
Property & Casualty Indicator	0.423** (2.529)				
Below-Median Risk-Based Capital Ratio		0.482** (2.340)	0.546* (1.807)	0.033 (0.136)	-0.058 (-0.189)
Below-Median Risk-Based Capital Ratio* Default Rate t-1			-1.066 (-0.453)		1.364 (0.784)

Do Lower Levels of Capital Cause Fire Sales?

- The observed patterns are potentially consistent with a capital-requirements-OTTI-fire-sale hypothesis.
- However, the evidence presented thus far does not rule out losses associated with poor credit-quality RMBS are themselves responsible for the lower levels of capital in the firm.
- Instrument: Negative operating income.

Results

- Controlling for changes in fundamentals, a capital-constrained P&C firm sells at lower price than one that is not capital-constrained.
- The difference is economically large (20%).
- No difference for life before 2009.
- Same result as for P&C in 2009 for life.

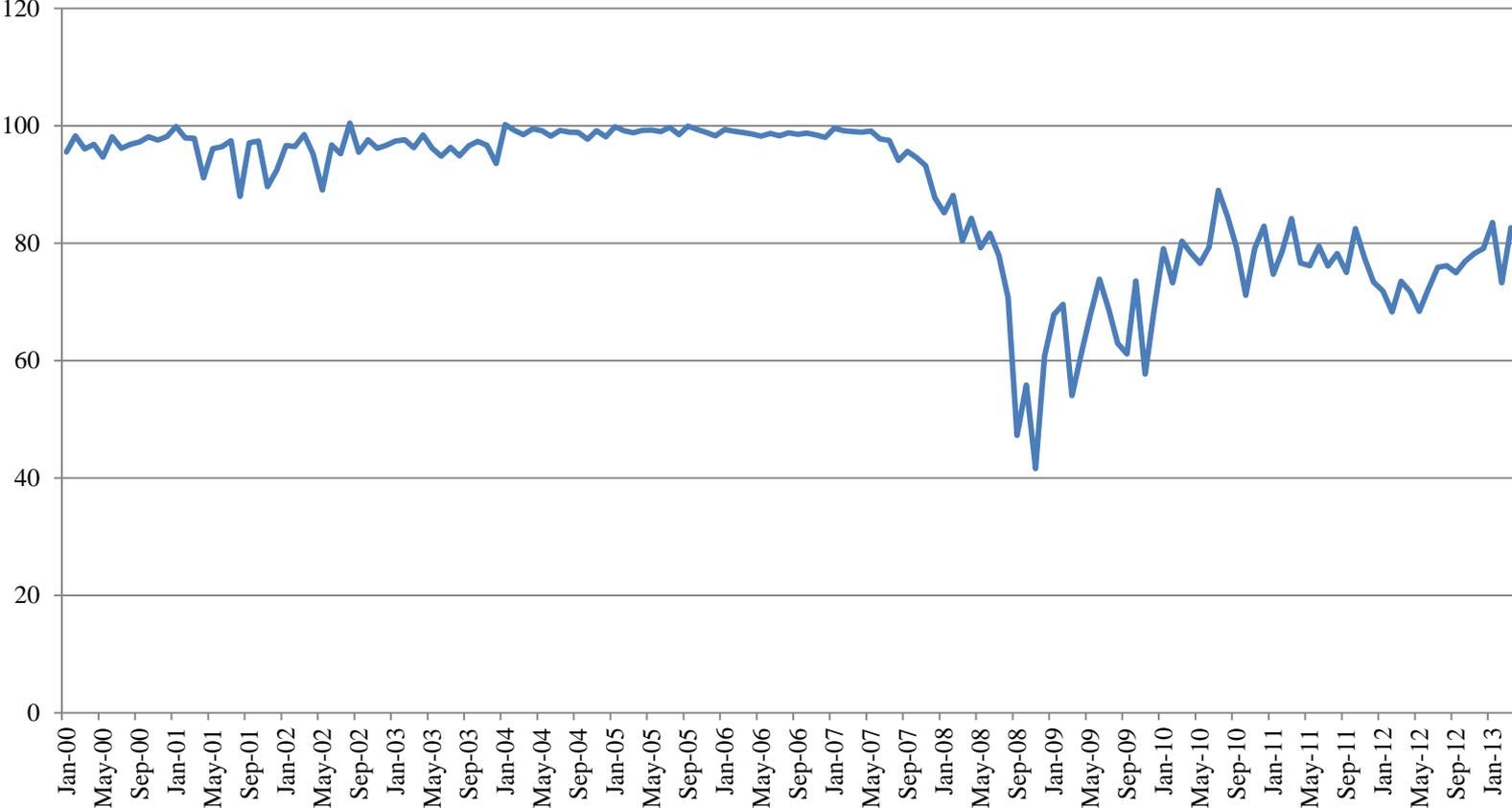
Are Discounts More Severe for the Most Credit-Impaired Securities?

- Regulatory capital charges increase as the credit quality of assets declines.
- Therefore, price discounts associated with urgent sales should be most severe for the most severely credit-impaired securities.
- We find that this is the case.

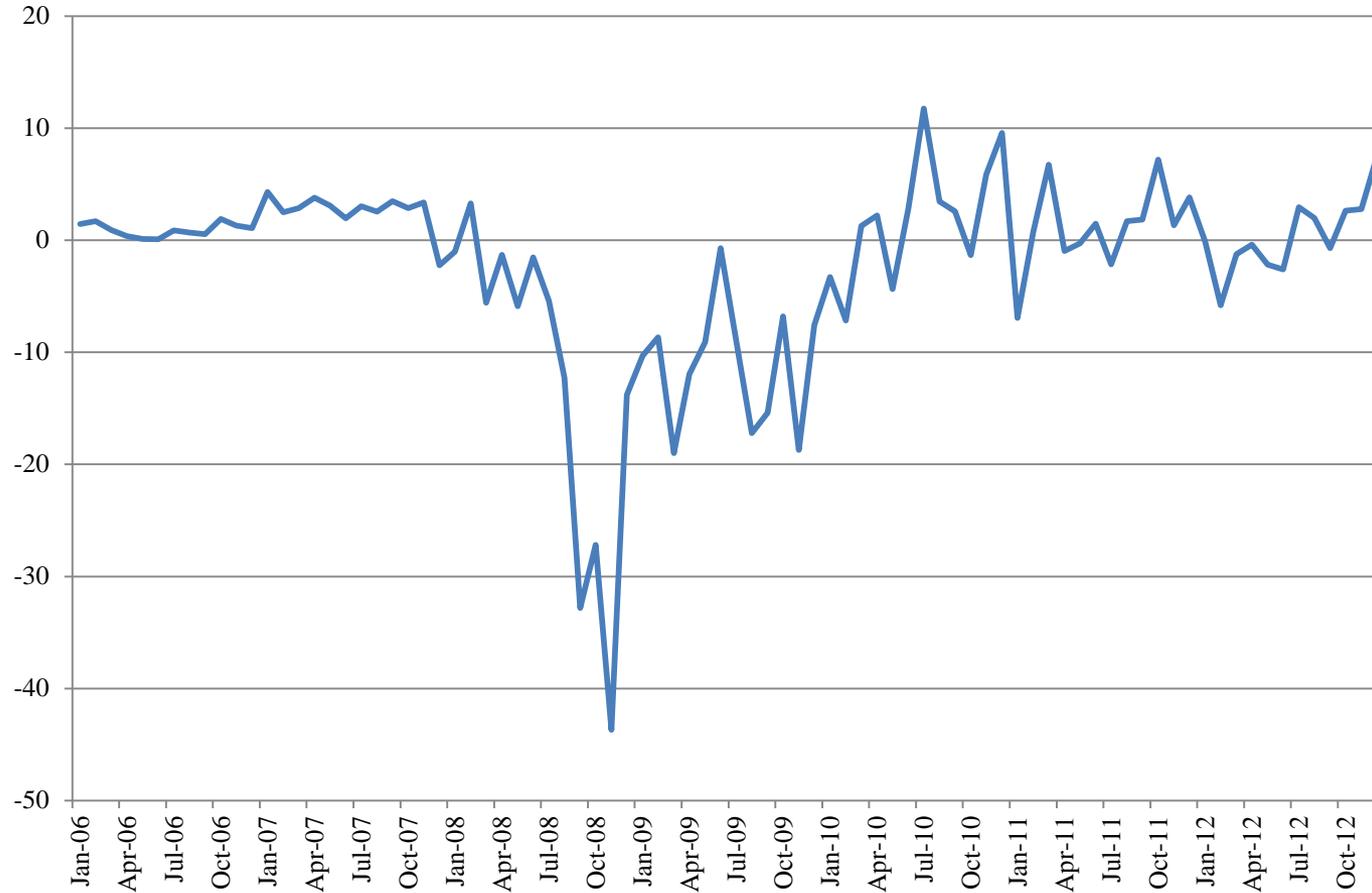
Did the RMBS market show signs of fire sales?

- We would expect:
 - Price reversals
 - High idiosyncratic variation in prices controlling for fundamental
- We find this.

Monthly Average RMBS Transaction Prices



Monthly Average RMBS Pricing Residuals



Three-month Moving Average of Standard Deviation in RMBS Pricing Residuals



Price Reversals (Controls Omitted)

Dependent Variable: % Change in Price from Prior
Transaction

(1)

(2)

Indicator: First Transaction Pre-Crisis, Second Transaction During Crisis

-18.740***

(4.97)

Indicator: First Transaction During Crisis, Second Transaction Post Crisis

15.367***

(5.16)

Indicator: First Transaction Pre-Crisis, Second Transaction Pre-Crisis

-7.740*

(1.82)

Indicator: First Transaction During Crisis, Second Transaction During Crisis

-6.559

(1.46)

Indicator: First Transaction Post-Crisis, Second Transaction Post-Crisis

-3.125

(0.81)

Indicator: First Transaction Pre-Crisis, Second Transaction Post-Crisis (omitted)

Conclusion

- Capital requirements in combination with OTTI accounting to lead to an economic motivation to engage in fire sales.
- Insurance companies with low levels of capital that were subject to OTTI accounting during the crisis were more likely to sell RMBS.
- Capital-constrained insurance companies sold RMBS at lower prices than non-capital constrained insurance companies.
- Fire sale discounts of capital constrained firms increased as the credit quality of the asset being sold declines.
- The market for RMBS exhibited signs of fire sales:
 - Price reversals, excessive cross-sectional volatility.