Investor Attention and Municipal Bond Returns

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The Big Picture

Question: how informationally efficient is the municipal bond market?
Revised Question: do investors in municipal bond markets use readily available information from other financial markets?

Answer: No. The market updates slowly and remains segmented from other linked markets.

Method: A simple event study, complicated greatly by illiquidity and heterogeneity.
More Detailed Method: When bond insurers become distressed and/or downgraded, we examine when and if returns on Aaa-rated uninsured bonds diverge from lower-rated insured bonds.

Our Contributions

1. Clean and rigorous analysis of whether muni investors respond to shocks (and which type) affecting the value of their investments.
   - Both retail and institutional municipal investors seem to ignore information in equity and CDS markets.
   - Changes in ratings for insurers prompt some selling by institutions.
   - Overall, the municipal market remains highly segmented from other markets.

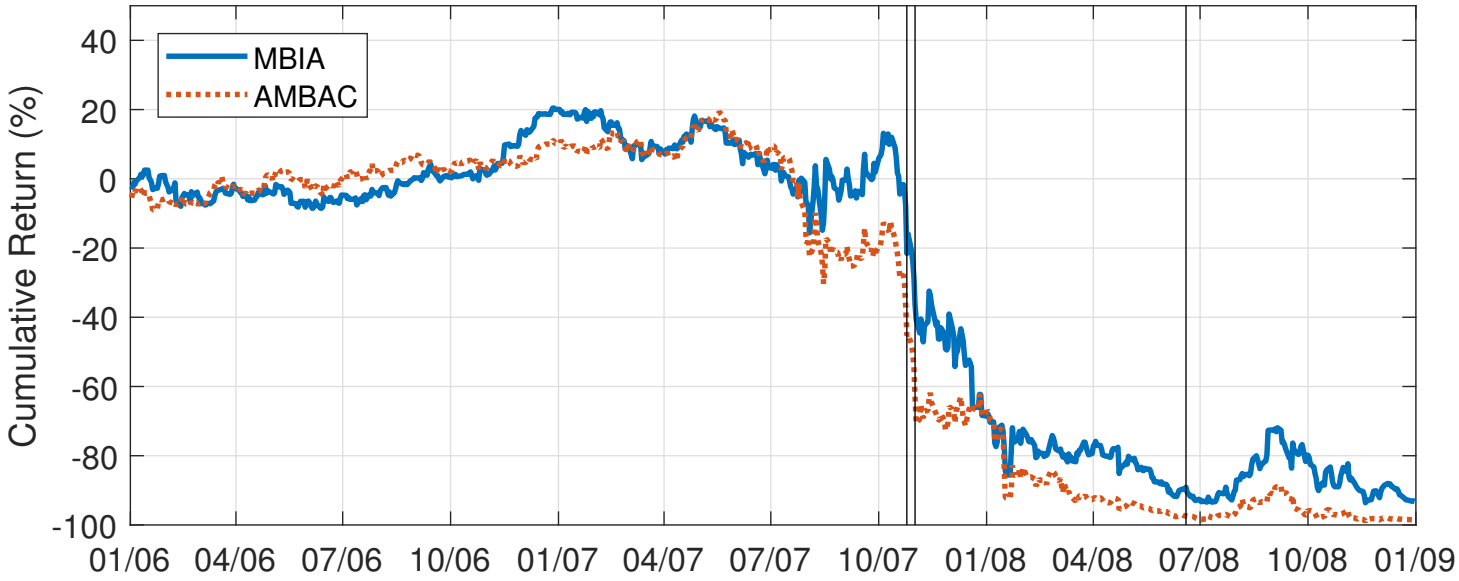
2. Novel analysis of whether insurance is valuable. Returns of low-rated insured bonds are identical to Aaa-rated uninsured bonds when insured by Aaa-rated insurer.

3. Robust methodology for computing indices and abnormal returns in illiquid and heterogeneous markets for use in event study analysis (with statistical inference).

We need an event date (x2)

1. Financial Distress revealed in equity market in Oct/Nov 2007
2. Loss of Aaa credit rating in June 2008

Importantly, the financial distress of the insurers is almost exclusively due to bad decisions to insure sub-prime CDO structures, and not due to credit deterioration in the municipal market.



The distress-downgrade period is valuable for research design: fundamental creditworthiness has changed but the "label" hasn't changed.

Signs of Distress Clear and Well-Publicized in 2007

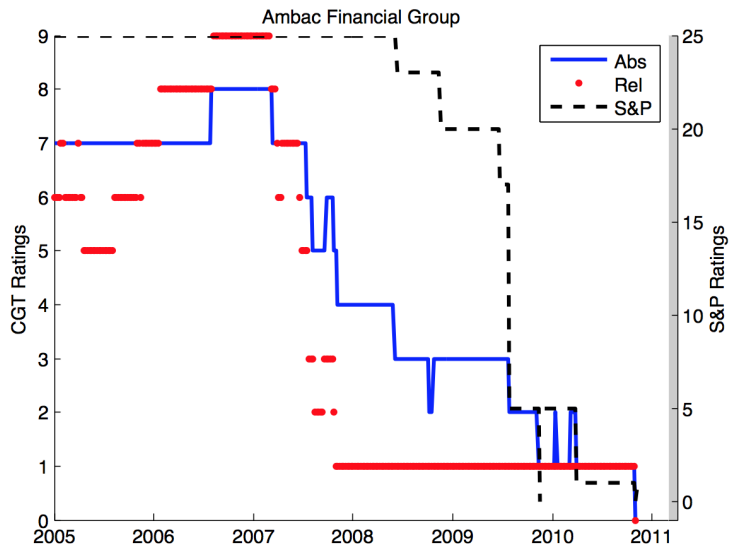
If unable to access additional capital, MBIA Inc. (Holdco) could be insolvent as soon as Q2'08

From "How to Save The Bond Insurers," a 145pg PowerPoint presentation by Bill Ackman, 11/28/17 (reported in NYT, FT and Reuters, 12/1/17)

MBIA Selected Financial Information

	2007	2006	2005
CDO par insured (US)	48,640	18,951	7,830
GO bond insured	20,742	20,777	27,586
Equity	2,336	9,849	8,065
Distance to Default	0.97	5.60	3.77
"Naive" Probability of Default	17%	0%	0%
Implied Moody's Rating	Caa	Aaa	Aaa
Actual Moody's Rating (12/31)	Aaa	Aaa	Aaa

Source: MBIA's 2007 10-K filing.



From Creal, Gramacy, & Tsay, 2014

▸ CDSGraph

Data (A Contribution by Itself)

1. Mergent Municipal Bond Securities database:
   - 3,555,964 bonds issued by 53,045 municipal issuers
   - Final sample: 763,070 G.O. bonds issued between 1960 - June 2016
2. Mergent insurer's data unreliable: have only the most recent insurer (original insurer overwritten)
   - Hand collect insurer portfolio novation data from insurance companies, track down transfered CUSIPs, and re-instate original insurer data
3. Comprehensive ratings histories directly from Moodys and S&P websites (provided by Ryan Israelsen MSU)
4. MSRB Municipal Bond Trade database:
   - After merging with our GO bond sample and cleaning: 4,456,041 trade pairs spanning 2005-2016/06
5. Other data pieces: CRSP, Bloomberg, CRAs' websites, insurers' websites and financial reports

Key Research Challenges

1. We need: daily returns on insured bond portfolios and on corresponding benchmark (non-insured Aaa bonds)
2. How to compute daily returns (of insured bond portfolios and of benchmark) when munis are so illiquid? (The average bond in sample trades about 30 times during 12-year sample period 2005-2016/07)
3. CAN'T just use data on the bonds that actually trade on each day to compute a day's average:
4. Important to measure portfolio returns employing all observations for all bonds in the portfolio... **but how**???

Key Research Challenges: Addressed with Insights from Real Estate Literature

- Muni bonds are like houses: highly heterogeneous and very illiquid
- Modify tools from real estate economists who use Repeat Sales Regressions (RSR) to calculate house price appreciation indices all the time (similar to Spiegel & Starks (2016) for corporate bonds)
- Apply GRSR (Peng (2010)) to estimate common return index for all bonds with the same insurer, as well as separate loadings for different underlying credit rating classes:

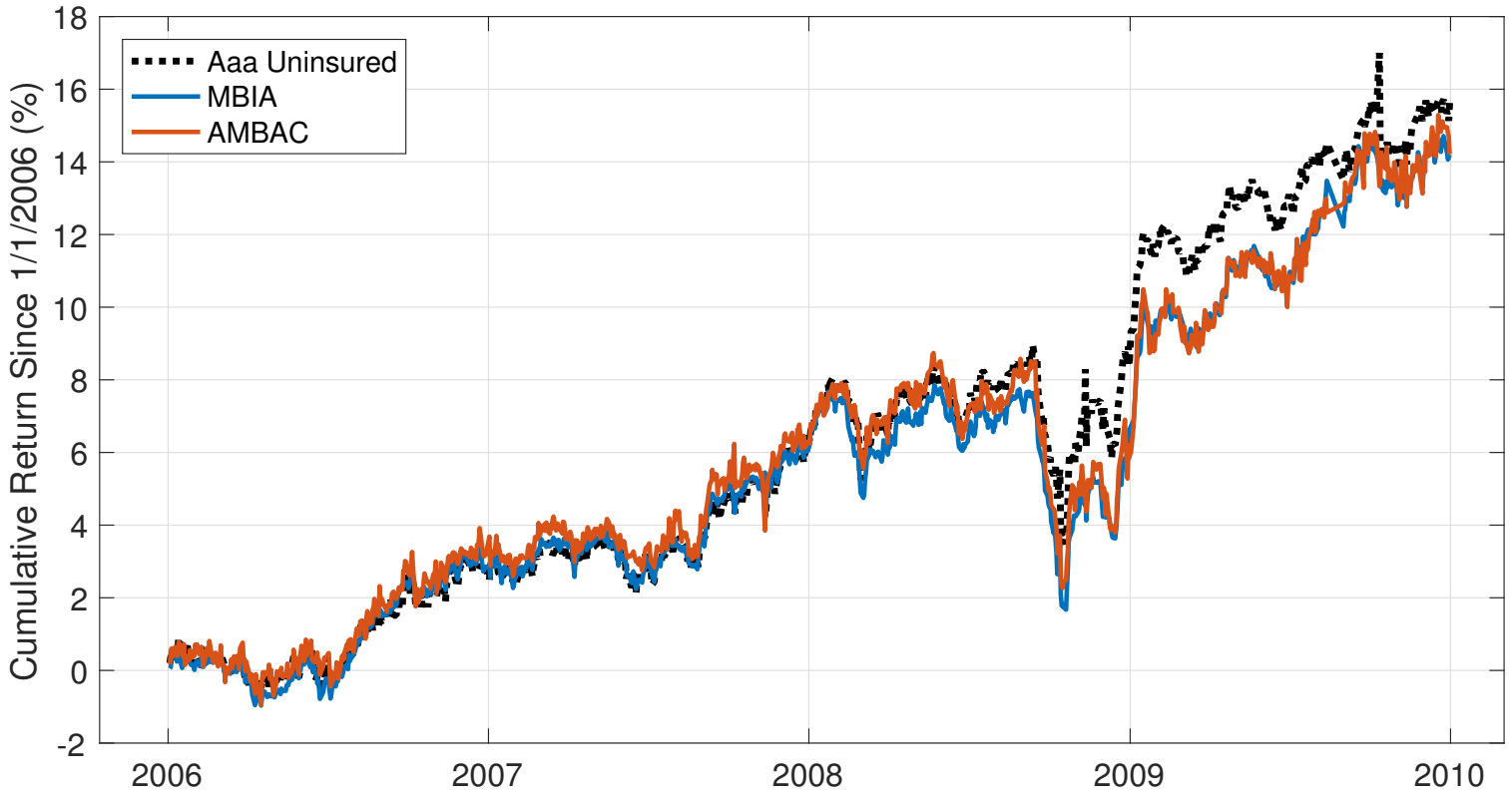
$$\Delta y_{i,b,s,l} = \sum_{t=b+1}^{s} \tau_{l,t} R_{m,t} + \sum_{t=b+1}^{s} \epsilon_{i,t}$$

$R_{m,t}$ = common return of all bonds with same insurance wrap, and l indexes the underlying rating class of bond i

- $\tau_{l,t}$ indicates the time-varying sensitivity of bonds in rating class l to the overall return pattern of all bonds with the same insurer

Result 1: When Do Insured Returns Diverge from Aaa?

- Divergence from true-Aaa returns starts in late 2008 (after downgrade)
- But not earlier (around time of financial distress in late 2007)

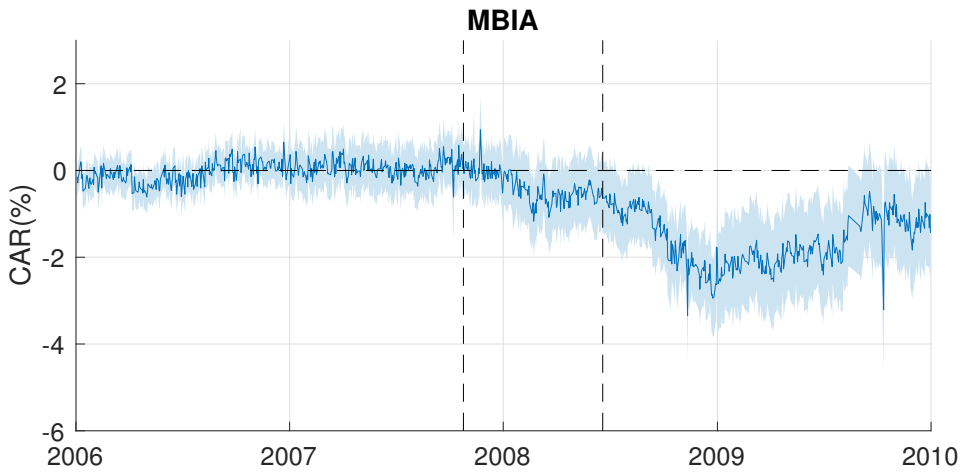


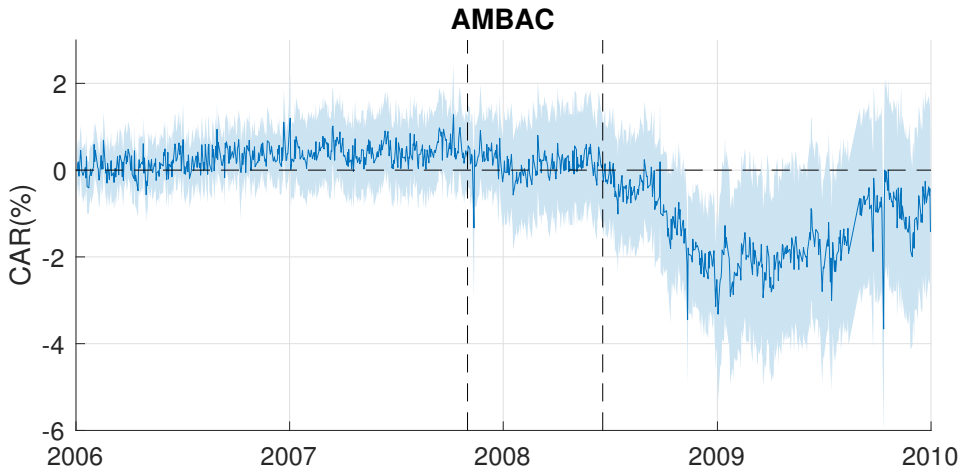
Formal Test of Divergence from true-Aaa Return

	MBIA		AMBAC	
	F-stat	χ^2 c.v.	F-stat	χ^2 c.v.
Sub-sample 1: Prior to Distress Date	341.26	507.84	397.83	513.11
Sub-sample 2: From Distress to Downgrade Date	147.83	192.70	42.76	187.24
Sub-sample 3: After Downgrade Date	2889.16^*	421.15	928.89^*	421.15

Result 2: CARs of MBIA- and AMBAC-insured Bonds

Vertical lines from left to right mark: 1) distress date, 2) downgrade date





▸ CAR Table Distress ▸ CAR Table Downgrade

Result 3: Attention of Institutional vs. Retail Investors

Granger causality test based on VAR of institutional vs. retail daily net order flow

- Sub-sample 1: Prior to Distress Date
- Sub-sample 2: From Distress to Downgrade Date
- Sub-sample 3: After Downgrade Date

Causality Direction	Full Sample	Sub-sample 1	Sub-sample 2	Sub-sample 3
Institutional $\rightarrow$ Retail	8.162^{***}	6.350^{***}	2.181	7.891^{***}
Retail $\rightarrow$ Institutional	4.617^{***}	5.598^{***}	1.500	2.228

Test of Information Transmission Across Linked Markets

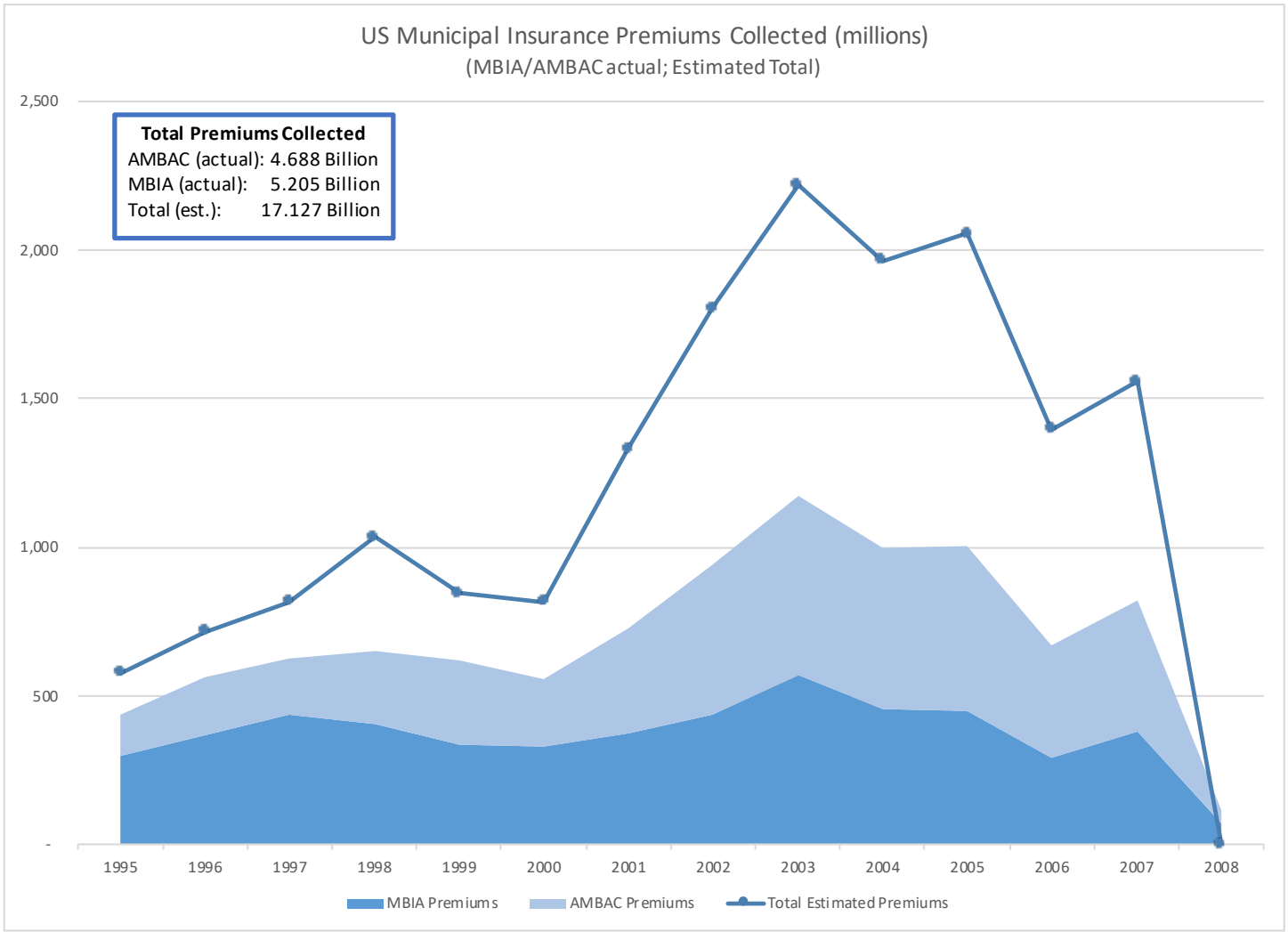
Expanded VAR with both insurers

Granger-causality Test (row variable $\rightarrow$ column variable?)

	ABK-Bond	ABK-Stock	ABK-CDS	MBI-Bond	MBI-Stock	MBI-CDS
ABK-Bond		0.838	2.234	10.257^{***}	1.124	0.655
ABK-Stock	0.827		4.333^{**}	1.129	0.674	0.447
ABK-CDS	0.271	0.567		0.463	1.235	1.637
MBI-Bond	36.394^{***}	0.451	1.715		1.131	1.566
MBI-Stock	1.013	2.226	2.134	2.212		11.828^{***}
MBI-CDS	1.766	4.789^{***}	21.232^{***}	0.616	0.659	

One Explanation: Maybe Insurance Has No Value?

Then someone should tell the municipalities...



Other Alternative Explanations

1. Maybe there isn't any default risk?
   - Then it doesn't make much sense to buy insurance...
   - However, we've replicated the analysis with revenue bonds, (which have much higher default risk) and they show similar patterns

     ▸ RevenueReturns ▸ RevenueRatings

2. Lehman Brothers, bailouts, and crisis
   - Significantly negative CARs precede Lehman bankruptcy
   - Trading activities in muni market around Lehman bankrupcy show "business as usual" ▸ Detail
   - Delayed reaction due to expectation of bailout? no such expectation evident in equity and CDS markets on insurers

3. Limits to arbitrage
   - Difficulty in short-selling munis? Negative CARs following downgrade indicate short sale contraints cannot be the entire story
   - What prevents "smart money" from taking advantage of informational inefficiency? High transaction costs?

Conclusions

- Muni market remains informationally inefficient and segmented
- Natural experiment designed around collapse of muni insurance industry shows:
  1. investors ignore insurers' insolvency widely revealed in other markets, but...
  2. do respond to insurers' loss of Aaa rating
- Institutional investors appear to respond ahead of retail investors, but the market is generally slow in updating
- Our paper also offers data and methodology contributions:
  - improved methodology to compute bond returns for illiquid muni market, overcoming major problems affecting earlier studies
  - comprehensive database related to municipal bond market, combining various data sources with credit rating history collected from CRAs and hand-collected data on contemporaneous insurer information

Appendix

Additional Results

CARs Around Distress Date (Event 1)

No significant CARs before, and lack of evidence of negative CARs after financial distress of insurers is well publicized

	Pre-event window					
	[-20:-1]		[-40:-1]		[-60:-1]	
	CAR	s.e.	CAR	s.e.	CAR	s.e.
MBIA	-0.15	0.20	-0.20	0.20	-0.06	0.20
AMBAC	-0.47^{*}	0.31	-0.07	0.31	0.02	0.32

	Post-event window					
	[0:20]		[0:40]		[0:60]	
	CAR	s.e.	CAR	s.e.	CAR	s.e.
MBIA	0.85^{***}	0.36	-0.03	0.23	-0.23	0.39
AMBAC	-0.15	0.31	-0.68^{**}	0.40	-0.37	0.57

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CARs Around Downgrade Date (Event 2)

No significant CARs before, significantly negative CARs after loss of Aaa insurance rating

	Pre-event window					
	[-20:-1]		[-40:-1]		[-60:-1]	
	CAR	s.e.	CAR	s.e.	CAR	s.e.
MBIA	-0.07	0.25	0.22	0.26	0.28	0.26
AMBAC	-0.33	0.39	-0.27	0.39	-0.07	0.40
	Post-event window					
	[0:20]		[0:40]		[0:60]	
	CAR	s.e.	CAR	s.e.	CAR	s.e.
MBIA	-0.48^{**}	0.27	-0.41^{*}	0.28	-0.87^{***}	0.29
AMBAC	-0.74^{**}	0.40	-0.79^{**}	0.43	-0.15	0.47

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Result 4: Information Transmission Across Linked Markets

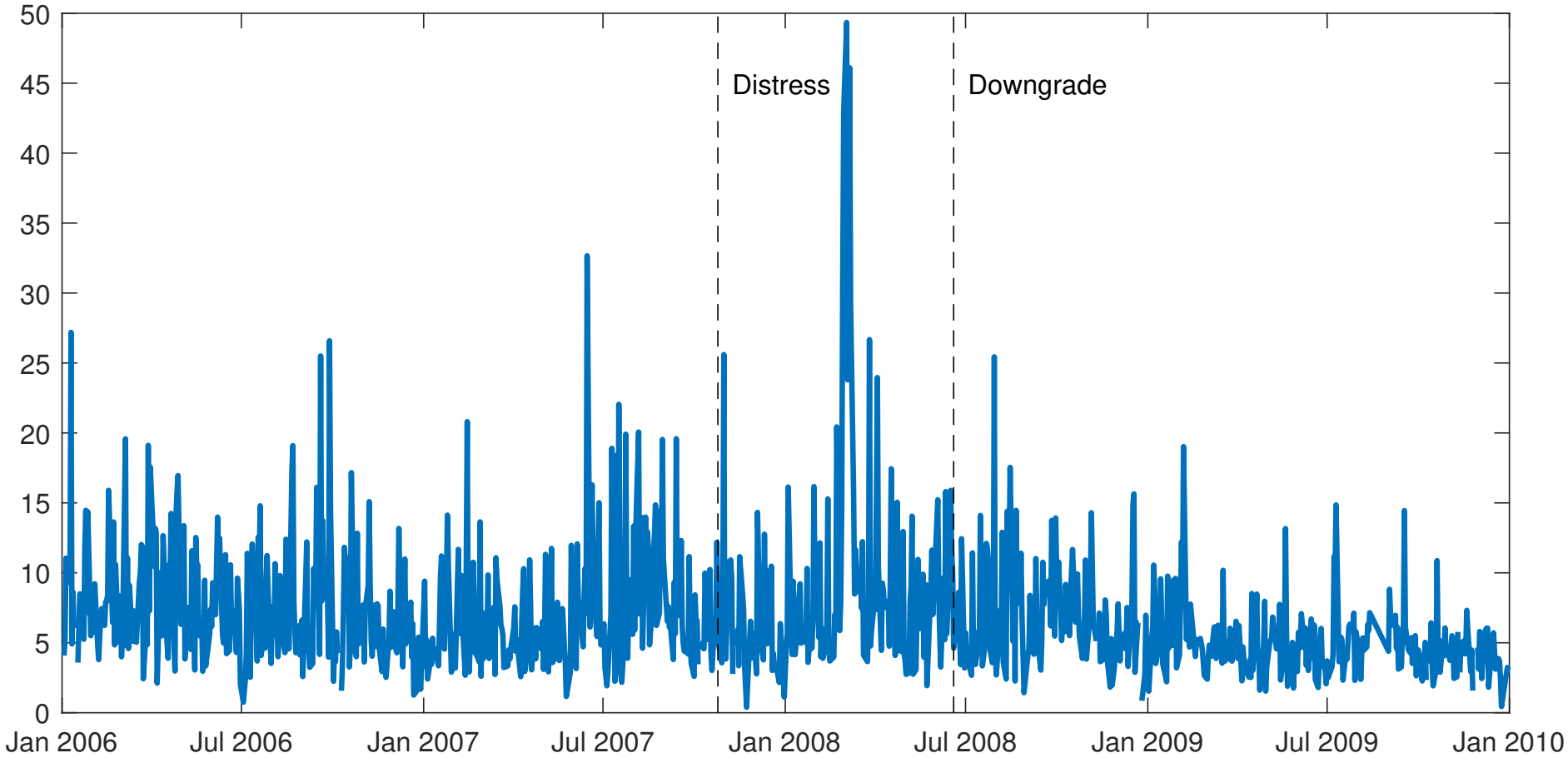
VAR of equity returns, changes in CDS spreads, and insured bond portfolio returns

Granger-causality Test (row variable → column variable?)

	Insured Bond	Stock Return	CDS Change
Panel A: MBIA			
Insured Bond		1.687	1.665
Stock Return	0.075		55.352^{***}
CDS Change	0.031	0.052	
Panel B: AMBAC			
Insured Bond		0.047	0.000
Stock Return	0.002		44.400^{***}
CDS Change	0.982	3.123^{*}	

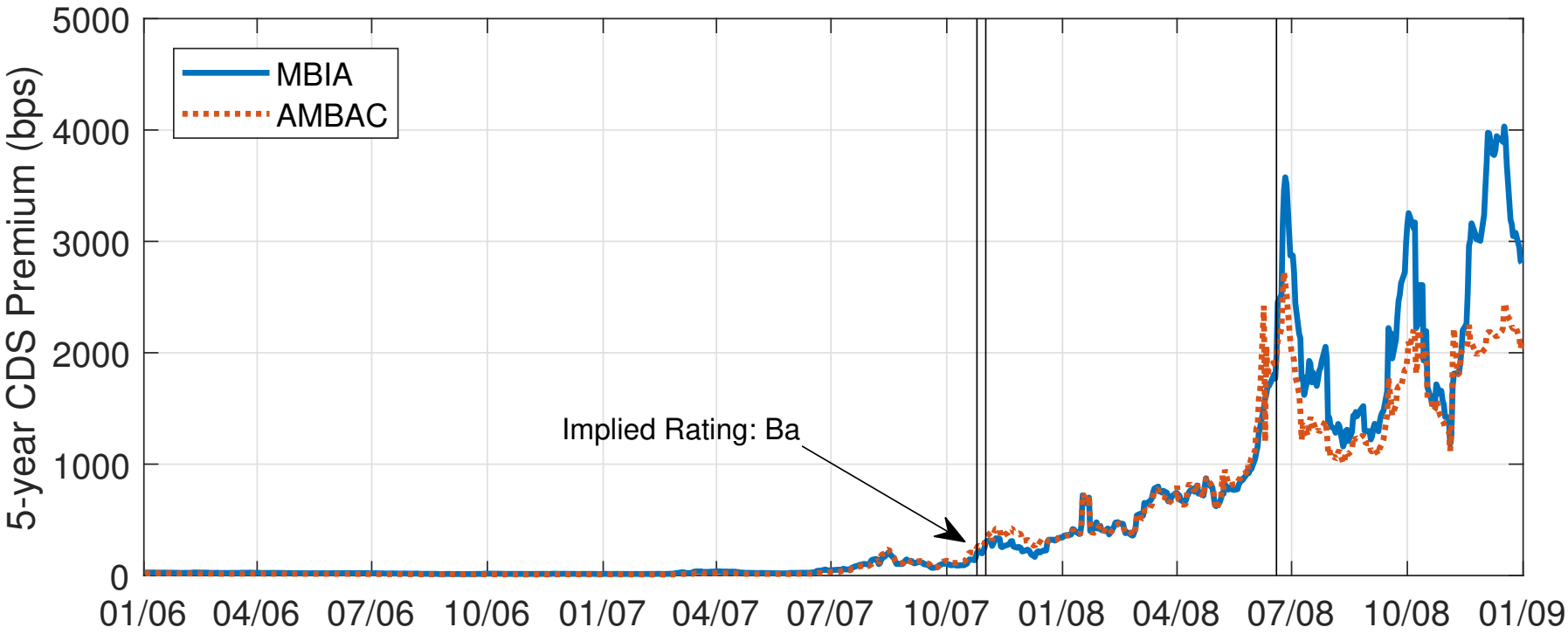
Institutional Investors Selling Ahead of Retail Investors

Daily ratio of institutional sell volume to retail sell volume



▸ More charts

MBIA and AMBAC CDS and Implied Rating



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Cumulative Returns for Revenue Bond Indices

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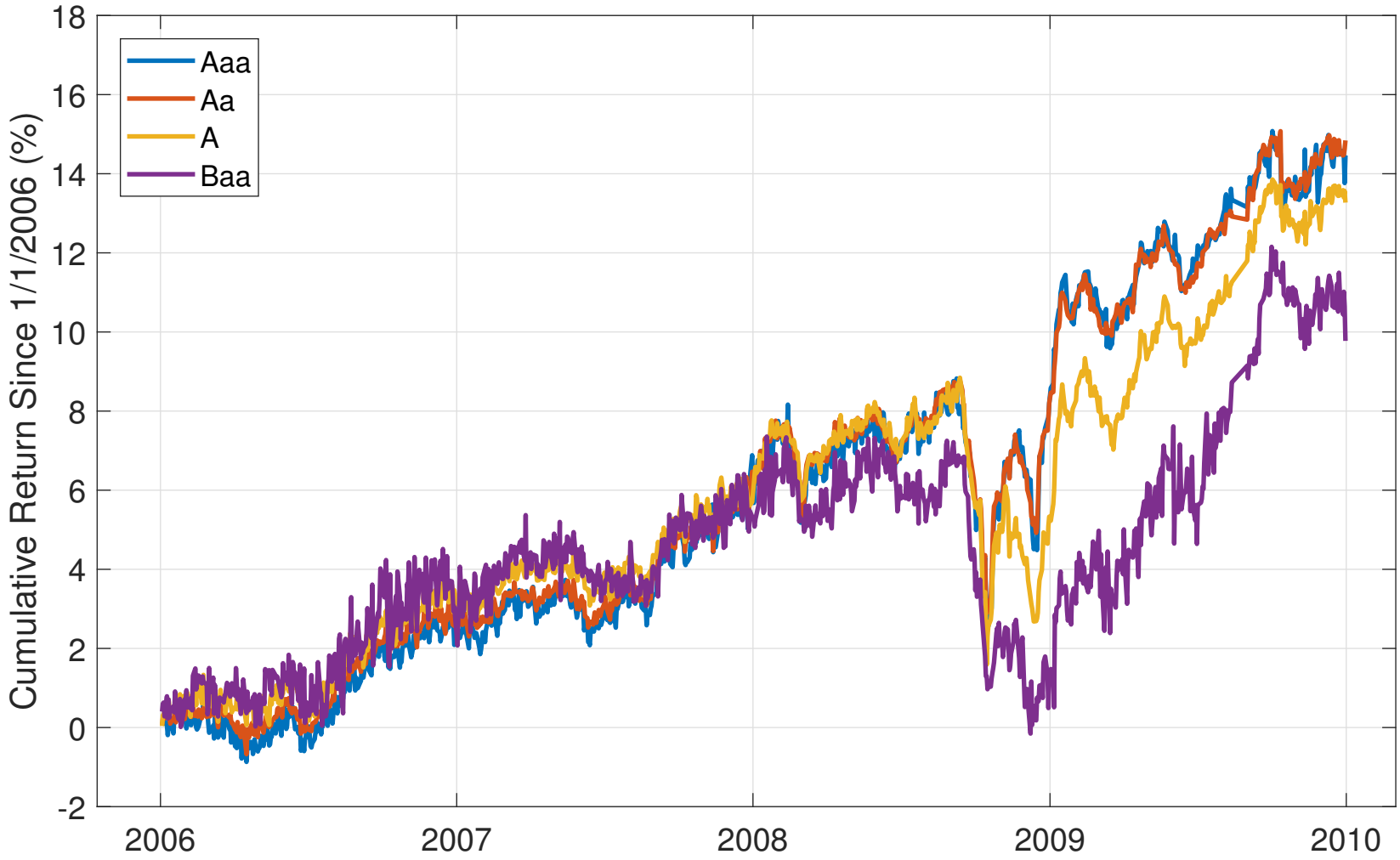
Cumulative Returns for Revenue Bond Indices by Rating



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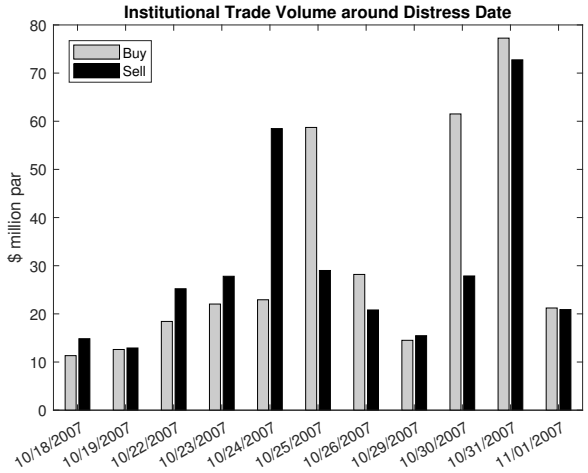
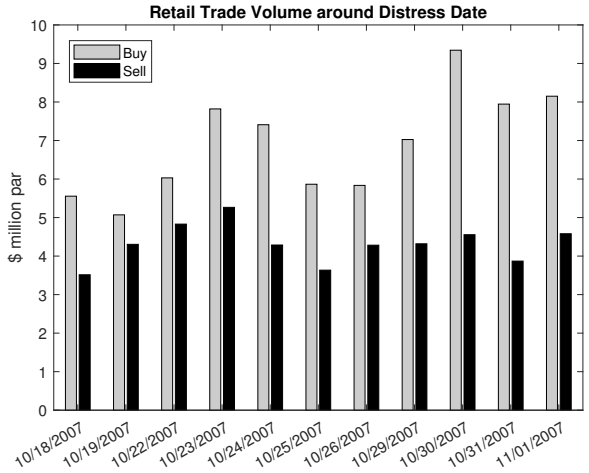
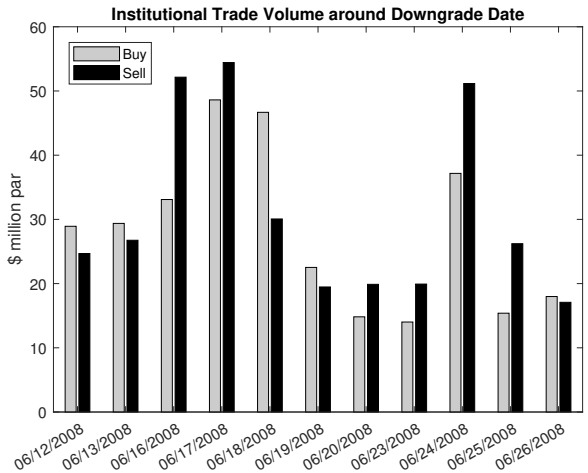
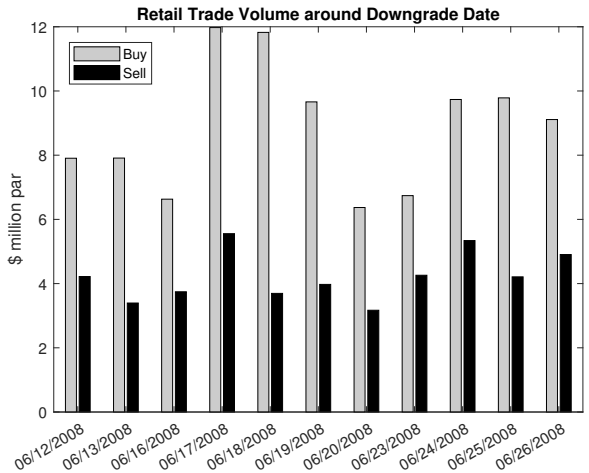
Trading Activity Around MBIA Distress and Downgrade









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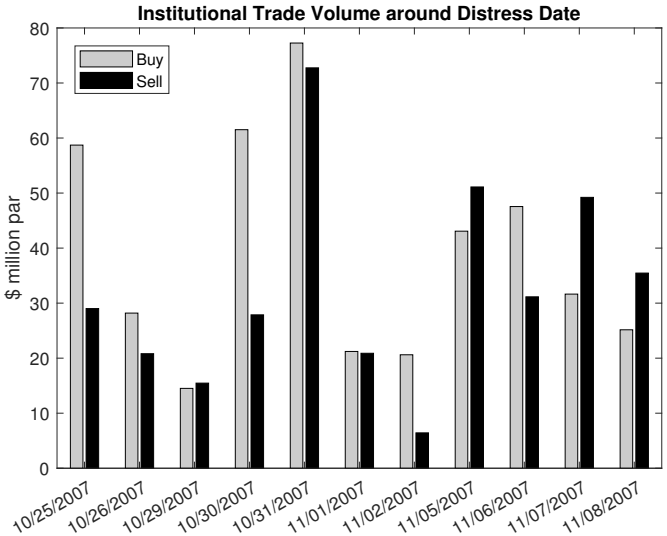
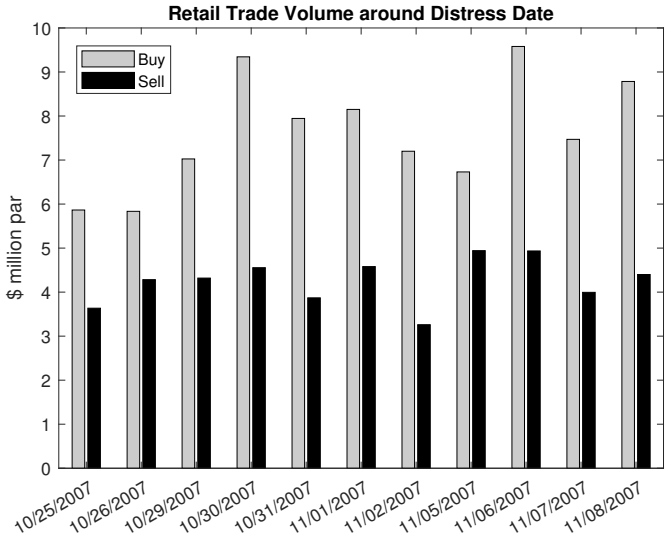
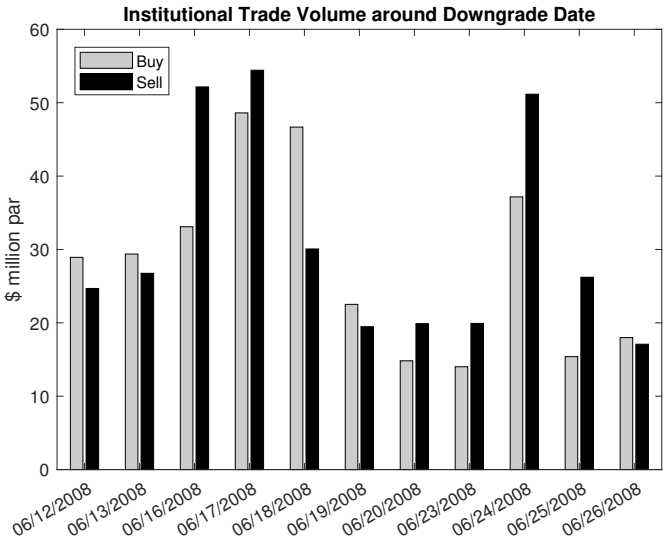
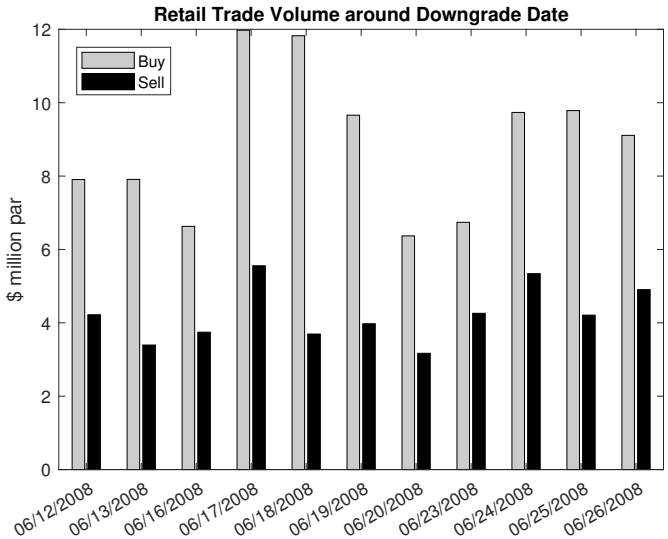
Trading Activity Around AMBAC Distress and Downgrade









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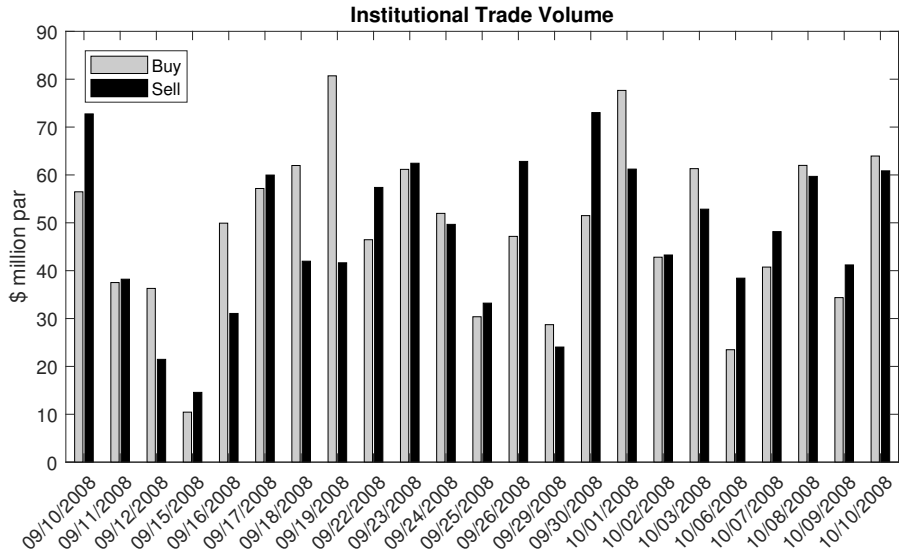
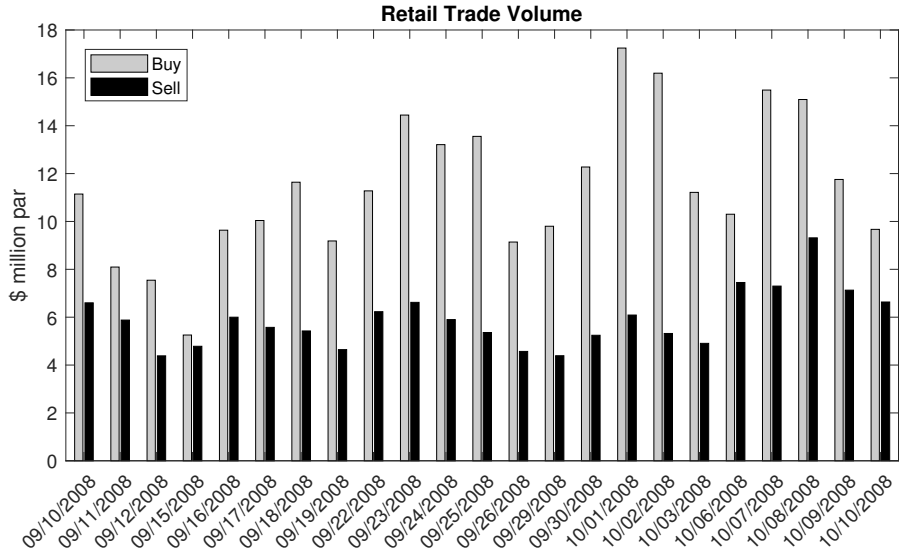
Trading Activity Around Lehman Brothers Bankruptcy





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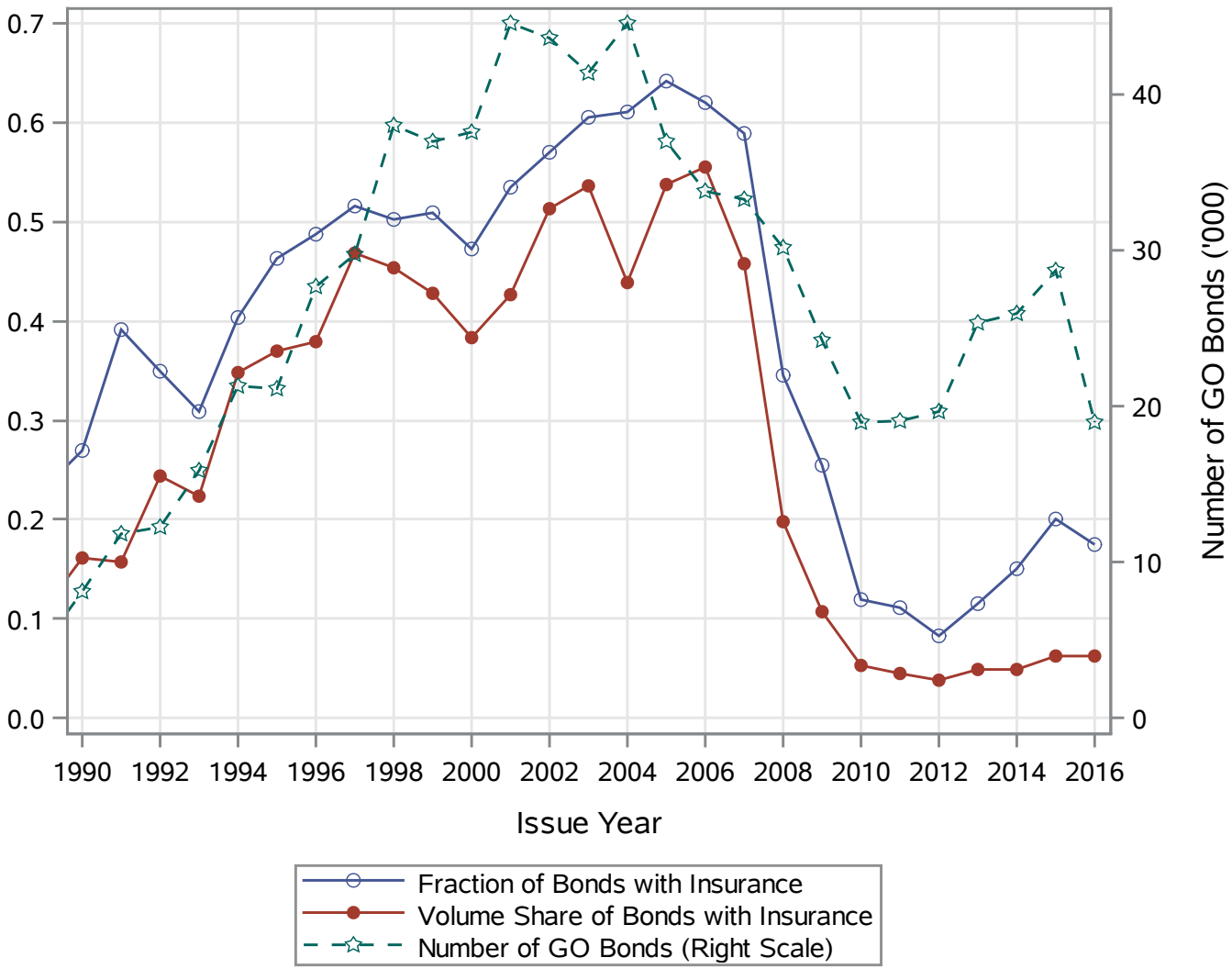
Demise of Monoline Insurance Industry



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