

# On-line Appendix for Mortgage-Backed Securities and the Financial Crisis of 2008: a Post Mortem

April 6, 2018

## **Abstract**

This on-line appendix is divided into three sections. Section A explains in detail, step by step, how we assembled the database for the paper using Bloomberg and the 2013 edition of the Mortgage Market Statistical Annual. Section B provides a brief description of the assembled database and the different variables that we were able to obtain from Bloomberg. This document serves as guide for replication and for understanding the contents of our database. Section C contains additional results, complementing the paper.

# A Database Construction

One of the challenges that we faced in developing the project that has led to the paper “Mortgage-Backed Securities and the Financial Crisis of 2008: a Post Mortem” was the construction of the database. On our main source for information, Bloomberg, there is no pre-defined function that allows the user to obtain a list of all the Mortgage Backed Securities available. In this section we explain step by step how we put together our data in a systematic way and how we used the 2013 edition of the Mortgage Market Statistical Annual to guide our securities search. We also make reference to the files we used in every step and to their location in our replication kit.

## Step 1. Find Deals of MBS

To find deals (series) of MBS securities we primarily used as source the 2013 edition of the Mortgage Market Statistical Annual, which in Volume II (Pages 50 to 108) has a set of tables with lists of what in principle are all the MBS deals from 2006 through 2012. Figure DA1 shows a snapshot of one of such tables. We did not limit our search to these deals. Once we identified the deal name on Bloomberg, we also looked for information on deals that had the same root name for years prior to 2006. For example, a deal found in the statistical annual for year 2007 is Merrill Lynch SURF 2007-BC1. Another sample deal is Wells Fargo Mortgage Backed Securities Trust WFMBS 2007-10. The root name of these two deals are SURF 2007 and WFMBS 2007 respectively. Having identified these deals on Bloomberg, we got information not only for all the SURF 2007 and WFMBS 2007 deals (see Figure DA2), but also for all the deals that have the root SURF and WFMBS, for example WFMBS 2004 (see Figure DA3).

Since our interest was to get as close as possible to the universe of RMBS issued, we also performed searches not based on the list of deals provided by the Mortgage Market Statistical Annual. We looked for deals also based on the names of financial institutions that were involved in structuring and managing securitization deals, in this way broadening the search and not solely relying on one source. In the end, the key to finding deals was to identify what the root names for Bloomberg were. For example, typing JP Morgan Mortgage can lead you to JPMMT Mtge on Bloomberg, which would give a new full list of RMBS deals.

A Series of MBS is a set of Mortgage-Backed Securities backed by the same pool of mortgages. Each security in the series corresponds to a tranche. In order to get identifiers of each individual security we needed to construct a list of all the deals, based on the root names. In order to obtain a list of the series, we would follow these steps:

1. Type on Bloomberg the name of a deal or the name of financial institution. For example,

Figure DA1: Snapshot of 2013 Mortgage Market Statistical Annual RMBS Deals List

## Non-Agency MBS Activity 2007

(Dollars in Millions)

Date	Deal Name	Amount	Support	Collateral	MBS Type	Subprime	Manager
10-Jan-07	Citigroup Mortgage Loan Trust 2007-WFHE1	\$434.22	Sub	FRM/ARM	BC	x	Citi
11-Jan-07	WaMu Asset-Backed Certificates 2007-HE1	\$1,360.34	Sub	FRM/ARM	BC	x	WaMu
12-Jan-07	Harborview NIM CI-7 Corp.	\$5.70	NIM	NIM	BC	x	RBS GC
12-Jan-07	SACO Mortgage Trust 2007-1	\$246.02	Sub	CES	2nd	x	BS
15-Jan-07	Washington Mutual WMABS 2007-HE1	\$276.90	Sub	FRM/ARM	BC	x	WaMu
16-Jan-07	MASTR Adjustable Rate Mortgages Trust 2007-1	\$2,099.43	Sub	ARM	Alt A		UBS
16-Jan-07	Option One Mortgage Loan Trust 2007-1	\$1,749.86	Sub	FRM/ARM	BC	x	LB
17-Jan-07	Bear Stearns ABS Trust 2007-SD1	\$279.82	Sub	FRM/ARM	SD	x	BS
17-Jan-07	Carrington Mortgage Loan Trust 2007-RFC1	\$857.27	Sub	FRM/ARM	BC	x	Citi
18-Jan-07	Option One Mortgage Securities Re-NIM 2007-1	\$75.00	NIM	NIM	BC	x	RBS GC
19-Jan-07	GSAMP Trust Series 2007-SEA1	\$127.55	Sub	FRM/ARM	SD	x	GS
19-Jan-07	IndyMac INDX NIM CI-2	\$35.76	NIM	NIM	Alt A		RBS GC
19-Jan-07	Morgan Stanley ABS Capital 2007-NC1	\$1,214.38	Sub	FRM/ARM	BC	x	MS
19-Jan-07	Option One Mortgage Loan Trust 2007-FXD1	\$817.69	Bond	FRM30	BC	x	BA
19-Jan-07	SABR Trust 2007-NC1	\$816.82	Sub	FRM/ARM	BC	x	BC
19-Jan-07	SASCO NIM 2006-BC6	\$48.40	NIM	NIM	BC	x	LB
19-Jan-07	Soundview CI-22 NIM, Series 2006-EQ2	\$36.80	NIM	NIM	BC	x	RBS GC
19-Jan-07	Washington Mutual NIM Trust 2007-HE1	\$10.81	NIM	NIM	BC	x	WaMu
22-Jan-07	Soundview CI-21 NIM, Series 2006-WF2	\$67.90	NIM	NIM	BC	x	RBS GC
22-Jan-07	WaMu Mortgage PTC 2007-HY1	\$3,041.31	Sub	ARM	Prime		WaMu
23-Jan-07	Banc of America Funding 2007-NIM1	\$10.79	NIM	NIM	Alt A		BA
23-Jan-07	Countrywide Home Loan Trust 2006-BC5N	\$28.87	NIM	NIM	BC	x	CSC
23-Jan-07	GSAMP 2006-FM3-N	\$31.22	NIM	NIM	BC	x	GS
23-Jan-07	IXIS Real Estate Capital Trust 2007-HE1	\$778.31	Sub	FRM/ARM	BC	x	MS
23-Jan-07	Merrill Lynch SURF 2007-BC1	\$789.11	Sub	FRM/ARM	BC	x	ML
23-Jan-07	SHARPS NIM 2006-NC2N	\$23.02	NIM	NIM	BC	x	DB
23-Jan-07	SHARPS NIM 2007-OA1N	\$25.69	NIM	NIM	BC	x	DB
23-Jan-07	WaMu Mortgage PTC 2007-OA1	\$1,100.05	Sub	ARM	Prime		WaMu
24-Jan-07	Accredited Mortgage Loan Trust 2007-1	\$755.52	Sub	FRM/ARM	BC	x	LB
24-Jan-07	BSSP NIM Trust 2007-N1 (BSMF 2006-SL6)	\$28.63	NIM	NIM	BC	x	BS
24-Jan-07	BSSP NIM Trust 2007-N1 (SACO 2007-1)	\$13.23	NIM	NIM	2nd		BS
24-Jan-07	ChaseFlex Trust 2007-1	\$450.01	Sub	FRM30	Alt A		JPM
24-Jan-07	CMO Holdings III Ltd. 2007-N1	\$93.58	NIM	NIM	BC	x	BS
24-Jan-07	CWAI T 2006-OC11N	\$29.70	NIM	NIM	Alt A		CSC

This figure shows a snapshot of the table in the 2013 edition of the Mortgage Market Statistical Annual, containing some information on RMBS deals issued in 2007. We used this table specifically to get a list of deals.

typing WFBMS 2007 Mtge will lead to a screen with all the series of MBS whose root name is WFMBS. In this screen one can see a list of all the deals whose root name was WFMBS 2007, including WFMBS 2007-10, which we had identified from the Statistical Annual. See Figure DA2 as an example of what such a screen looks like. In addition, typing WFMBS Mtge can lead to a list for all the deals that have been issued with the root name WFMBS for all years. Figure DA3 shows that the deals under the umbrella WFMBS started in 2004. In this way we went back before 2006 and found the deals issued in the years for which we did not have information from the Statistical Annual. Also, using the names of financial institutions and typing for example JP Morgan Mortgage can lead to JPMMT Mtge on Bloomberg and provide and similar list of deals.

2. With the list of the series on the screen, we went on to export it to Excel. To do this, on Bloomberg go to export or click on the top right-hand corner on the green arrow and drag the list onto Excel.

3. We save the list of tickers of the series.

Figure DA2: Snapshot of an Example of a Search for a List of Deals in 2007

WFMB5 2007 Mtge  
<Menu> for series list

95 Options Page 1/2 Mortgag View All Classes

25 Series									
CF	Series	Pricing Date	Collateral	Net Cpn	WAC	WAM			Orig Bal at Iss
1)	*	2007 - AR10	12/21/07 Whole ARM	6.30	6.561	21Y 4M			357,537,982
2)	*	2007 - AR3	3/21/07 Whole ARM	5.88	6.143	20Y 8M			488,796,716
3)	*	2007 - AR4	8/27/07 Whole ARM	2.86	3.116	20Y 11M			421,914,996
4)	*	2007 - AR5	10/23/07 Whole ARM	6.14	6.395	21Y 1M			604,977,737
5)	*	2007 - AR6	10/24/07 Whole ARM	2.79	3.049	21Y 1M			1,399,536,070
6)	*	2007 - AR7	11/20/07 Whole ARM	2.83	3.092	21Y 3M			1,116,803,961
7)	*	2007 - AR8	11/26/07 Whole ARM	2.82	3.077	21Y 2M			435,434,104
8)	*	2007 - AR9	11/26/07 Whole ARM	6.21	6.471	21Y 3M			508,489,333
9)	*	2007 - 1	1/11/07 Whole 30yr	6.01	6.272	20Y 6M			600,991,640
10)	*	2007 - 2	2/26/07 Whole 30yr	5.98	6.236	20Y 7M			1,505,652,587
11)	*	2007 - 3	3/27/07 Whole 30yr	6.01	6.272	20Y 7M			1,354,453,990
12)	*	2007 - 4	3/26/07 Whole 30yr	5.99	6.245	20Y 8M			1,800,061,020
13)	Pd	2007 - 5	4/25/07 Wh 30y Relo	5.61	5.866	21Y 3M			461,281,364
14)	*	2007 - 6	4/25/07 Whole 30yr	5.95	6.215	20Y 9M			700,312,919
15)	*	2007 - 7	5/25/07 Whole 30yr	5.93	6.191	20Y 10M			5,100,122,414
16)	*	2007 - 8	6/28/07 Whole 30yr	5.95	6.208	20Y 10M			2,750,025,945
17)	Pd	2007 - 9	6/25/07 Wh 30y Relo	5.67	5.926	18Y 3M			751,843,367
18)	*	2007 - 10	6/28/07 Whole 30yr	6.01	6.275	20Y 11M			1,700,746,270
19)	*	2007 - 11	7/26/07 Whole 30yr	6.00	6.261	21Y 0M			3,954,809,375

Australia 61 2 9777 8600 Brazil 5511 2395 9000 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000  
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This figure shows a snapshot of the Bloomberg screen in which we searched for the list of deals with root name WFMB5 2007 based on the list of deals provided by the Statistical Annual

Figure DA3: Snapshot of an Example of a Search for a List of Deals Before 2006

WFMB5 Mtge

95 Options Page 7/14 Mortgag View All Classes

249 Series									
CF	Series	Pricing Date	Collateral	Net Cpn	WAC	WAM			Orig Bal at Iss
1)	*	2004 - CC	12/13/04 Whole ARM	2.84	3.098	18Y 6M			300,216,725
2)	*	2004 - D	4/12/04 Whole ARM	2.97	3.351	17Y 9M			357,876,502
3)	*	2004 - DD	12/15/04 Whole ARM	2.83	3.093	18Y 6M			600,082,218
4)	*	2004 - E	4/22/04 Whole ARM	3.08	3.339	17Y 10M			320,489,949
5)	*	2004 - EE	12/21/04 Whole ARM	2.87	3.125	17Y 11M			1,583,069,043
6)	*	2004 - F	5/13/04 Whole ARM	2.91	3.295	17Y 10M			400,536,041
7)	*	2004 - G	5/17/04 Whole ARM	2.87	3.127	17Y 8M			417,087,401
8)	*	2004 - H	5/20/04 Whole ARM	2.88	3.141	17Y 11M			458,184,853
9)	*	2004 - I	6/14/04 Whole ARM	2.83	3.093	17Y 3M			1,651,759,021
10)	*	2004 - J	6/24/04 Whole ARM	2.74	3.001	18Y 0M			426,419,494
11)	*	2004 - K	6/14/04 Whole ARM	2.76	3.017	18Y 0M			1,216,697,217
12)	*	2004 - L	6/23/04 Whole ARM	2.78	3.037	18Y 1M			457,327,472
13)	*	2004 - M	7/26/04 Whole ARM	2.75	3.009	18Y 1M			800,536,770
14)	*	2004 - N	7/26/04 Whole ARM	2.73	2.990	18Y 1M			1,200,723,373
15)	*	2004 - O	7/19/04 Whole ARM	2.74	3.003	18Y 1M			700,153,218
16)	*	2004 - P	8/11/04 Whole ARM	2.74	3.004	18Y 1M			1,522,920,382
17)	*	2004 - Q	8/12/04 Whole ARM	2.74	3.003	18Y 2M			677,971,620
18)	*	2004 - R	8/26/04 Whole ARM	2.74	3.000	18Y 2M			641,321,384
19)	*	2004 - S	8/26/04 Whole ARM	2.78	3.043	17Y 10M			1,777,319,714

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SN 166440 PDT GMT-7:00 G597-598-1 15-Jun-2016 09:59:14

This figure shows a snapshot of the Bloomberg screen in which we searched for the list of deals with root name WFMB5 issued before 2006, this is, for the years for which we did not have information from the Mortgage Market Statistical Annual

We downloaded our data in 4 rounds. We have two files with all the series or deals that we downloaded data for. The name of the files are:

- MBSSeriesToDownloadRound1.xlsx. There are three sheets, “Series Sheets 2-50”, “Series 80-147” and “Series 150-218”. All the information of the bonds corresponding to the series is what we have labeled as round 1 of data downloading.
- MBSSeriesToDownloadRounds2to4.xlsx. There are three sheets, “Series Sheets 300-323, 400-403”, “Series Sheets 404-407” and “Series Sheets 408-413”. Information corresponding to the bonds of the MBS series in sheets 300 to 307 were downloaded in round 2, for sheets 308 to 323 in round 3, and for sheets 400 to 413 in round 4.

Also, in the same location there is a file called MBSSeriesAndBondsLeftOut.xlsx. In this file we have three sheets. In the first sheet we have the deals that we found on Bloomberg but that we did not download any information for due to our limited access to Bloomberg. In the second and third sheets we have series of MBS and their corresponding list of bonds for which we have information from 1999 onwards but that we did not download information prior to 1999 due also to our limited access to Bloomberg.

The location of files to replicate this step is:

- MBS Project/Replication/Database Construction/Step 1- Find MBS Series

## **Step 2. Construct a list of the underlying bonds for each MBS series**

The purpose of this step is to obtain a list with the Bloomberg tickers of all the underlying bonds (tranches) corresponding to the each of series that we identified in Step 1. This will result in more than 140 thousand securities for which we downloaded detailed data. For example, for the deal that we have been using as example, WFMBS 2007-10, the list of individual bonds making up the deal is shown in Figure DA4.

A challenge at this point is how to obtain a list of all the bonds underlying all the deals that we found in step 1 in a systematic way. The way we overcame this challenge was to follow these steps:

1. On Bloomberg, type XLTP XMBD <GO>. Figure DA5 shows a snapshot of this page on Bloomberg.
2. Select (1) and download the bond generator for Mortgages. This is an Excel file that allows you to enter a list of deals like the one we obtained in Step 1 and get a list of all the bonds underlying the MBS series.

Figure DA4: Example of a List of RMBS Bonds (Tranches) in a Deal

95 Options								View All Classes	
WFMBS 2007-10 WELLS FARGO MORTGAGE BACKED SECURITIES TRUST									
Template	Classic			Orig(000)	Curr(000)	Cpn	OMAL	Orig Hty/Cusip	Tranche Description
1)	Y	IA1		300,000	50,104	6.000	5.71	7/25/37 949837AA6	PT, SSHR, AS
2)	Y	IA2		50,000	672	6.000	2.59	7/25/37 949837AB4	SEQ, SSHR, AS
3)	Y	IA3		11,446	3,577	6.000	5.24	7/25/37 949837AC2	SEQ, AS
4)	Y	IA4		15,709	4,910	6.000	9.43	7/25/37 949837AD0	SEQ, AS
5)	Y	IA5		101,994	13,363	6.000	3.99	7/25/37 949837AE8	PAC(11), SSHR, AS
6)	Y	IA6		71,354	23,714	6.000	11.97	7/25/37 949837AF5	PAC(11), SSHR, AS
7)	Y	IA7		29,719	3,278	6.000	3.85	7/25/37 949837AG3	PAC(22), AS
8)	Y	IA8		59,907	4,715	6.000	3.02	7/25/37 949837AH1	DRB, SUP, AS
9)	Y	IA9		19,969	1,572	6.000	3.02	7/25/37 949837AJ7	ARB, SUP, AS
10)	Y	IA10		100,000	12,263	5.900	3.92	7/25/37 949837AK4	AD, PAC(11), AS
11)	Y	IA11		1,667	204	6.000	3.92	7/25/37 949837AL2	IO, HTL
12)	Y	IA12		19,158	6,367	6.000	7.77	7/25/37 949837AM0	AD, PAC(11), SSHR, AS
13)	Y	IA13		11,609	0	6.000	0.94	7/25/37 949837AN8	Z, SUP, AS
14)	Y	IA14		47,121	3,164	1.146	3.12	7/25/37 949837AP3	FLT, SUP, AD, AS
15)	Y	IA15		7,854	527	35.124	3.12	7/25/37 949837AQ1	IIIV, SUP, AD, AS
16)	Y	IA16		12,505	2,544	6.000	5.74	7/25/37 949837AR9	AD, SEQ, AS
17)	Y	IA17		20,117	6,283	6.000	9.99	7/25/37 949837AS7	AD, SEQ, AS
18)	Y	IA18		13,814	6,040	6.000	15.33	7/25/37 949837AT5	Z, SEQ, SSHR, AS
19)	Y	IA19		40,085	848	6.000	2.99	7/25/37 949837AU2	PAC(11), SSHR, AS
20)	Y	IA20		51,693	17,180	6.000	7.79	7/25/37 949837AV0	PAC(11), SSHR, AS
21)	Y	IA21		57,686	710	6.000	2.34	7/25/37 949837AW8	SUP, AS
22)	Y	IA22		40,000	6,681	0.946	5.71	7/25/37 949837AX6	FLT, PT, SSHR, AS
23)	Y	IA23		4,516	956	36.324	7.17	7/25/37 949837AY4	IIIV, PAC(11), AS
24)	Y	IA24		2,150	90	36.324	2.66	7/25/37 949837AZ1	IIIV, SUP, AS

This figure shows a snapshot of the Bloomberg page with all the individual RMBS bonds that make up the sample deal

- Open the bond generator on Excel enabling macros. Figure DA6 shows a snapshot of this Excel file.
- Go to the list of series from Step 1, copy it and paste it on the Bond Generator file.
- Generate the list of tickers of bonds by clicking on the button that activates and runs the macro.
- Copy paste the tickers of bonds onto an Excel sheet.

We did this for each round of data downloads. In order to be able to download the data on Bloomberg in step 3, we divided list of bonds into parts. So, for example, Sheet2 in the file MBSSeriesToDownloadRound1.xlsx from step 1 contains a list of MBS securities (several tranches of several series). Sheet3 contains some other bonds, Sheet4 other bonds and so forth. Each of these sheets is then saved as TickersSheetY.txt, where Y takes different values to identify each set of bonds. For each round there is a folder with all the txt files. Also, for each round there is a file named “MBS\_SheetsToProcessRoundX.txt” (X = 1, 2, 3, 4) which contains the possible values that Y takes in each round.

The location of files to replicate this step is:

- MBS Project/Replication/Database Construction/Step 2- Get Underlying Bonds

Figure DA5: Screenshot of the Page to Obtain the Bond Generator

XLTP XMBD  
<Menu> to Return

Excel Template Library: Underlying MTGE Bond List Generator - XMBD

2) Description 3) Learn More

Underlying MTGE Bond List Generator - XLTP XMBD  
XMBD helps users get a list of all bonds underlying the deals or structure that are part of their portfolio. When given a list of bonds in a portfolio, the application returns a list of all bonds in the same structures as those in the portfolio.

Area of Interest FI/Credit  
Asset Class Mortgage Backed / Asset Backed Securities  
Related Functions SECF

Open

Users of Underlying MTGE Bond List Generator - XLTP XMBD also use...

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Portfolio Surveillance - XLTP XRSA  
Portfolio Cashflow Generator - XLTP XHPC

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This figure shows a snapshot of the Bloomberg page from which the Bond Generator can be downloaded

Figure DA6: Screenshot of Bloomberg's Bond Generator in Excel

Request Data

Request Data	List of all bonds in the structures	Deals	List of all bonds in Deals
GRND 1 C Mtge	GRND 1 A MTGE	GRND 1	HERME 12 A MTGE
HERME 12 D Mtge	GRND 1 B MTGE	HERME 12	HERME 12 B MTGE
AABST 2004-3 A1 Mtge	GRND 1 C MTGE	AABST 2004-3	HERME 12 C MTGE
	GRND 1 D MTGE		HERME 12 D MTGE
	GRND 1 E MTGE		HERME 12 E MTGE
	GRND 1 F MTGE		GRND 1 A MTGE
	HERME 12 A MTGE		GRND 1 B MTGE
	HERME 12 B MTGE		GRND 1 C MTGE
	HERME 12 C MTGE		GRND 1 D MTGE
	HERME 12 D MTGE		GRND 1 E MTGE
	HERME 12 E MTGE		GRND 1 F MTGE
	AABST 2004-3 A1 MTGE		AABST 2004-3 A1 MTGE
	AABST 2004-3 A2A MTGE		AABST 2004-3 A2A MTGE
	AABST 2004-3 A2B MTGE		AABST 2004-3 A2B MTGE
	AABST 2004-3 M1 MTGE		AABST 2004-3 M1 MTGE
	AABST 2004-3 M2 MTGE		AABST 2004-3 M2 MTGE
	AABST 2004-3 M3 MTGE		AABST 2004-3 M3 MTGE
	AABST 2004-3 B1 MTGE		AABST 2004-3 B1 MTGE
	AABST 2004-3 B2 MTGE		AABST 2004-3 B2 MTGE
	AABST 2004-3 B3 MTGE		AABST 2004-3 B3 MTGE
	AABST 2004-3 X MTGE		AABST 2004-3 X MTGE
	AABST 2004-3 P MTGE		AABST 2004-3 P MTGE
	AABST 2004-3 R MTGE		AABST 2004-3 R MTGE

This figure shows a snapshot of the Excel file that can be used in conjunction with Bloomberg to get a list of all the RMBS underlying a given securitization deal

### **Step 3. Download first part of data on Matlab**

In this step we download the data from Bloomberg into Matlab. To do this first we open the connection between Bloomberg and Matlab by writing on Matlab's command window `c=blp()`. Then we run the following matlab files on a Bloomberg terminal:

1. Run `ReadTickers.m` for a file `TickersSheetY.txt`. This will define the set of MBS securities for which the information is being downloaded depending on the value of `Y`.
2. Run `DownloadDataLosses.m` to get information on cash flows. The resulting files are identified as `DataSheetY.mat`.
3. Run `DownloadIdentification.m` to get information to identify the security (e.g CUSIP) or of some of its characteristics. The resulting files are identified as `IDSheetY.mat`.
4. Run `DownloadRatings.m` this to get information on the credit rating. The resulting files are identified as `RatingsSheetY.mat`.
5. Run `DownloadDataSomeMetrics.m` to get information on some other characteristics of the security. The resulting files are identified as `SecuritySheetY.mat`.
6. Run `DownloadDataGeoPurpose.m` to get information on geographic composition and purpose of the underlying loans. The resulting files are identified as `GeoSheetY.mat`.

The resulting data files are in the folder "Bloomberg Data", with one subfolder per round of downloads.

The location of files to replicate this step is:

- MBS Project/Replication/Database Construction/Step 3 - Download first part of data on Matlab

### **Step 4. Clean up data and remove error fields from Bloomberg**

In this step we organize the data that we downloaded from Bloomberg. Here we make sure that all files for all sheets look the same and have exactly the same information for all securities. We remove a field called `Error` that sometimes is created as part of the process of downloading data from Bloomberg. The code to do this varies slightly from round to round and can be found in the subfolder "Code and Intermediate Steps". The output files from this step which contain the data already cleaned and organized is in the subfolder "Cleaned Bloomberg Data For Step 5".

The location of files to replicate this step is:



- MBS Project/Replication/Database Construction/Step 4 - Clean up Data

## **Step 5. Put together cash flow data and convert it to text files**

In this step we put together all the Bloomberg files to produce consolidated tables, each having the same information on cash flows (Balance, Principal, Coupon, Interest, Losses, and Factor) for all securities. This was done for each round of data downloading separately and therefore there is code and files corresponding to each round. The input files are the original Bloomberg files from step 4.

To get the consolidated tables, execute the following steps in order:

1. Run `MBSDatabaseConstruction_Step5_CASHFLOW_dates_RoundX.m` for each round ( $X=1,2,3,4$ )
2. Run `MBSDatabaseConstruction_Step5_CASHFLOW_RoundX.m` for each round ( $X=1,2,3,4$ )
3. Run `MBSDatabaseConstruction_Step5_HISTFACT_dates_RoundX.m` for each round ( $X=1,2,3,4$ )
4. Run `MBSDatabaseConstruction_Step5_HISTFACT_RoundX.m` for each round ( $X=1,2,3,4$ )
5. Run `MBSDatabaseConstruction_Step5_LOSSES_dates_RoundX.m` for each round ( $X=1,2,3,4$ )
6. Run `MBSDatabaseConstruction_Step5_LOSSES_RoundX.m` for each round ( $X=1,2,3,4$ )

Notice that this code was run on RCC. This code produces the following output files:

- `Step5_BalanceAllSecurities_RoundX.txt` ( $X=1,2,3,4$ )
- `Step5_CouponsAllSecurities_RoundX.txt` ( $X=1,2,3,4$ )
- `Step5_DatesCashFlows_RoundX.txt` ( $X=1,2,3,4$ )
- `Step5_DatesHistFact_RoundX.txt` ( $X=1,2,3,4$ )
- `Step5_DatesHistLosses_RoundX.txt` ( $X=1,2,3,4$ )
- `Step5_HistFactAllSecurities_RoundX.txt` ( $X=1,2,3,4$ )
- `Step5_InterestAllSecurities_RoundX.txt` ( $X=1,2,3,4$ )
- `Step5_LossesAllSecurities_RoundX.txt` ( $X=1,2,3,4$ )
- `Step5_Principal_RoundX.txt` ( $X=1,2,3,4$ )

The location of files to replicate this step is:

- MBS Project/Replication/Database Construction/Step 5 - Put Together Cash Flow Data

## Step 6. Reduce Number of Dates for Cash Flows

In this step we take all the dates for which we have information on cash flows, losses, or factor (fraction of outstanding balance after losses and principal payments) and we convert them to monthly dates. For example, if for June 2001, we had some cash flow information for June 5th, June 17th, and June 25th, we would just keep June 2001 as a date/month for which we have information.

To accomplish this, we take the output files from steps 5.1, 5.3 and 5.5, and run the matlab files DateReductionRoundX.m (X=1,2,3,4). This produces the following files:

- Step6\_ReducedDatesCashFlows\_RoundX.txt (for X = 1, 2, 3, 4)
- Step6\_ReducedDatesHistFact\_RoundX.txt (for X = 1, 2, 3, 4)
- Step6\_ReducedDatesHistLosses\_RoundX.txt (for X = 1, 2, 3, 4)

These files will then be used as inputs in Step 8.

The location of files to replicate this step is:

- MBS Project/Replication/Database Construction/Step 6 - Reduce Number of Dates

## Step 7. Get first part of the non-time series information for all securities

In this step we obtain the first part of the non-time series information for all the securities in our database. This data includes information like CUSIP numbers, Bloomberg Ticker, Deal Manager, Maturity Dates, Credit Ratings, etc. To accomplish this, run the following matlab code in order:

1. MBSDatabaseConstruction\_Step7\_Round1.m
2. MBSDatabaseConstruction\_Step7\_Round2.m
3. MBSDatabaseConstruction\_Step7\_Round3.m
4. MBSDatabaseConstruction\_Step7\_Round4.m

Notice that this code was run on RCC. This code takes the original Bloomberg files from Step 4 and produces the following files:

- Step7\_DatabaseSecurities\_RoundX.txt (for  $X = 1, 2, 3, 4$ ). We use these files to match our data with the Mortgage Market Statistical Annual.
- Step7\_DatabaseSecurities\_AllRounds.txt. This file contains variables for all the securities in our database. It is the result of putting together Step7\_DatabaseSecurities\_RoundX.txt.

The location of files to replicate this step is:

- MBS Project/Replication/Database Construction/Step 7 - Get First Part of Non-Time

## **Step 8. Reduce the dimension of the data on cash flows**

The purpose of this step is to reduce the size of the tables produced in Step 5. The tables in Step 5 have the exact dates when the cash flows or losses were recorded. This means that for a given month, we may have several dates with information. In this step we reduce the information to a monthly frequency. To achieve this, we use the monthly dates from Step 6. In addition, to guarantee that all tables are linked properly, we add Bloomberg ID and Cusips using the tables from Step 7.

To achieve this run the following code:

1. Reducing\_BalanceTable\_Dimension\_RoundX.m (for  $X = 1, 2, 3, 4$ )
2. Reducing\_CouponsTable\_Dimension\_RoundX.m (for  $X = 1, 2, 3, 4$ )
3. Reducing\_FactorTable\_Dimension\_RoundX.m (for  $X = 1, 2, 3, 4$ )
4. Reducing\_InterestTable\_Dimension\_RoundX.m (for  $X = 1, 2, 3, 4$ )
5. Reducing\_LossesTable\_Dimension\_RoundX.m (for  $X = 1, 2, 3, 4$ )
6. Reducing\_PrincipalTable\_Dimension\_RoundX.m (for  $X = 1, 2, 3, 4$ )

Notice that this code was run on RCC. The location of files to replicate this step is:

- MBS Project/Replication/Database Construction/Step 8 - Reduce Dimension of Cash

## **Step 9. Put together cash flow data from all rounds**

In this step we consolidate all the cash-flow related tables so that the data of the four rounds of data downloading are all together. The input files are the output files of Step 8. To perform this step run the matlab code `PuttingTogetherCashFlowsForAllSecurities.m`. This produces the following output files:

- `Step9_BalanceTable_AllRounds.txt`
- `Step9_CouponsTable_AllRounds.txt`
- `Step9_FactorTable_AllRounds.txt`
- `Step9_InterestTable_AllRounds.txt`
- `Step9_LossesTable_AllRounds.txt`
- `Step9_PrincipalTable_AllRounds.txt`
- `Step9_UniquenessSecurities.txt`

The location of files to replicate this step is:

- `MBS Project/Replication/Database Construction/Step 9 - Put Together Cash Flow`

## **Step 10. Download second part of the data onto Excel**

After having organized the data on cash flows we set out to find further variables that give us a better description of each bond or their underlying mortgages. The data was originally collected in five files:

1. `Data2ndPart_Rnd1to3_MBSIssuedBefore2003.xlsx`. This file contains variables for MBS securities that were downloaded in rounds 1 through 3 and whose issue date was in 2002 or before.
2. `Data2ndPart_Rnd1to3_MBSIssuedBetween2003and2005.xlsx`. This file contains variables for MBS securities that were downloaded in rounds 1 through 3 and whose issue date occurred between 2003 and 2005.
3. `Data2ndPart_Rnd1to3_MBSIssuedBetween2006and2012.xlsx`. This file contains variables for MBS securities that were downloaded in rounds 1 through 3 and whose issue date occurred between 2006 and 2012.

4. Data2ndPart\_Rnd1to3\_MBSIssuedBetween2013and2014.xlsx. This file contains variables for MBS securities that were downloaded in rounds 1 through 3 and whose issue date occurred either in 2013 or in 2014.
5. Data2ndPart\_Rnd4.xlsx. This file contains variables for MBS securities that were downloaded in round 4.

This files contain the information exactly as it comes out from Bloomberg. We then convert this Excel Files into tab-separated text files. The resulting files are:

1. Step10\_Data2ndPart\_Rnd1to3\_MBSIssuedBefore2003.txt
2. Step10\_Data2ndPart\_Rnd1to3\_MBSIssuedBetween2003and2005.txt
3. Step10\_Data2ndPart\_Rnd1to3\_MBSIssuedBetween2006and2012.txt
4. Step10\_Data2ndPart\_Rnd1to3\_MBSIssuedBetween2013and2014.txt
5. Step10\_Data2ndPart\_Rnd4.txt

The location of files to replicate this step is:

- MBS Project/Replication/Database Construction/Step 10 - Put Together Cash Flow

## **Step 11. Clean and add Cusip numbers to second part of the data**

In this step we first put all the data of Step 10 in one table and then we sort it with the goal of having all the securities in the same order as we have them in the other tables. We also add the CUSIP\_ID numbers. To do this we run on RCC the matlab file PuttingTogetherCashFlowsForAllSecurities.m. The resulting file is called Step11\_MBSSecuritiesDescription2.txt.

The location of files to replicate this step is:

- MBS Project/Replication/Database Construction/Step 11 - Clean Second Part of Data

## **Step 12. Matching with Statistical Annual**

In this step we assess how comprehensive the database that we construct is in terms of its coverage of the non-agency MBS Market. To do this we take the table titled Non-Agency MBS Activity on pages 50 to 108 in Volume II of the Mortgage Market Statistical Annual and match the deals that we downloaded from Bloomberg with those in the table. In principle this table

lists all MBS deals by year from 2006 through 2012. For each round of data download we have a folder with the result of the matching. The matching is based on the fields from Bloomberg that are similar to those in the Statistical Annual's table, specifically the pricing date, issuing date, deal name, deal manager, and notional amount. The results of the matching can be found within the folder "Coverage AllRounds" in the file "MatchingStatAnnualAndBloombergSummary.xlsx"

We also produce a file titled "Step12\_MBSMatchedStatsAnnual.txt", which has the following variables:

- Variable1 - names: corresponds to the Bloomberg ticker
- Variable 2 - CUSIP\_ID: it is the cusip number of each bond
- Variable 3 - MBS\_TypeStatsAnnual\_1: it contains the classification of MBS deal by type of mortgage (e.g Prime, Subprime, etc). In some cases, the deal could be classified as Scratch and Dent or Second Lien, and also subprime. In these cases we give priority to Subprime. The values of this variable are: 1 (Subprime), 2 (Prime), 3(Alt-A), 4 (2nd), 5 (re-MBS), 6 (Other), 7 (Scratch & Dent), 8 (Unclassified)
- Variable 4 - NIM: it takes value 1 if the bond belongs to a NIM deal, and zero otherwise
- Variable 5 - MBS\_TypeStatsAnnual\_2: it contains the classification of MBS deal by type of mortgage (e.g Prime, Subprime, etc). In this case Scratch and Dent or Second Lien would have priority over Subprime. The values of this variable are: 1 (Subprime), 2 (Prime), 3(Alt-A), 4 (2nd), 5 (re-MBS), 6 (Other), 7 (Scratch & Dent), 8 (Unclassified)

The location of files to replicate this step is:

- MBS Project/Replication/Database Construction/Step 12 - Matching with Statistical Annual

### **Step 13. Create classification variables**

In this step we construct indicator variables that help us classify securities in certain categories and read certain characteristics more easily. Here we include the information from Step 12 and also add the following information:

- Codes for credit risk ratings for the 5 agencies we have in the data
- Classification dummies for CMBS, RMBS, other MBS.

- Classification dummies for Agency-backed securities and Government-related securities
- Classification dummy for CDOs
- Classification Dummies for types of tranches: IO, PO, Z, floating and inverse floating

The location of files to replicate this step is:

- MBS Project/Replication/Database Construction/Step 13 - Create ClassificationVariables

## **Step 14. Create Final Tables with Non-Duplicated Securities**

In this step we take all the tables and using the file Step9\_UniquenessSecurities.txt we remove all duplicated securities to finally have a cleaned dataset.

The location of files to replicate this step is:

- MBS Project/Replication/Database Construction/Step 14 - Create Final Tables
- MBS Project/Replication/Database: This is the directory where our final database

## B Database Description

For this paper we have constructed a database that contains detailed information on a comprehensive collection of Non-Agency Mortgage Backed Securities. Our database has data for almost 9,000 MBS deals which translate into 147,606 unique mortgage backed securities issued between 1987 and 2014. These securities were issued by more than 200 firms and have a notional amount of \$6.1 trillion, out of which 65% was issued between 2004 and 2007. See Table DA1 for a brief description of the quantities in our data year by year.

**Table DA1: MBS Database Description: Deals, Securities, Firms, And Notional Amounts by Year**

*This table reports some figures that describe the size of all the data that we were able to gather from Bloomberg on Mortgage Backed Securities by year of issuance. The original raw data includes securities issued in 2014. Since we started building the database at the beginning of 2014, we do not have a comprehensive sample of securities for this year and therefore the figures should not be seen as representative.*

Year	No Deal	No Deal Managers	No of Parent Issuers	No of Issuers	Number of MBS	Notional (US Billion)	Average Deal Size (US Million)
1987-1999	962	36	48	415	10.235	290,6	302,0
2000	235	21	44	168	2.859	99,0	421,4
2001	418	23	56	291	6.114	193,2	462,2
2002	587	30	70	429	8.526	322,5	549,5
2003	802	30	93	668	12.667	486,7	606,8
2004	1.126	30	116	935	16.090	739,2	656,5
2005	1.387	29	140	1.150	22.496	1.031,5	743,7
2006	1.584	39	156	1.376	27.586	1.266,8	799,7
2007	1.040	35	153	925	19.471	960,6	923,7
2008	113	20	35	98	1.579	106,6	943,7
2009	172	17	23	146	5.764	181,7	1.056,1
2010	169	17	26	138	6.414	181,8	1.075,7
2011	113	13	22	88	3.214	79,1	699,8
2012	99	11	20	66	1.826	39,8	401,7
2013	134	13	18	103	2.189	101,2	754,9
2014	44	9	14	29	576	26,6	603,9
All Years	8.985	85	228	6.803	147.606	6.106,8	679,7

In this paper we have focused our attention on private residential MBS. These non-agency MBS make up bulk of our data and are the ones that we restrict our attention to. However, given the broad search that we have conducted, our full database contains some other securities including more than 3,400 CMBS with notional amount of \$426 billion. In the collection process some information on Agency MBS was collected. Including the VA (Veteran Affairs) loans, which are partially backed by the Government through the U.S Department of Veteran Affairs, only about 1% of the bonds in our data are Government-related, which leaves us with 146,000 private-label MBS. It is also worth noting that our data is not a comprehensive collection of



CDOs. Finally, about 10% of the data corresponds to re-securitizations, which became more common after the financial crisis. Table DA2 presents figures on the number of deals, number of bonds and notional amounts for different classification criteria of the securities in our database.

**Table DA2: RMBS Database: Deals, Securities and Nominal Amounts by Different Classification Criteria**

*This table reports some figures that describe the type of mortgage backed securities that comprise our database. All the securities in the database are classified by different criteria as long as the information was available.*

Classification Criteria	Deals		MBS Bonds		Notional Amount	
	No.	%	No.	%	\$ Billion	%
<b><i>Type of Collateral</i></b>						
RMBS	8,631	96.3	143,781	97.4	7,521.99	94.1
CMBS	220	2.5	3,444	2.3	426.00	5.3
Other MBS	97	1.1	328	0.2	32.51	0.4
Unclassified	17	0.2	111	0.1	15.74	0.2
<b><i>Agency vs Private</i></b>						
Agency	163	1.8	906	0.6	246.28	3.1
Private Label	8,802	98.2	146,758	99.4	7,749.96	96.9
<b><i>Government Backed</i></b>						
Govt.-backed	239	2.7	1,659	1.1	280.74	3.5
Non Govt.-backed	8,733	97.3	146,005	98.9	7,715.50	96.5
<b><i>Collateralized Debt Obligation</i></b>						
CDO	96	1.1	579	0.4	197.88	2.5
Non-CDO	8,866	98.9	147,085	99.6	7,798.35	97.5
<b><i>Resecuritization</i></b>						
Resecuritization	815	9.1	19,972	13.5	742.35	9.3
Non_Resecuritization	8,178	90.9	127,692	86.5	7,253.89	90.7

The information that we have for each security can be better described by categories. The bulk of our information is the cash flows and losses of each security each month after issuance. We observe the interest payments, principal payments, outstanding balance, the coupon rate and the losses each month.

Some variables help us describe the security and some of its characteristics. These include dates of issuance, coupon type and frequency, maturity date, the type of tranche it represents, its notional amount, and the credit rating assigned by up to 5 different credit rating agencies. Some other variables are related to the collateral of the securities, the underlying mortgages. These include information on the composition of the mortgages by type of rates (adjustable

rates vs fixed rate mortgages), by type of occupancy (vacation home, family home, etc), by purpose of the mortgage (equity take out, refinance, purchase). Other variables are related to commonly-used MBS metrics like WAM, WAC, WAL. Finally, there are variables that not only tell us about the underlying mortgages but also about the risk and the type of the security. These include information on the distribution of credit scores, loan size, and loan to value ratios.

Many of the variables related to MBS vary over time. For example, one can talk about the average loan size at issuance or the average loan size at any other point in time; or one can talk about the credit rating given upon issuance and the current credit rating of a security. For most variables we were able to obtain the values upon issuance. For some of these variables we may have gathered also current information (current meaning the value of the variable at the time we collected the data). For some of these variables the time series information may exist, for some it may not. We are uncertain about the benefit of the “current” value of a variable if we do not have access to the time series. We did not collect information on all the existing time series due to constraints in the amount of information that can be extracted from the data sources in a given month. If needed, these time series could be potentially obtained.

## **Detailed Description of Files and Variables**

We now list and describe each of the files and variables in our database. The database is comprised of the following 9 main files:

1. MBS SecuritiesDescription1.txt
2. MBS SecuritiesDescription2.txt
3. MBS SecuritiesClassification.txt
4. BalanceTableMBS.txt
5. CouponsTableMBS.txt
6. InterestTableMBS.txt
7. PrincipalTableMBS.txt
8. LossesTableMBS.txt
9. FactorTableMBS.txt

The link between all 9 files is the CUSIP ID number of each MBS and its corresponding Bloomberg Ticker. The location of files in the project's folder is:

- MBS Project/Replication/Database/MainFiles

## Description

We now describe each file of the database.

**File 1. SecuritiesDescription1MBS.txt** This file contains variables that describe and characterize a given MBS. It is a txt file, separated by the delimiter '|' (bar) and it can be read in Matlab as a table. By categories, the file contains the following 41 variables in order.

### *Security Identification*

- Variable 1 - Names: it is the ticker of the security on Bloomberg. One can access the information on any security on Bloomberg by typing name and the key MTGE.
- Variable 2 - ID\_CUSIP: it is the CUSIP number of the MBS. The number consists of nine characters (including letters and numbers) that uniquely identify a company or issuer and the type of security. This field may be useful to match the database with other databases such as LoanPerformance
- Variable 3 - LEAD\_MGR: Name of the financial institution that acted as lead manager (underwriter) in the deal. This field has been used to match MBS with the information in the Statistical Annual.
- Variable 4 - MTG\_DEAL\_NAME: Name of the MBS deal. For all the securities (tranches) involved in a given deal, this provides the common part of the Ticker (Bloomberg Name). This field has been used to match MBS with the information in the Statistical Annual.

### *Security Description*

- Variable 5 - MTG\_DEAL\_TYP: It contains a description of the type of MBS issued in the deal. This field can be used to put MBS into categories such as Commercial MBS, Autos, Residential MBS. A problem is that some of the descriptions are generic (e.g CDO, ABS), and therefore some more information is required to make a full classification.

- Possible values: ABS, AUTOS, BUSINESS, CDO, CMBS-CMO, CMBS-CONDUIT, CMBS-CTL, CMBS-EURO, CMBS LGR/OTHR FLT, CMBS-PORTFOLIO, CMBS-REREMIC, CMBS- SASB, CMBS-SMALL BAL, CMO, COMMERCIAL, HOME EQT, MANUFCT HM, MBB, MBS, MPT, NPL, re-SEC, STUDENTS, SWAP TRUST
- Variable 6 - SECURITY\_TYP: This field provides some information on the type of security issued. It may have information on whether the security is Agency backed or not, the type of loan (residential, commercial, etc) and the type of tranche. This field that can help classify the securities into Residential MBS, CMBS, Agency MBS. Many of the securities have the descriptor “Prvt CMO” so further information is needed.
  - Possible values: ABS Auto, ABS Home, ABS Other, Agncy ABS Home, Agncy ABS Other, Agncy CMBS, Agncy CMO FLT, Agncy CMO INV, Agncy CMO IO, Agncy CMO Other, Agncy CMO Z, Agncy CMO PO, CF, CMBS, Prvt CMO FLT, Prvt CMO INV, Prvt CMO IO, Prvt CMO Other, Prvt CMO Z, Prvt CMO PO, SN
- Variable 7 - SECURITY\_TYP2: This field also provides information on the type of MBS. We have used it in combination with the previous two fields to classify the securities.
  - Possible Values: ABS, ABS Other, ABS/MEZZ, CMBS, CMO, CRE, RMBS, Whole Loan
- Variable 8 - MTG\_CMO\_CLASS: It is a particle of the Bloomberg Ticker that identifies the Tranche.
- Variable 9 - COLLAT\_TYP: Describes the underlying collateral. It may contain information on the type of mortgage (e.g AltA) the maturity time, the type of rate (e.g ARM). It can be used to help classify the MBS
  - For example, some fields contain the following particles: FNTY FGTY FHTY GNTY G2TY. They all correspond to Agency Pools, Fannie Mae, Freddie Mac and Ginnie Mae.
- Variable 10 - ISSUE\_DT: Date in which the security is issued. This field is recorded as a serial date number (see ISSUE\_DATE)
- Variable 11 - ISSUE\_DATE: format YYYYMMDD for ISSUE\_DT.

- Variable 12 - MTG\_PX\_SPD\_DT: Date in which the security was originally priced. Field recorded as a serial number (see PRICING\_DATE)
- Variable 13 - PRICING\_DATE: format YYYYMMDD for MTG\_PX\_SPD\_DT
- Variable 14 - MATURITY: This field is recorded as a serial date number (see MATURITY\_DATE).
- Variable 15 - MATURITY\_DATE: format YYYYMMDD for MATURITY
- Variable 16 - CPN\_TYP: coupon type of the bond, or type of interest to be paid to investors
  - Possible Values: FIXED, FLOATING, STEP, VARIABLE, ZERO
- Variable 17 - CPN: value of the coupon at time of download. Unfortunately it does not contain the reference rate.
- Variable 18 - MTG\_ORIG\_AMT: value of the original principal amount of the MBS or, in other words, principal balance at issuance of the security
- Variable 19 - MTG\_TRANCHE\_TYP\_LONG: Description of the Tranches and how they get paid. There are many possible descriptors and securities will generally have several.
  - Some common values:
    - \* FLT (Floater), INV (Inverse Floater), PT (Pass-Through), IO (Interest Only), R (Residual), Z (Accrual), PO (Principal Only)
- Variable 20 - ORIG\_CREDIT\_SUPPORT: Original credit support percentage for a CMO class/tranche from their subordinated classes in the same CMO deal.

#### *Credit Rating Information*

- Variable 21 - RTG\_FITCH: Current credit rating (at time of download, March 2014 through February 2015) by Fitch
- Variable 22 - RTG\_FITCH\_INITIAL: Initial credit rating by Fitch
- Variable 23 - RTG\_KBRA: Current credit rating (at time of download) by Kroll Bond Rating Agency

- Variable 24 - RTG\_KBRA\_INITIAL: Initial credit rating by KBRA
- Variable 25 - RTG\_MOODY: Current credit rating (at time of download) by Moodys
- Variable 26 - RTG\_MDY\_INITIAL: Initial credit rating by Moodys
- Variable 27 - RTG\_SP: Current credit rating (at time of download) by Standard and Poors
- Variable 28 - RTG\_SP\_INITIAL: Initial credit rating by Standard and Poors
- Variable 29 - RTG\_DBRS: current credit rating by Dominion Bond Rating Service
- Variable 30 - RTG\_DBRS\_INITIAL: initial credit rating by Dominion Bond Rating Service

#### *Standard MBS Metrics*

- Variable 31 - MTG\_ORIG\_WAC: Original Weighted Average Coupon of the pool of loans that make up the MBS
- Variable 32 - MTG\_ORIG\_WAL: Weighted average life as of issuance in Years (expected time to receive principal payments)
- Variable 33 - MTG\_ORIG\_WAM: Weighted average maturity as of issuance (in Months)

#### *Geographic Information*

- Variable 34 - MTG\_GEO1\_ERL: Percentage of original principal corresponding to the state with highest participation in the MBS
- Variable 35 - MTG\_GEO2\_ERL: Percentage of original principal corresponding to the state with the second highest participation in the MBS
- Variable 36 - MTG\_GEO3\_ERL: Percentage of original principal corresponding to the state with the third highest participation in the MBS
- Variable 37 - MTG\_GEO4\_ERL: Percentage of original principal corresponding to the state with the fourth highest participation in the MBS
- Variable 38 - MTG\_GEO5\_ERL: Percentage of original principal corresponding to the state with the fifth highest participation in the MBS

#### Loan Purpose

- Variable 39 - MTG\_LOAN\_PURPOSE\_EQUITY\_ERL: The earliest percentage of the Loan Purpose (the reason for the loan) for Equity Take Out
- Variable 40 - MTG\_LOAN\_PURPOSE\_PURCHASE\_ERL: The earliest percentage of the Loan Purpose (the reason for the loan) for Purchase
- Variable 41 - MTG\_LOAN\_PURPOSE\_REFINANCE\_ERL: The earliest percentage of the Loan Purpose (the reason for the loan) for Refinance

**File 2. SecuritiesDescription2MBS.txt** This file contains variables that further describe a given MBS. It is a txt file, separated by the delimiter '|' (bar). The information is available for all securities issued in 2003 or later. The file contains the following 49 variables in order.

- Variable 1 - Names: it is the ticker of the security on Bloomberg.
- Variable 2 - ID\_CUSIP: it is the CUSIP number of the MBS.
- Variable 3 - WALTV\_ORIG: Original weighted average amortized loan to original value of the underlying loans comprising the collateral
- Variable 4 - MTG\_QRT\_LTV\_MIN: Lowest original loan to value percentage of any loan in the pool.
- Variable 5 - MTG\_QRT\_LTV\_25: 25th percentile of original loan to value percentage in the pool
- Variable 6 - MTG\_QRT\_LTV\_MED: 50th percentile of original loan to value percentage in the pool
- Variable 7 - MTG\_QRT\_LTV\_75: 75th percentile of original loan to value percentage in the pool
- Variable 8 - MTG\_QRT\_LTV\_MAX: Highest original loan to value percentage of any loan in the pool.
- Variable 9 - MTG\_WAOCS: Weighted average original credit score of a pool
- Variable 10 - MTG\_QRT\_SCORE\_MIN: Lowest original credit score of any loan in the pool
- Variable 11 - MTG\_QRT\_SCORE\_25: 25th percentile original credit score in the pool

- Variable 12 - MTG\_QRT\_SCORE\_MED: 50th percentile original credit score in the pool
- Variable 13 - MTG\_QRT\_SCORE\_75: 75th percentile original credit score in the pool
- Variable 14 - MTG\_QRT\_SCORE\_MAX: Highest original credit score of any loan in the pool
- Variable 17 - MTG\_QRT\_AOLS\_MIN: Smallest original size of any loan in the pool
- Variable 18 - MTG\_QRT\_AOLS\_25: 25th percentile original loan size in the pool
- Variable 16 - MTG\_QRT\_AOLS\_MED: 50th percentile original loan size in the pool
- Variable 19 - MTG\_QRT\_AOLS\_75: 75th percentile original loan size in the pool
- Variable 15 - MTG\_QRT\_AOLS\_MAX: Largest original size of any loan in the pool
- Variable 20 - MTG\_ORIG\_MIN\_LOAN\_SIZE: Minimum original loan size. It reports the minimum original loan amount for loans currently backing the deal
- Variable 21 - MTG\_AVG\_ORIG\_LOAN\_SIZE : Average of original loan size of loans currently backing the deal
- Variable 22 - MTG\_AVG\_AOLS: Average original loan size
- Variable 23 - MTG\_WA\_ORIG\_LOAN\_SIZE: Weighted average of original loan size of loans currently backing the deal
- Variable 24 - MTG\_ORIG\_MAX\_LOAN\_SIZE: Maximum original loan size. It reports the maximum original loan amount for loans currently backing the deal
- Variable 25 - MTG\_AMORT\_TYPE\_ARM\_ERL: The earliest percentage of the Adjustable Rate Mortgage (ARM) Loans.
- Variable 26 - MTG\_AMORT\_TYPE\_LEVEL\_FRM\_ERL: The earliest percentage of the Fixed Rate Mortgage (ARM) Loans.
- Variable 27 - CUM\_LOSS\_PCT: Current Percentage of cumulative loss on the underlying loans comprising the collateral specific to the group to which the security belongs. Cumulative Loss that will not be recovered and has been taken as a writeoff on the balance sheet.



- Variable 28 - ALL\_COLLAT\_CUM\_LOSS\_PCT: Current Percentage of cumulative loss on the underlying loans comprising the entire collateral that backs the CMO deal. Not specific to the group to which the security belongs. Cumulative Loss that will not be recovered and has been taken as a writeoff on the balance sheet. Warning. Variables 27 and 28 could coincide. Dividing Variable 29 by variable 28, yields the deal amount
- Variable 29 - ALL\_COLLAT\_CUM\_LOSS: cumulative loss on the underlying loans comprising the entire collateral that backs the CMO deal
- Variable 30 - CPN\_FREQ: Number of times per year interest is paid
- Variable 31 - MTG\_PX\_SPD: Prepayment speed at which the security was originally priced
- Variable 32 - MTG\_OCCUPANCY\_OWNER\_ERL: The earliest percent of the occupancy (the purpose of the property) for owner occupied
- Variable 33 - MTG\_OCCUPANCY\_INVESTMENT\_ERL: The earliest percent of the Occupancy (the purpose of the property) for owner occupied
- Variable 34 - MTG\_OCCUPANCY\_VACATION\_ERL: The earliest percent of the Occupancy (the purpose of the property) for vacation
- Variable 35 - MTG\_SINGLE\_FAMILY\_ERL: The earliest percent of Single Family Mortgaged Properties, the type of properties against which the loans were written
- Variable 36 - MTG\_CONDOMINIUM\_ERL: The earliest percent of Condominium Mortgaged Properties, the type of properties against which the loans were written
- Variable 37 - MTG\_2\_4\_FAMILY\_ERL: The earliest percent of 2-4 Family Mortgaged Properties, the type of properties against which the loans were written
- Variable 38 - MTG\_PUD\_ERL: The earliest percent of PUD (Planned Unit Development) Mortgaged Properties, the type of properties against which the loans were written
- Variable 39 - MTG\_NUM\_POOLS: Number of pools/loans backing the deal or collateral group. It seems to be the current value.
- Variable 40 - MTG\_NUM\_BONDS\_DEAL: Number of Tranches in the deal or collateral group

- Variable 41 - MTG\_WHLN\_NUMBER\_LOAN: The current number of loans, created as collateral for the deal, which are still outstanding
- Variable 42 - ID\_BB\_PARENT\_CO: The Bloomberg Company ID number for the controlling company of the current security
- Variable 43 - ID\_BB\_COMPANY: Bloomberg number that is assigned to all companies that issue securities
- Variable 44 - TRANCHE\_NUM: Tranche number of the security
- Variable 45 - CALLABLE: Indicates whether the security is subject to early redemption through a call provision.
- Variable 46 - ISSUE\_PX: Price of the security at issuance
- Variable 47 - MTG\_NUM\_ORIG\_LOAN: Number of loans in the pool as of issuance. It may not be available for most securities
- Variable 48 - MTG\_PROPERTY\_TYP: The majority type of property the loans were written against
- Variable 49 - RESECURITIZATION\_INDICATOR: Indicates if the bond is a derivative of another security. Possible values (Y, N)
- Variable 50 - MTG\_IS\_AGENCY\_BACKED: Indicates if an MBS is backed by a Government Agency. Possible values (Y,N)
- Variable 51 - CMBS\_TYP: Describes the types of loans comprising the collateral of the CMBS. This field may be useful to separate RMBS from CMBS.
- Variable 52 - AIFMD\_EXPOSURE\_RPT\_SUB\_AST\_TYP: Sub-asset type security classification of the European Securities and Markets Authority. This field may help to identify RMBS

**File 3. MBS Securities Classification.txt** This file contains variables that can help classify the securities into different categories. The file contains the following 29 variables in order

- Variable 1 - Names: it is the ticker of the security on Bloomberg.
- Variable 2 - ID\_CUSIP: it is the CUSIP number of the MBS.

- Variable 3 - MBS\_TypeStatsAnnual\_1: Classification variables into prime and subprime categories according to Mortgage Market Statistical Annual
- Variable 4 - NIM: Dummy variable that takes the value 1 if the MBS is a Net Interest Margin Bond
- Variable 5 - MBS\_TypeStatsAnnual\_2: Classification variables into prime and subprime categories according to Mortgage Market Statistical Annual
- Variable 6 - Found: Dummy variable that takes the value 1 if the security was found in the Mortgage Market Statistical Annual
- Variable 7 - SPoors\_Rating: Indicator variable for credit ratings by Standard & Poors
- Variable 8 - Moodys\_Rating: Indicator variable for credit ratings by Moodys
- Variable 9 - Fitch\_Rating: Indicator variable for credit ratings by Fitch
- Variable 10 - KBRA\_Rating: Indicator variable for credit ratings by KBRA
- Variable 11 - DBRS\_Rating: Indicator variable for credit ratings by DBRS
- Variable 12 - reSec: Dummy variable that takes the value 1 if the MBS is a resecuritization
- Variable 13 - ReSecType: indicator variable to classify resecuritizations
- Variable 14 - RMBS: Dummy variable that takes the value 1 if the MBS is an RMBS
- Variable 15 - CMBS: Dummy variable that takes the value 1 if the MBS is a CMBS
- Variable 16 - OtherMBS: Dummy variable that takes the value 1 if the MBS could not be classified as RMBS or CMBS
- Variable 17 - UnclassifiedMBS: Dummy variable that takes the value 1 if the MBS is not classified as RMBS, CMBS, or other MBS
- Variable 18 - AgencyMBS: Dummy variable that takes the value 1 if the MBS is an Agency-backed security
- Variable 19 - Gov: Dummy variable that takes the value 1 if the MBS is backed by the government
- Variable 20 - CDOs: Dummy variable that takes the value 1 if the securitization is a CDO

- Variable 21 - TrancheIO: Dummy variable that takes the value 1 if the MBS is an interest only tranche
- Variable 22 - TranchePO: Dummy variable that takes the value 1 if the MBS is a principal only tranche
- Variable 23 - TrancheZ: Dummy variable that takes the value 1 if the MBS is an z tranche
- Variable 24 - TrancheFloat: Dummy variable that takes the value 1 if the MBS is a floater
- Variable 25 - TrancheAllFloater: Dummy variable that takes the value 1 if the MBS is a floater or an inverse floater
- Variable 26 - TrancheInvFloat: Dummy variable that takes the value 1 if the MBS is an inverse floater
- Variable 27 - TrancheResidual: Dummy variable that takes the value 1 if the MBS is a residual tranche
- Variable 28 - TrancheX: Dummy variable that takes the value 1 if the MBS is an X tranche
- Variable 29 - TrancheExcess: Dummy variable that takes the value 1 if the MBS is an excess tranche

**File 4. BalanceTableMBS.txt** This file contains the time series of principal balance at the end of each month for each MBS from April 1987 through September 2014. Since the data was downloaded from March 2014 through February 2015, it is best to use the information in this file up to December 2013. This guarantees that the information was already uploaded on Bloomberg and also that the time of coverage was the same for all securities. It is a txt file separated by the delimiter '|'. It can be read in Matlab as a table. The structure of the file is the following:

- Column 1 - Names: it is the ticker of the security on Bloomberg.
- Column 2 - ID\_CUSIP: it is the CUSIP number of the MBS.
- Column 3 through Column 331: Principal Balance at the end of each month from April 1987 through September 2014

**File 5. CouponsTableMBS.txt** This file contains the time series of coupon rates that were applied on a given month on the principal balance as of the previous month for each MBS from April 1987 through September 2014. Since the data was downloaded from March 2014 through February 2015, it is best to use the information in this file up to December 2013. It is a txt file separated by the delimiter '|'. It can be read in Matlab as a table. The structure of the file is the following:

- Column 1 - Names: it is the ticker of the security on Bloomberg.
- Column 2 - ID\_CUSIP: it is the CUSIP number of the MBS.
- Column 3 through Column 331: Coupon rate applied each month from April 1987 through September 2014

**File 6. InterestTableMBS.txt** This file contains the time series of interest payments at the end of each month for each MBS from April 1987 through September 2014. Since the data was downloaded from March 2014 through February 2015, it is best to use the information in this file up to December 2013. It is a txt file separated by the delimiter '|'. It can be read in Matlab as a table. The structure of the file is the following:

- Column 1 - Names: it is the ticker of the security on Bloomberg.
- Column 2 - ID\_CUSIP: it is the CUSIP number of the MBS.
- Column 3 through Column 331: Interest payment of each month from April 1987 through September 2014

**File 7. PrincipalTableMBS.txt** This file contains the time series of principal payments each month for each MBS from April 1987 through September 2014. Since the data was downloaded from March 2014 through February 2015, it is best to use the information in this file up to December 2013. It is a txt file separated by the delimiter '|'. It can be read in Matlab as a table. The structure of the file is the following:

- Column 1 - Names: it is the ticker of the security on Bloomberg.
- Column 2 - ID\_CUSIP: it is the CUSIP number of the MBS.
- Column 3 through Column 331: Principal payment of each month from April 1987 through September 2014

**File 8. LossesTableMBS.txt** This file contains the time series of losses each month for each MBS from April 1987 through September 2014. Since the data was downloaded from March 2014 through February 2015, it is best to use the information in this file up to December 2013. It is a txt file separated by the delimiter '|'. It can be read in Matlab as a table. The structure of the file is the following:

- Column 1 - Names: it is the ticker of the security on Bloomberg.
- Column 2 - ID\_CUSIP: it is the CUSIP number of the MBS.
- Column 3 through Column 331: Losses each month from April 1987 through September 2014

**File 9. FactorTableMBS.txt** This file contains the time series of a variable called Factor each month for each MBS from April 1987 through September 2014. The factor records what proportion of the principal of a security is still outstanding. It is defined as follows:

$$Factor_t = 1 - \frac{CumulativeLosses_t + CumulativePrincipalPaid_t}{OriginalBalance}$$

Since the data was downloaded from March 2014 through February 2015, it is best to use the information in this file up to December 2013. It is a txt file separated by the delimiter '|'. It can be read in Matlab as a table. The structure of the file is the following:

- Column 1 - Names: it is the ticker of the security on Bloomberg.
- Column 2 - ID\_CUSIP: it is the CUSIP number of the MBS.
- Column 3 through Column 331: Factor each month from April 1987 through September 2014

## C Additional Results

### C.1 Data and RMBS Classification: Additional information.

Table TA1: Database Coverage of the universe of Non-Agency RMBS

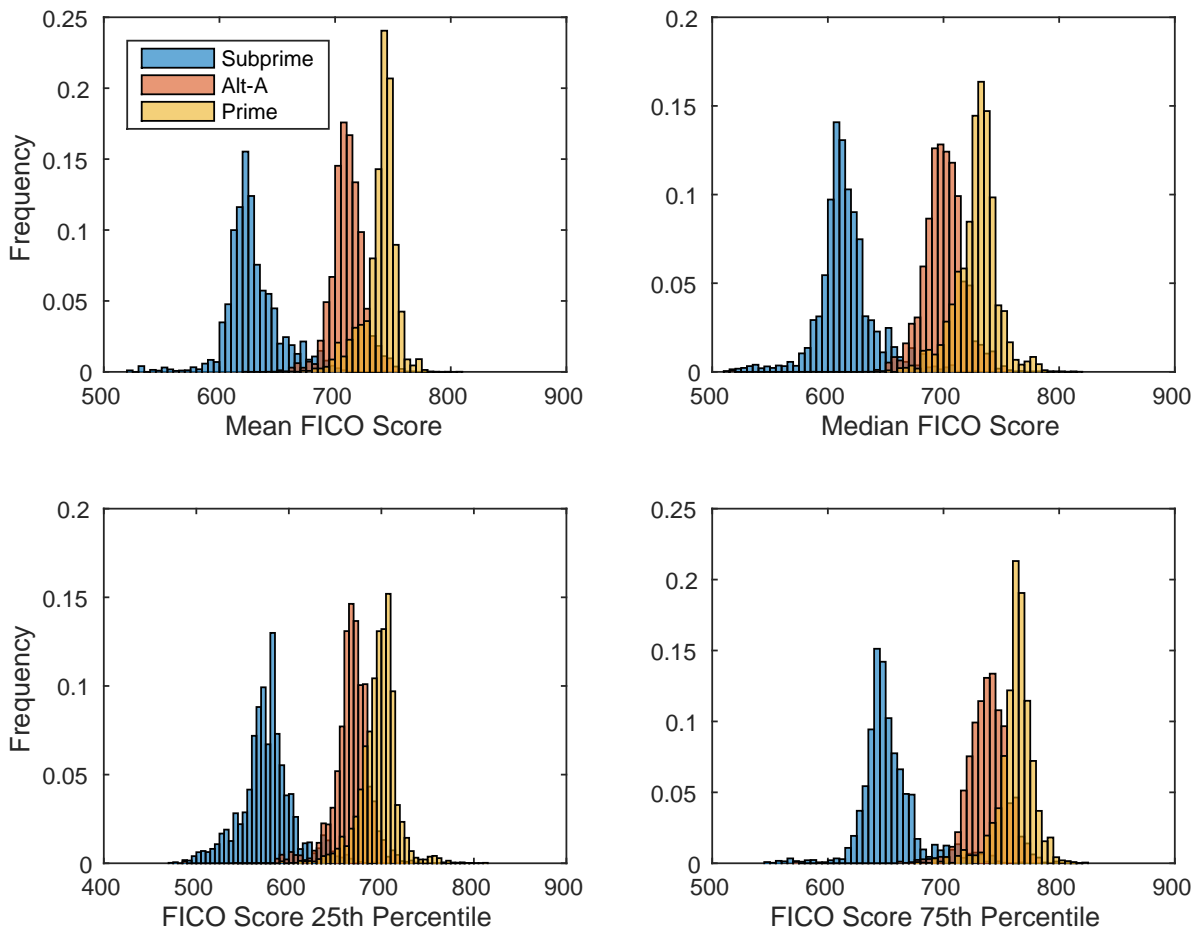
*This table compares our database to the universe of mortgage-backed securities for 2006 to 2012, as listed in the Mortgage Market Statistical Annual 2013 Edition. By value, our database contains about 95% of the Non-agency mortgage-backed securities issued between 2006 and 2012. To make the match between we use the the Mortgage Market Statistical Annual 2013 Edition and Bloomberg we used information on issue dates, the deal manager, the deal name, and the principal amount. We do not present numbers for the period before 2006 because the Statistical Annual Edition 2013 only has information starting in 2006. The principal amount numbers are in \$ billion.*

<b>Panel A: Principal Amount and Deals Coverage by Type of Mortgage-backed Security</b>											
	<b>Prime</b>		<b>Alt-A</b>		<b>Subprime</b>		<b>Other</b>		<b>Total</b>		
	Amount	Deals	Amount	Deals	Amount	Deals	Amount	Deals	Amount	Deals	
Unmatched	9.8	15	16.2	30	33.6	52	26.3	90	85.9	187	
Matched	406.5	484	596.5	739	656.4	771	304.4	643	1,963.8	2,637	
Total	416.3	499	612.7	769	690.0	823	330.7	733	2,049.8	2,824	
Pct. Matched	97.7	97.0	97.4	96.1	95.1	93.7	92.0	87.7	95.8	93.4	

<b>Panel B: Principal Amount Coverage by Year and Type of Mortgage-backed Security</b>									
<b>Type of MBS</b>	<b>Year</b>								
	2006	2007	2008	2009	2010	2011	2012	All Years	
<b>All</b>									
Principal Amount	1,129.3	697.0	58.6	60.4	63.8	27.6	13.2	2,049.8	
Pct. Matched	97.3	93.4	95.2	95.0	97.7	97.3	91.6	95.8	
<b>Prime</b>									
Principal Amount	218.79	180.4	7.0	5.5	0.5	0.7	3.5	416.3	
Pct. Matched	96.9	98.6	94.4	100.0	100.0	100.0	100.0	97.7	
<b>Alt-A</b>									
Principal Amount	362.79	247.4	1.9	-	0.7	-	-	612.7	
Pct. Matched	99.1	94.9	72.5	100.0	100.0	100.0	100.0	97.4	
<b>Subprime</b>									
Value	470.11	213.4	2.4	0.9	-	0.5	2.8	690.0	
Principal Amount	96.6	91.8	97.9	100.0	100.0	100.0	100.0	95.1	
<b>Other</b>									
Value	77.57	55.8	47.4	54.0	62.6	26.4	6.9	330.7	
Principal Amount	93.8	76.0	100.0	100	100	100	100	92.0	

Figure TA1: **Distribution of FICO Scores by Type of Mortgage**



*This figure plots histograms for different moments of the distribution of FICO Scores of the mortgage loans underlying the Residential Mortgage Backed Securities in our database. These moments correspond to the value-weighted average, the median, 25th and 75th percentiles of FICO scores upon issuance of the MBS. The histograms are shown by type of mortgage loan (Prime, Alt-A, and Subprime) and only securities issued in the period 2006-2012 are included.*



## C.2 Fact 1: Additional information.

Table TA2: Credit Rating Activity of Non-Agency Residential Mortgage Backed Securities: 1987-2013

*This table presents some figures about the credit rating activity in the RMBS market between 1987 and 2013. We refer to rating activity as the participation of credit rating agencies in providing a credit rating to a bond. We measure such activity as both the number of bonds and the principal amount represented, by agency or group of agencies. The calculations are based on the credit ratings assigned upon issuance.*

Rating Activity	MBS Bonds		Principal Amount	
	No.	Pct.	(\$ Billion)	Pct.
Rated by at least one agency	115,282	81.4	5,214.1	92.0
Rated by 2 or more agencies	87,937	62.1	4,812.3	84.9
Rated by all 3 big agencies	16,324	11.5	1,085.0	19.1
Rated by all agencies	0	0.0	0	0.0
Rated by Standard & Poors	90,006	63.6	4,518.0	79.7
Rated by Moody's	67,036	47.3	3,931.5	69.4
Rated by Fitch	58,692	41.4	2,530.6	44.6
Rated by Kroll (KBRA)	207	0.1	19.7	0.3
Rated by DBRS	7,179	5.1	366.6	6.5
Not Rated	26,348	18.6	453.8	8.0
<b>All Bonds</b>	<b>141,630</b>	<b>100.0</b>	<b>5,667.9</b>	<b>100.0</b>

**Table TA3: Non-Agency Residential Mortgage Backed Securities: Credit Rating Composition 1987-2013**

*This table shows the number of bonds and their corresponding principal amounts by credit rating. The credit rating corresponds to the rating assigned to a bond upon issuance. If several ratings were given, we have taken an average. The first 4 columns of the table show amounts and percentages for the entire database. The last 3 columns show the percentages for the principal amount of the bonds rated by each of the three main rating agencies. The last row of the last three columns shows the total principal amount of the bonds rated by each agency, which is the base for the percentage calculations. All bonds issued between 1987 and 2013 are included in the computations.*

Rating	MBS Bonds		Principal Amount		Principal Amount By Agency		
	No.	Pct.	(\$ Billion)	Pct.	S&P	Moody's	Fitch
AAA	65,590.0	56.8	4,535.1	86.9	88.9	89.8	89.8
AA	13,298.0	11.5	297.0	5.7	4.8	5.4	4.1
A	13,355.0	11.6	212.3	4.1	2.9	2.5	3.7
BBB	13,062.0	11.3	118.4	2.3	1.9	1.8	1.8
BB	6,096.0	5.3	40.1	0.8	0.6	0.4	0.4
B	3,865.0	3.3	13.6	0.3	0.4	0.0	0.1
CCC	66.0	0.1	0.3	0.0	0.2	0.0	0.0
CC	22.0	0.0	0.6	0.0	0.2	0.0	0.0
C	51.0	0.0	3.3	0.1	0.1	0.0	0.0
Rated	115,405.0	81.2	5,220.5	91.7	4,523.4	3,931.5	2,531.4
Not Rated	26,774.0	18.8	472.1	8.3			

### C.3 Facts 2 and 3: Additional Information.

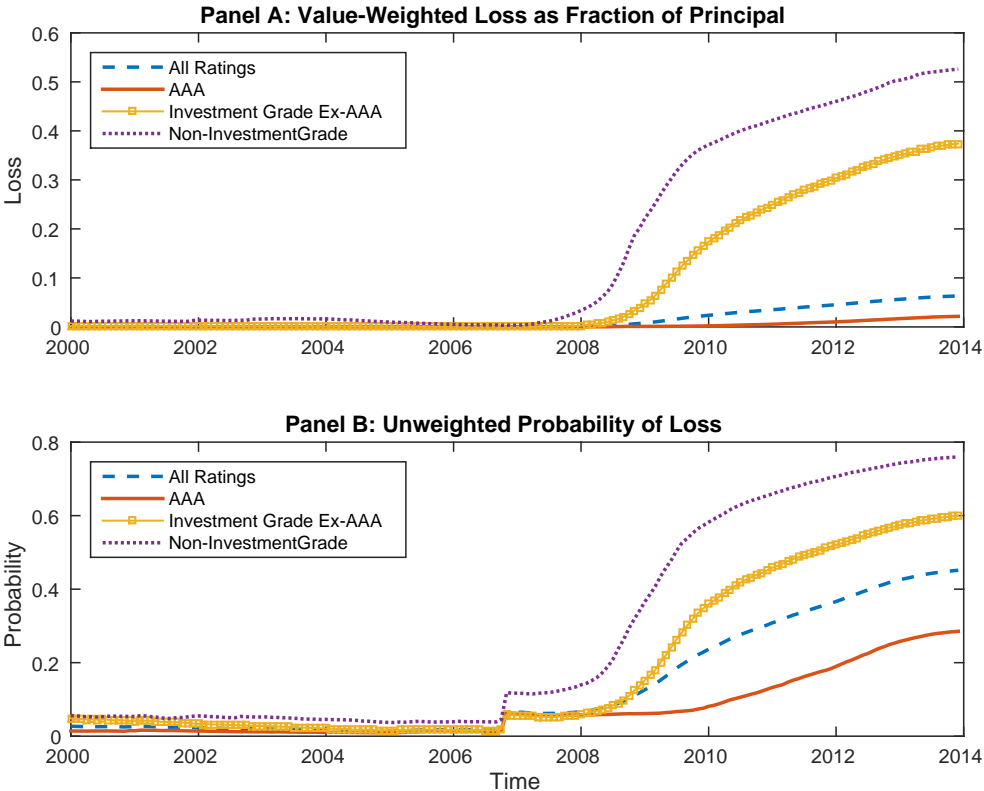
Table TA4: RMBS Losses as of December 2013

This table shows the number of securities with losses and the dollar size of the losses in December 2013, about six years after the beginning of the Subprime crisis in mid-2007. Panel A. breaks down the numbers by credit rating. We exclude all the MBS bonds for which the original principal amount is only a reference or that can distort our computations. The excluded bonds include bonds with zero original balance, excess tranches, interest-only bonds, and Net Interest Margin deals (NIM). Only bonds issued up to 2008 are part of the computations.

<b>Panel A: Losses by Credit Rating as of December 2013</b>						
	<b>Number of Securities</b>			<b>Dollar Amount</b>		
	Total	W/ Losses	Pct. Losses	Total	W/ Losses	Pct. Losses
All RMBS	93,902	43,264	45.1	4,965.6	313.7	6.3
AAA	49,188	14,035	28.5	4,402.4	94.9	2.2
AA	12,087	6,290	52.0	263.7	87.4	33.1
A	11,144	6,655	59.7	144.9	55.7	38.4
BBB	12,015	8,213	68.4	101.6	47.7	46.9
NIG	9,468	7,192	75.9	53.1	27.9	52.6

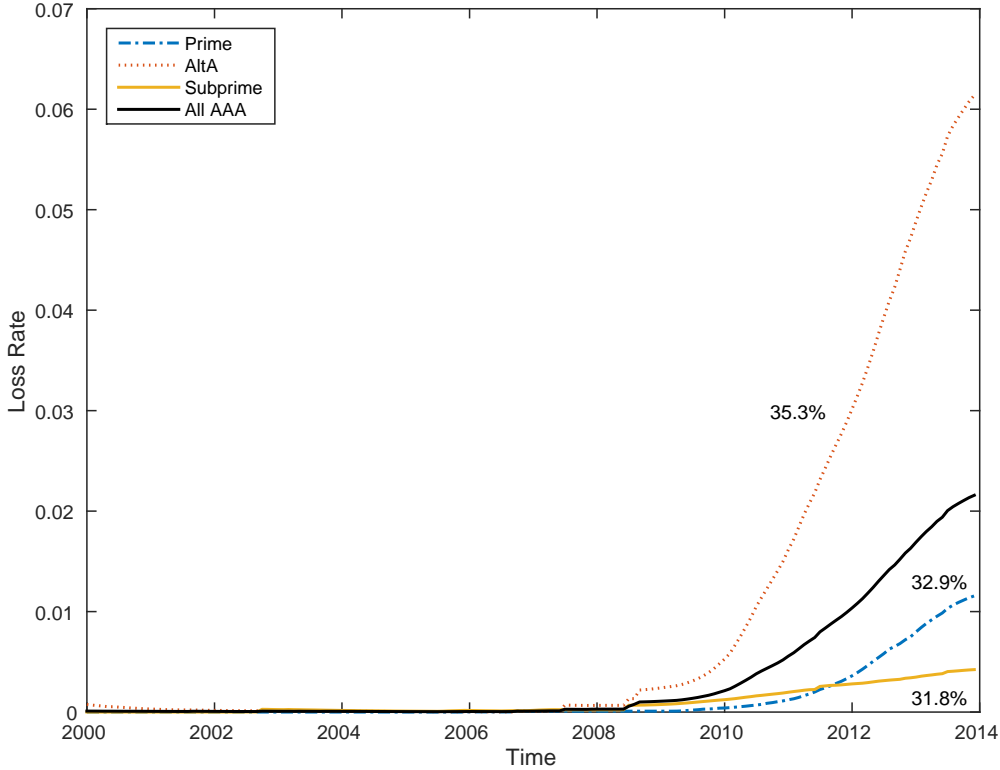
<b>Panel B: Losses by Mortgage Type and Credit Rating as of December 2013</b>						
	<b>Number of Securities</b>			<b>Dollar Amount</b>		
	Total	W/ Losses	Pct. Losses	Total	W/ Losses	Pct. Losses
<b><i>All Securities</i></b>						
Prime	25,476.	11,604	45.6	1,238.7	35.9	2.9
Alt-A	27,135	17,515	64.5	1,327.3	139.9	10.6
Subprime	18,705	9,032	48.2	1,196.0	116.8	9.77
<b><i>AAA Rated Securities</i></b>						
Prime	15,610	5,177	33.2	1,172.7	13.6	1.2
Alt-A	14,851	7,466	50.3	1,210.0	74.3	6.1
Subprime	6,509	528	8.1	979.5	4.1	0.4
<b><i>Investment Grade Ex-AAA Securities</i></b>						
Prime	6,436	3,736	114.2	54.0	18.0	33.4
Alt-A	9,610	7,708	80.2	96.5	55.0	57.0
Subprime	10,893	7,352	67.5	203.9	102.7	50.4
<b><i>Non-Investment Grade Securities</i></b>						
Prime	3,430	2,691	78.5	12.0	4.3	35.9
Alt-A	2,674	2,341	87.5	20.8	10.7	51.4
Subprime	1,303	1,152	88.4	12.7	10.0	78.6

Figure TA2: Losses and Probability of Loss in RMBS Over Time



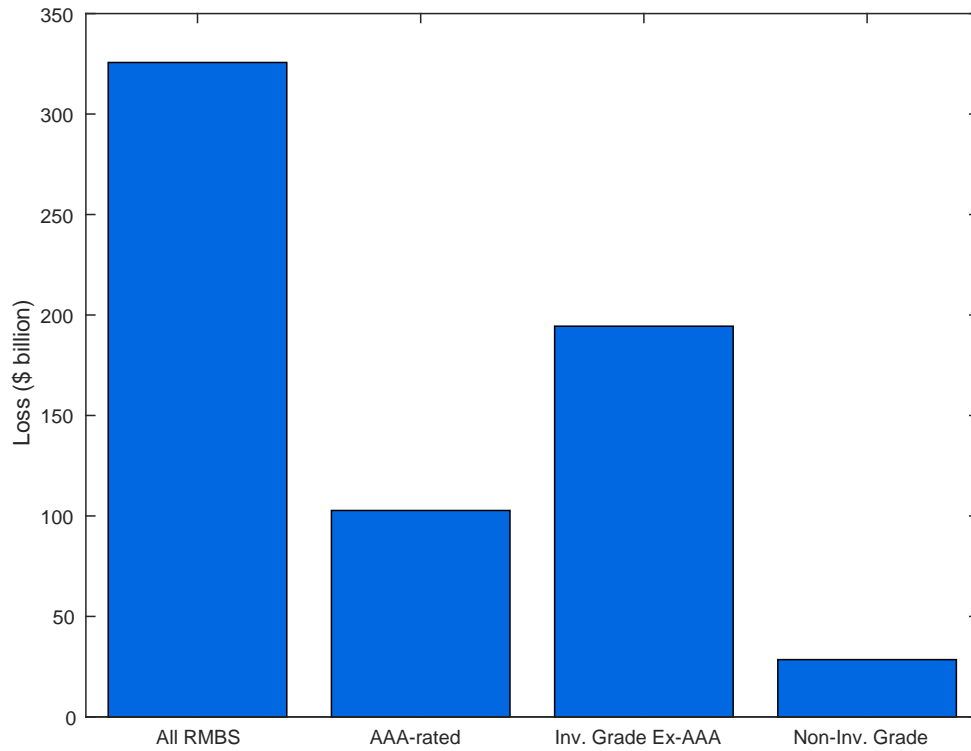
This figure shows the losses as a fraction of principal and the probability of losses incurred by the Residential Mortgage Backed securities in our database during the period 2000-2013. In this figure we group together bonds that had a rating of BB or below into a non-investment grade category, and bonds with ratings of BBB, A and AA into an investment grade category that exclude AAA securities. Panel A plots the cumulative losses as a fraction of principal weighted by the principal amount by credit rating. Panel B plots the fraction of securities that at any point in time have had some principal losses by credit rating. Only bonds issued up to 2008 are part of the computations.

Figure TA3: Losses Over Time by Type of Mortgage for AAA-Rated RMBS



*This figure plots the losses as a fraction of principal weighted by principal amount for the AAA-rated Residential Mortgage Backed Securities in our database during the period 2000-2013. Securities are classified by type of mortgage loan (Prime, Alt-A, and Subprime). The percentages shown next to the lines correspond to the principal dollar value in AAA securities that belong to each category as a fraction of the total principal value of AAA securities that belong to each category as a fraction of the total principal value of AAA securities. Only bonds issued up to 2008 are part of the computations.*

Figure TA4: Dollar Amount of Losses in Non-Agency RMBS



*This figure shows the cumulative Dollar amount of losses in RMBS up to December 2013 in billions of dollar. The category Investment Grade Ex-AAA includes AA, A, and BBB rated securities. The Non-Investment Grade Category includes all bonds rated BB and below*

## C.4 Fact 4: Additional Information

Table TA5: Principal-Weighted Probability of Loss in RMBS and Credit Ratings

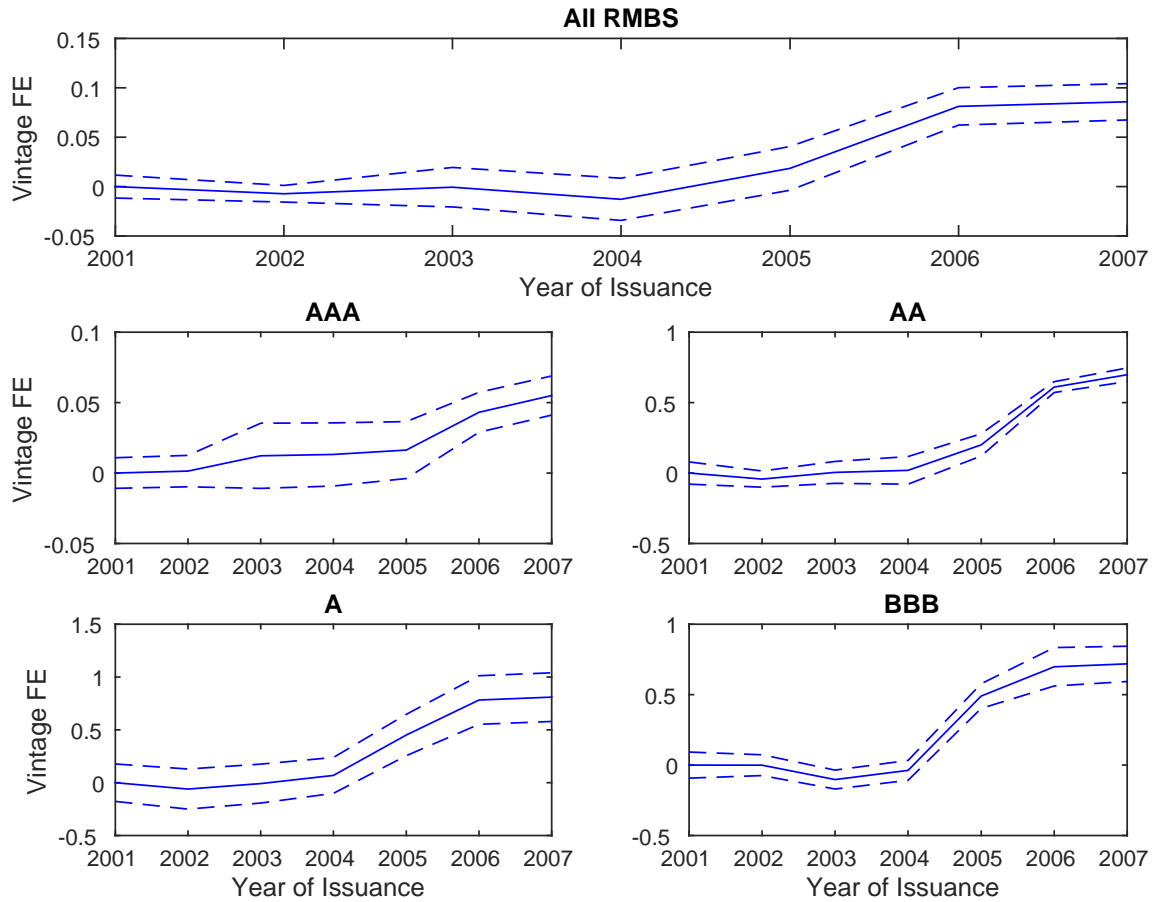
*This table presents linear regressions to study the relation between the probability of incurring losses and credit ratings. The regressions are weighted by the principal dollar amount upon issuance of each RMBS. The LHS in the regression is a dummy variable that takes the value one if the cumulative losses as of December 2013 are strictly greater than zero, and takes the value zero otherwise. The RHS of the regression includes a constant and credit rating dummy variables. In these regressions we only include bonds that have a rating. In this way the constant of the regression corresponds to AAA securities, and we have renamed the constant as AAA. To interpret correctly the other coefficients, one must take into account the constant.*

Credit Rating	Full Sample	Before 2003	2003 - 2005	2006-2008
AAA	0.2747*** (0.0016)	0.0639*** (0.0019)	0.1667*** (0.0021)	0.4636*** (0.0028)
AA	0.1603*** (0.0066)	0.0207* (0.0107)	0.1010*** (0.0088)	0.1667*** (0.0106)
A	0.2073*** (0.0087)	0.0178 (0.0111)	0.1472*** (0.0114)	0.3351*** (0.0155)
BBB	0.3177*** (0.0104)	0.1690*** (0.0170)	0.3168*** (0.0131)	0.3136*** (0.0179)
BB	0.5943*** (0.0169)	0.2203*** (0.0389)	0.6514*** (0.0238)	0.4819*** (0.0253)
B	0.5885*** (0.0308)	0.2264*** (0.0560)	0.7656*** (0.0466)	0.4303*** (0.0452)
CCC	0.5822** (0.2272)	0.9361 (0.7475)	0.4627 (0.3134)	0.5364 (0.3381)
CC	0.6340*** (0.1472)	0.4459 (1.2919)	-0.0239 (0.3900)	0.5364*** (0.1785)
C or Below	0.7176*** (0.0589)	0.0696 (0.3045)	0.8333 (0.5286)	0.5364*** (0.0681)
Observations	93,902	19,230	38,381	36,291
R-squared	0.0370	0.0079	0.0451	0.0376

Standard errors in parentheses

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

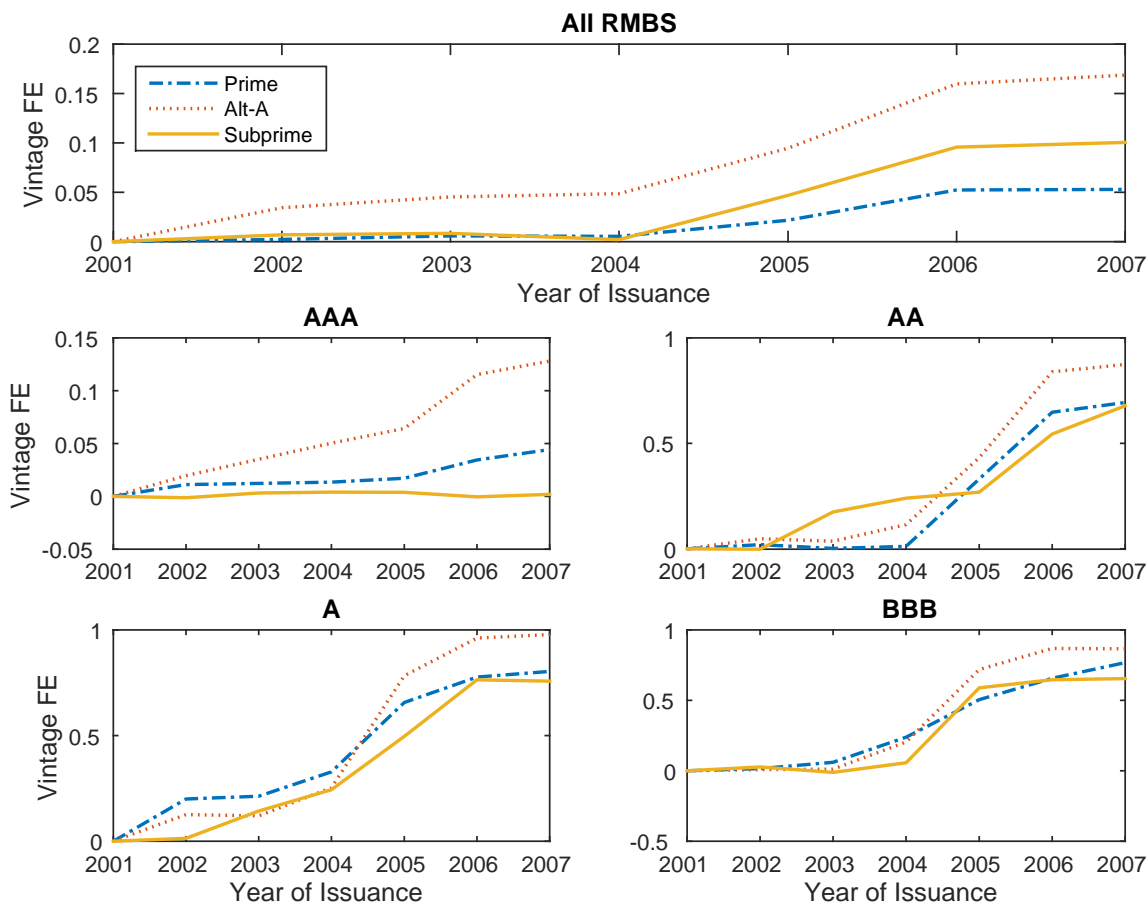
Figure TA5: Vintage Fixed Effects on Weighted Losses



*This figure plots the coefficient estimates corresponding to issue year (vintage) dummy variables in linear regressions that have as left hand side variable the cumulative losses as of December 2013 as a fraction of principal and on the right hand side have all the covariates available in our database as controls. The lines are the mean plus/minus one standard error.*

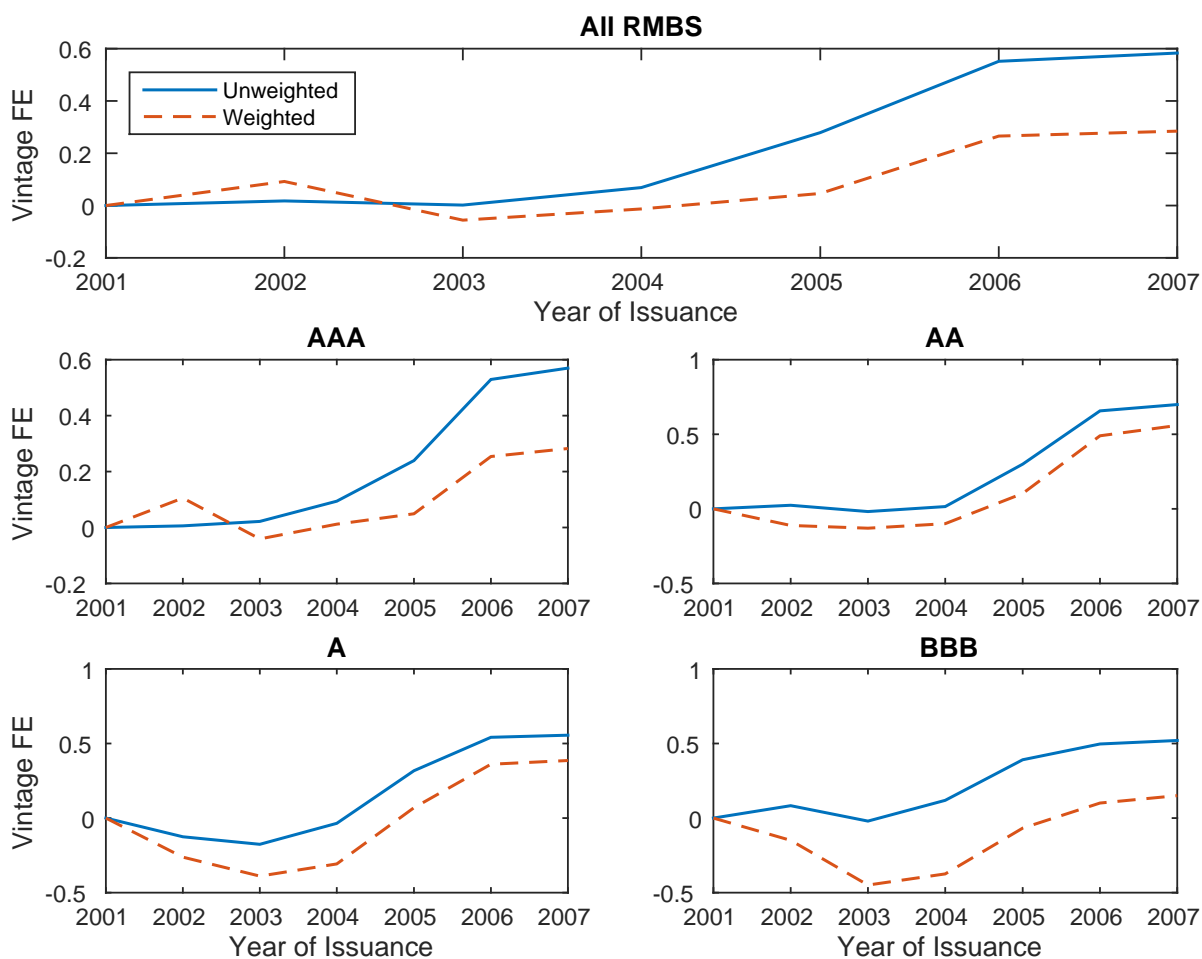


Figure TA6: Vintage Fixed Effects on Weighted Losses by Type of Mortgage Loan



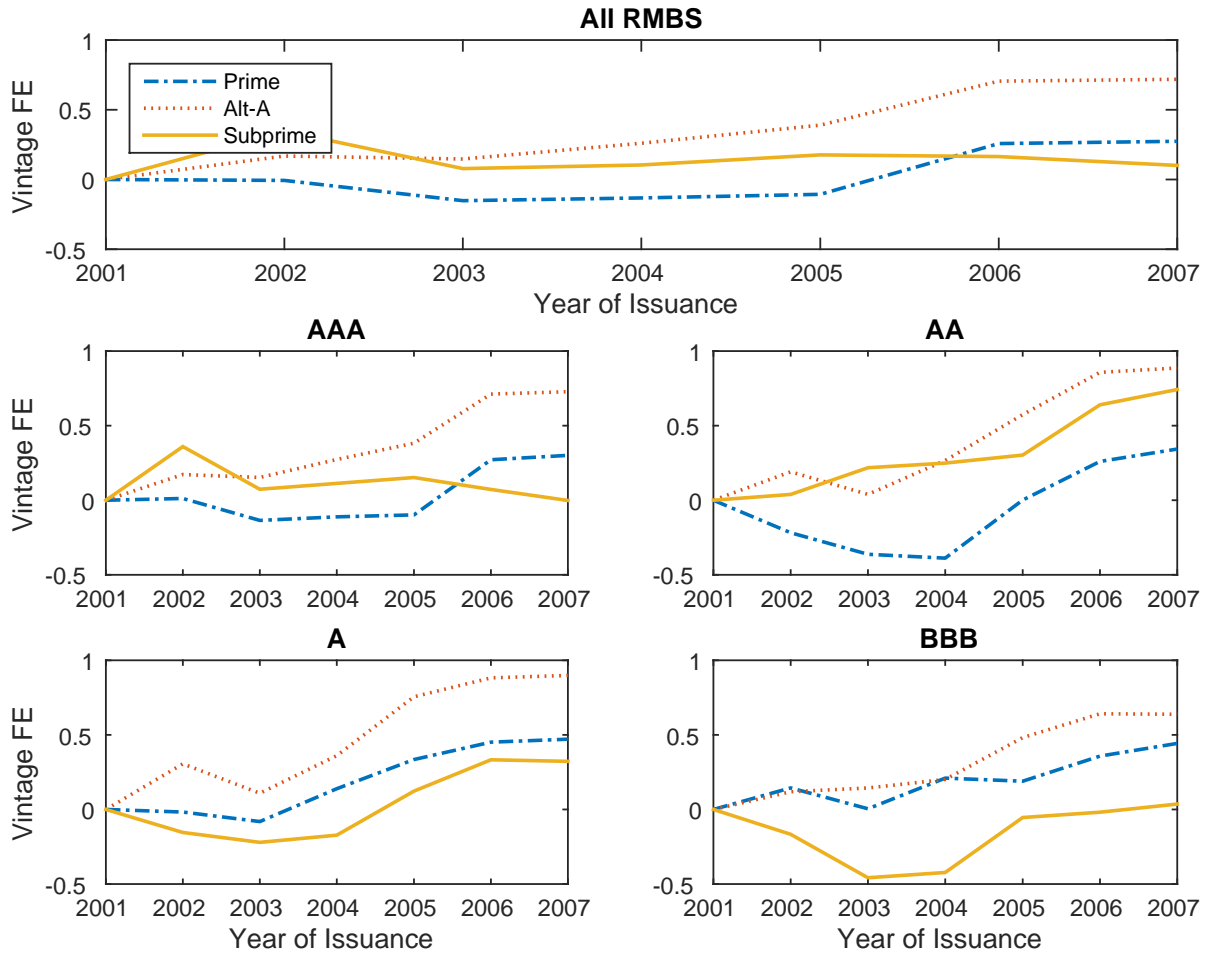
*This figure plots the coefficient estimates corresponding to issue year (vintage) dummy variables in linear regressions that have as left hand side variable the cumulative losses as of December 2013 as a fraction of principal and on the right hand side have all the covariates available in our database as controls. The results are broken down by category of mortgage loan: Prime, Alt-A, and Subprime.*

Figure TA7: Vintage Fixed Effects on Probability of Loss



*This figure plots the coefficient estimates corresponding to issue year (vintage) dummy variables in linear regressions that have as left hand side variable a dummy variable that takes the value one if the cumulative losses as of December 2013 are strictly greater than zero, and takes the value zero otherwise. The right hand side have all the covariates available in our database as controls, including issue year dummies.*

Figure TA8: Vintage Fixed Effects on Weighted Probability of Loss by Type of Mortgage Loan



*This figure plots the coefficient estimates corresponding to issue year (vintage) dummy variables in linear regressions that have as left hand side variable a dummy variable that takes the value one if the cumulative losses as of December 2013 are strictly greater than zero, and takes the value zero otherwise. The right hand side have all the covariates available in our database as controls, including issue year dummies. The results are broken down by category of mortgage loan: Prime, Alt-A, and Subprime.*

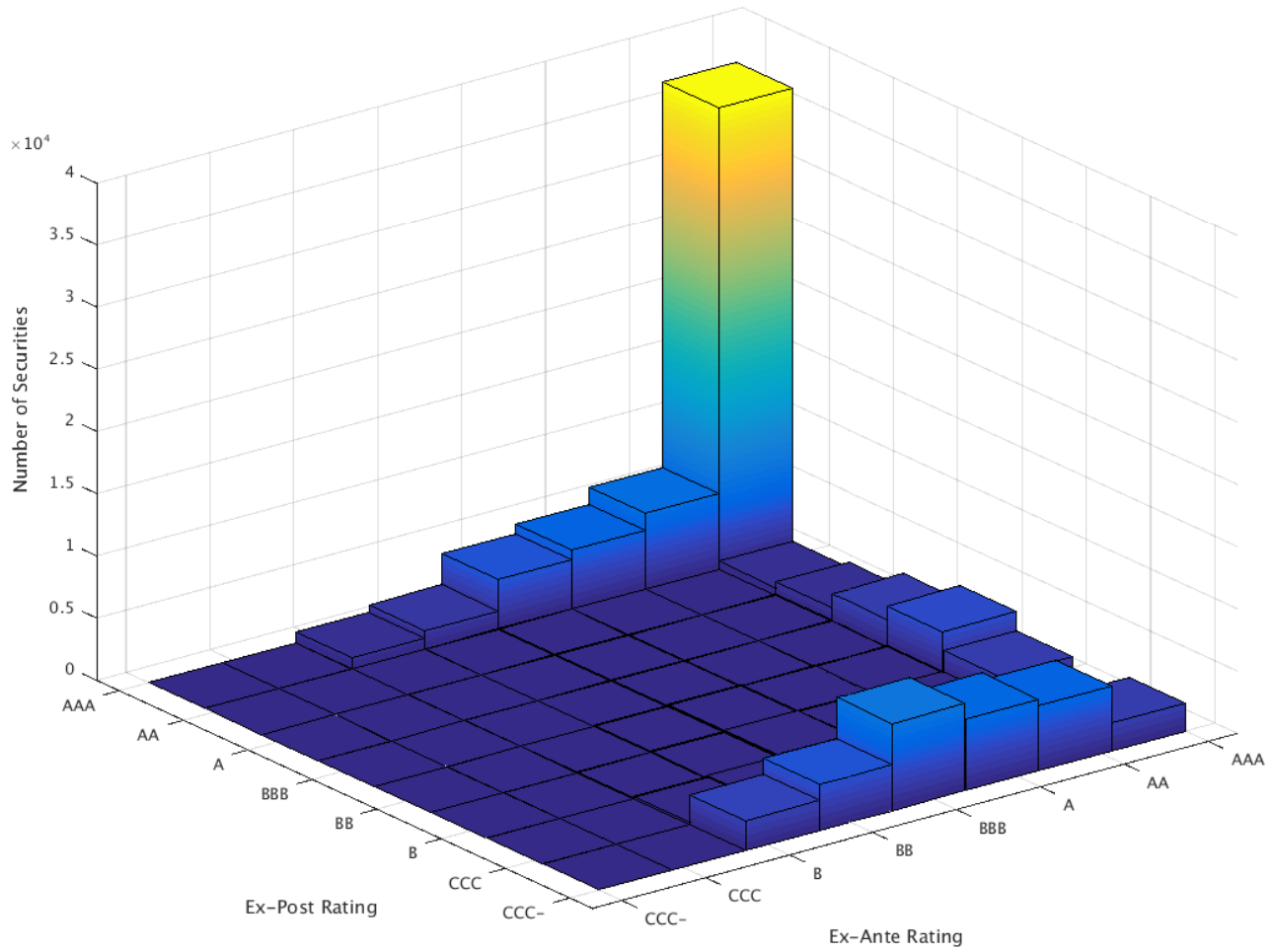
## C.5 Fact 5 and 6: Additional Information

Figure TA9: Moody's Idealized Cumulative Expected Loss Rates

Rating	Year									
	1	2	3	4	5	6	7	8	9	10
Aaa	0.000028%	0.000110%	0.000390%	0.000990%	0.001600%	0.002200%	0.002860%	0.003630%	0.004510%	0.005500%
Aa1	0.000314%	0.001650%	0.005500%	0.011550%	0.017050%	0.023100%	0.029700%	0.036850%	0.045100%	0.055000%
Aa2	0.000748%	0.004400%	0.014300%	0.025850%	0.037400%	0.048950%	0.061050%	0.074250%	0.090200%	0.110000%
Aa3	0.001661%	0.010450%	0.032450%	0.055500%	0.078100%	0.100650%	0.124850%	0.149600%	0.179850%	0.220000%
A1	0.003196%	0.020350%	0.064350%	0.103950%	0.143550%	0.181500%	0.223300%	0.264000%	0.315150%	0.385000%
A2	0.005979%	0.038500%	0.122100%	0.189750%	0.256850%	0.320650%	0.390500%	0.455950%	0.540100%	0.660000%
A3	0.021368%	0.082500%	0.198000%	0.297000%	0.401500%	0.500500%	0.610500%	0.715000%	0.836000%	0.990000%
Baa1	0.049500%	0.154000%	0.308000%	0.456500%	0.605000%	0.753500%	0.918500%	1.083500%	1.248500%	1.430000%
Baa2	0.093500%	0.258500%	0.456500%	0.660000%	0.869000%	1.083500%	1.325500%	1.567500%	1.782000%	1.980000%
Baa3	0.231000%	0.577500%	0.940500%	1.309000%	1.677500%	2.035000%	2.381500%	2.733500%	3.063500%	3.355000%
Ba1	0.478500%	1.111000%	1.721500%	2.310000%	2.904000%	3.437500%	3.883000%	4.339500%	4.779500%	5.170000%
Ba2	0.858000%	1.908500%	2.849000%	3.740000%	4.625500%	5.373500%	5.885000%	6.413000%	6.957500%	7.425000%
Ba3	1.545500%	3.030500%	4.328500%	5.384500%	6.523000%	7.419500%	8.041000%	8.640500%	9.190500%	9.713000%
B1	2.574000%	4.609000%	6.369000%	7.617500%	8.866000%	9.839500%	10.521500%	11.126500%	11.682000%	12.210000%
B2	3.938000%	6.418500%	8.552500%	9.971500%	11.390500%	12.457500%	13.205500%	13.832500%	14.421000%	14.960000%
B3	6.391000%	9.135500%	11.566500%	13.222000%	14.877500%	16.060000%	17.050000%	17.919000%	18.579000%	19.195000%
Caa	14.300000%	17.875000%	21.450000%	24.134000%	26.812500%	28.600000%	30.387500%	32.175000%	33.962500%	35.750000%

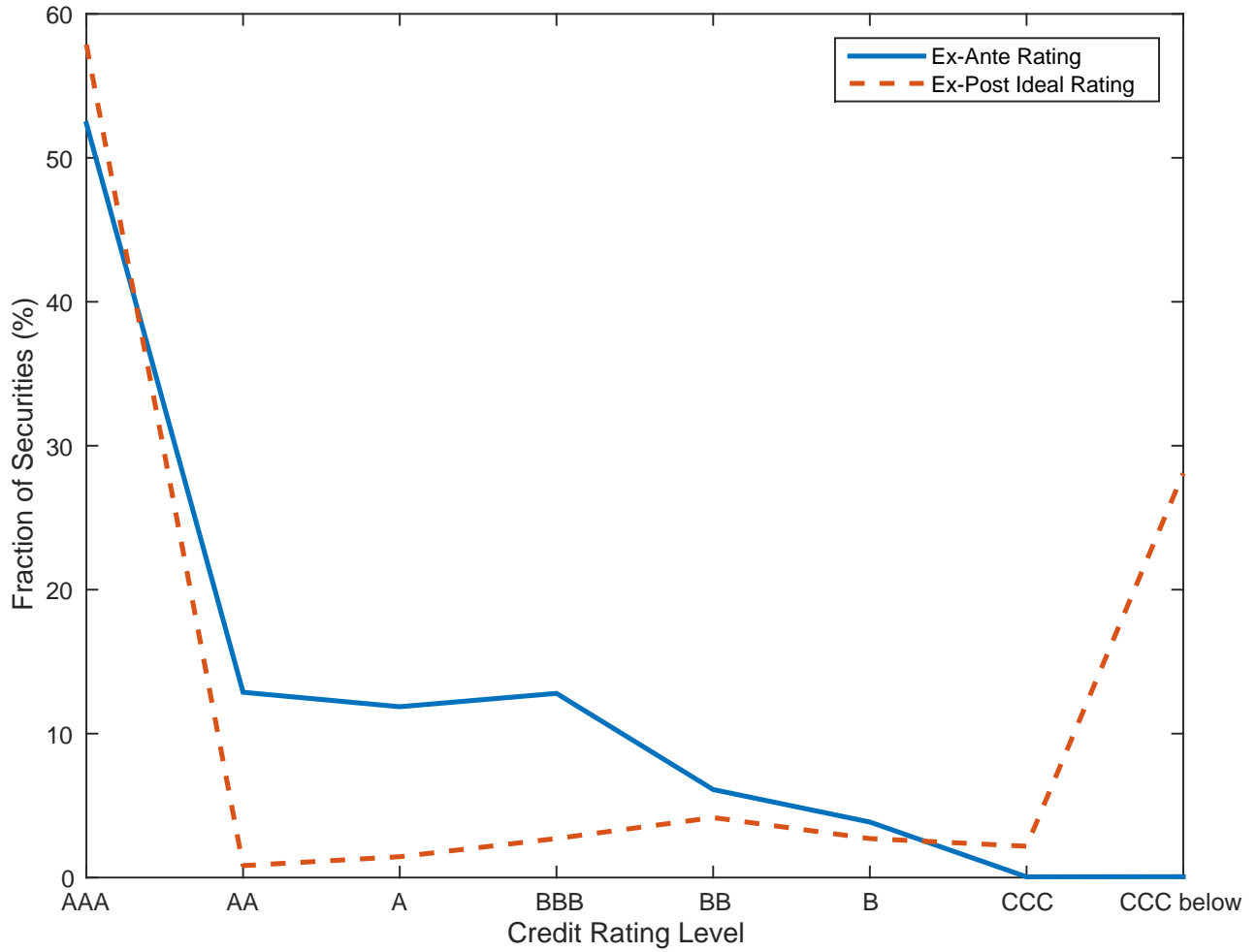
*This figure presents a table that relates credit ratings with the loss rates (loss as fraction of principal) that asset backed securities would be expected to have. The table was used up to the crisis as a reference and it was produced by Moody's. Importantly, Moody's would use this table as part of the risk and valuation analysis, but not as summary statistic that would completely determine its rating. The table is available here [https://www.moody.com/sites/products/productattachments/marvel\\_user\\_guide1.pdf](https://www.moody.com/sites/products/productattachments/marvel_user_guide1.pdf)*

Figure TA10: “Misratings” Ratings Based on Moody’s Ideal Ratings



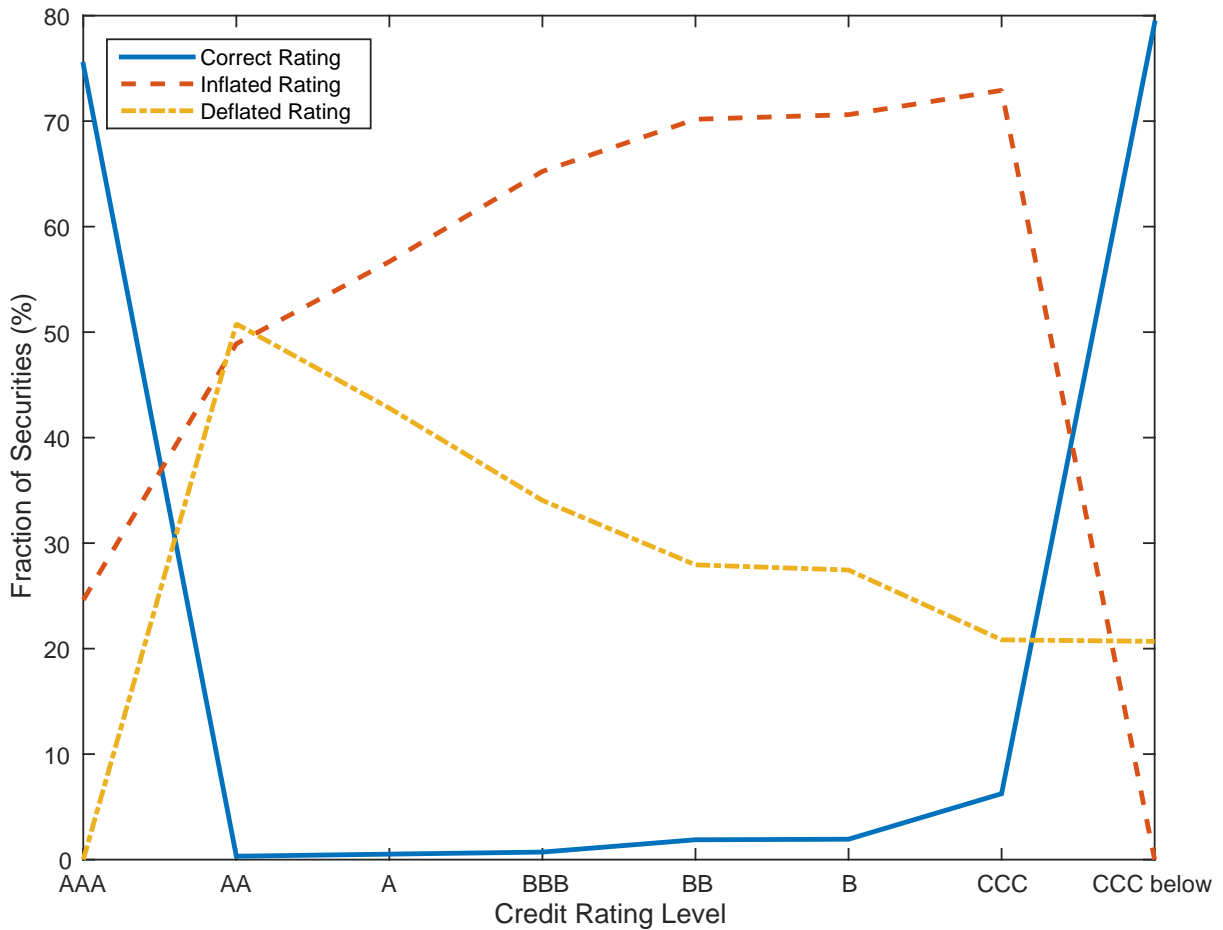
*This figure classifies each security in a bin defined in two dimensions. One dimension is the ex-ante credit rating as determined by the original credit rating. The second dimension is the ex-post rating determined by Moody’s table for idealized expected losses. If all securities had behaved as expected, all the mass would be represented in bars on the diagonal running southwest-northeast in the plot. The height of the bar represents the number of securities.*

Figure TA11: Ex-Ante vs Ex-Post Ideal Ratings - Unweighted Version



*In this figure, for each security, we compare the original credit rating (which we call here Ex-Ante Rating) to the rating that ex-post we would have assigned given the security's realized loss using Moody's idealized Expected Loss Table by Rating, which we present in Figure TA9 in the technical appendix. The solid line shows the fraction of securities that was assigned each rating level. The dotted line shows the fraction of securities that should have gotten each rating level based on their loss as a fraction of original principal. Unlike figure 3 in the paper, the calculations here are not weighted by dollar value of principal.*

Figure TA12: "Right" and "Wrong" Ratings Based on Moody's Ideal Ratings - Unweighted Version



*This figure compares the original rating of each security to the rating we would have assigned ex-post based on Moody's idealized Expected Loss Table by Rating. If the two ratings coincide, we say that the security was correctly rated. If the original rating is higher than what it should have been based on realized losses, we say that the security had an inflated rating. Finally, if the original rating is lower than what it should have been based on realized losses, we say that the security had a deflated rating. Unlike figure 4 in the paper, the calculations here are not weighted by dollar value of principal.*

## C.6 Fact 7: Additional Information

Table TA6: House Prices and Probability of Loss

*This table presents regressions to study the relation between the probability of incurring losses and changes in house prices.*

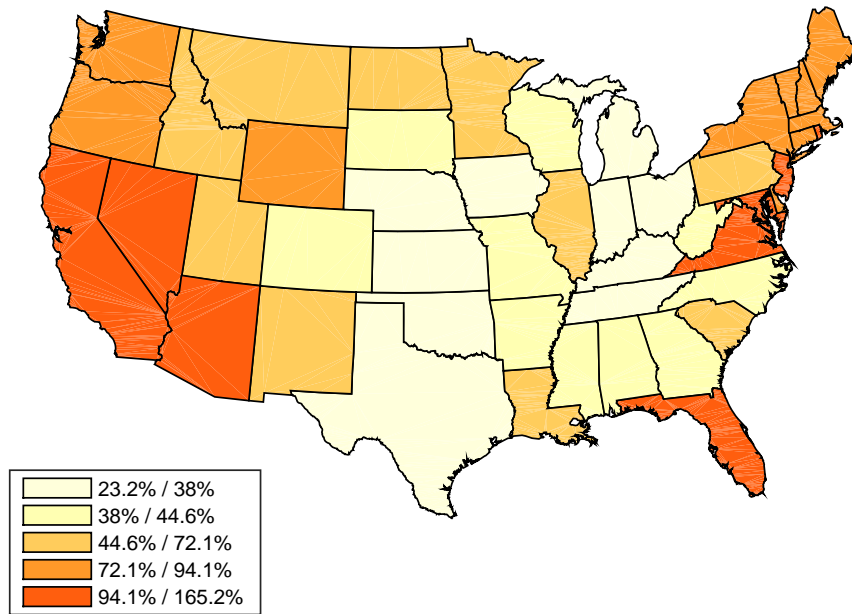
	(1)	(2)	(3)	(4)	(5)
$\Delta HP$ 2000 - 2006	0.338*** 0.007		-0.510*** 0.022	-0.376*** 0.030	-0.551*** 0.069
$\Delta HP$ 2006 - 2009		-0.0834*** 0.014	-1.828*** 0.045	-1.288*** 0.052	-1.320*** 0.155
AA				0.318*** 0.008	0.310*** 0.008
A				0.394*** 0.010	0.382*** 0.010
BBB				0.45*** 0.012	0.439*** 0.012
BB				0.601*** 0.018	0.575*** 0.017
B				0.502*** 0.032	0.486*** 0.032
CCC				0.633*** 0.224	0.596*** 0.217
CC				0.317 0.227	0.252 0.221
C or Below				0.458*** 0.058	0.397*** 0.057
Subprime				-0.255*** 0.004	-0.282*** 0.005
Alt-A				0.095*** 0.004	0.051*** 0.004
Constant	0.062*** 0.005	0.038*** 0.005	0.084*** 0.005	0.217*** 0.013	0.454*** 0.017
State Dummies	No	No	No	No	Yes
Weighted Dummies	No	No	No	No	Yes
Observations	93,902	93,902	93,902	71,316	71,316
R-squared	0.0257	0.0372	0.0428	0.1634	0.2086
Weighted	Yes	Yes	Yes	Yes	Yes "

Standard errors in parentheses: \* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

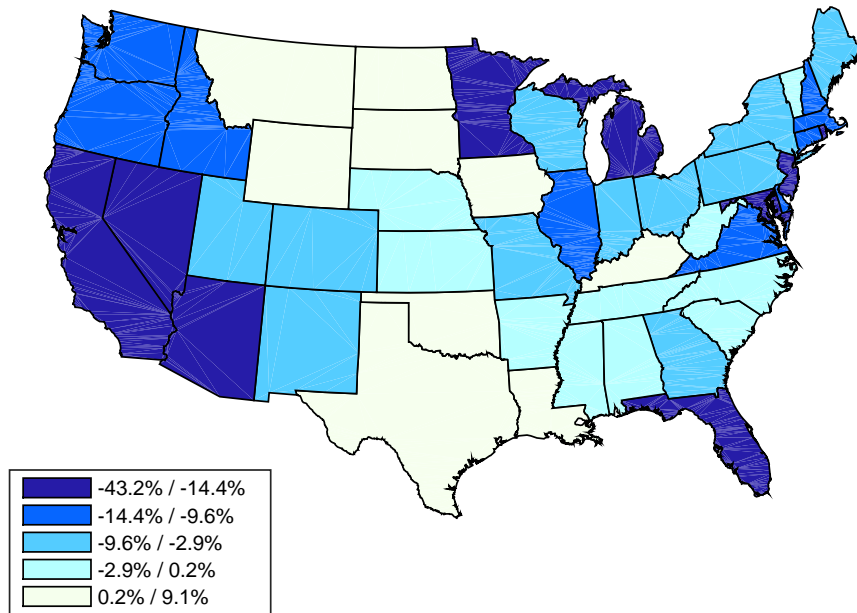


Figure TA13: State-Level House Price Boom and Bust From 2000-Q1 to 2009-Q2

Panel A. Boom: 2000-Q1 to 2006-Q4



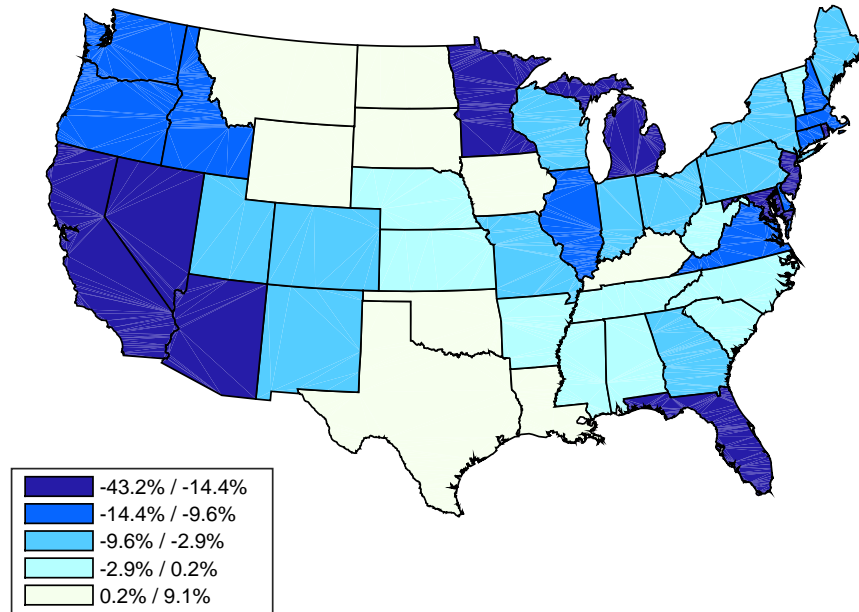
Panel B. Bust: 2006-Q4 to 2009-Q4



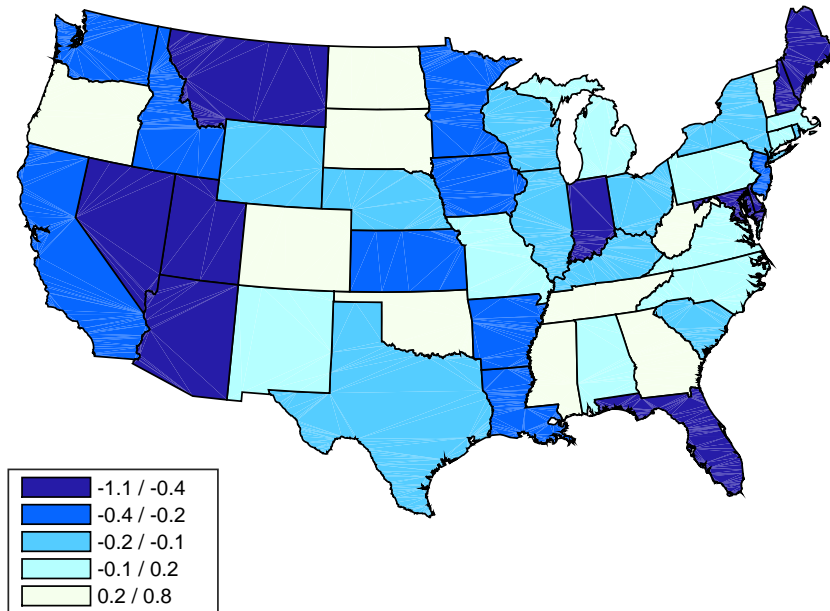
*This map highlights the differences in house price increases between the first quarter of 2000 and the fourth quarter of 2006 and house price decreases between the fourth quarter of 2006 and the fourth quarter of 2009 across states. The house price data comes from the Federal Housing Agency and corresponds to the State-Level All-transaction indexes available here <http://www.fhfa.gov/DataTools/Downloads/Pages/House-Price-Index-Datasets.aspx#qeqe>. States are grouped in quintiles according to the house price change the experienced in each period. Each color on the map represents a quintile, with darkest colors representing bigger absolute changes (red for the period of price increases and blue for the period of price decreases).*

Figure TA14: House Price Bust and State-Level Dummies on Loss Rates

Panel A. Bust: 2006-Q4 to 2009-Q4



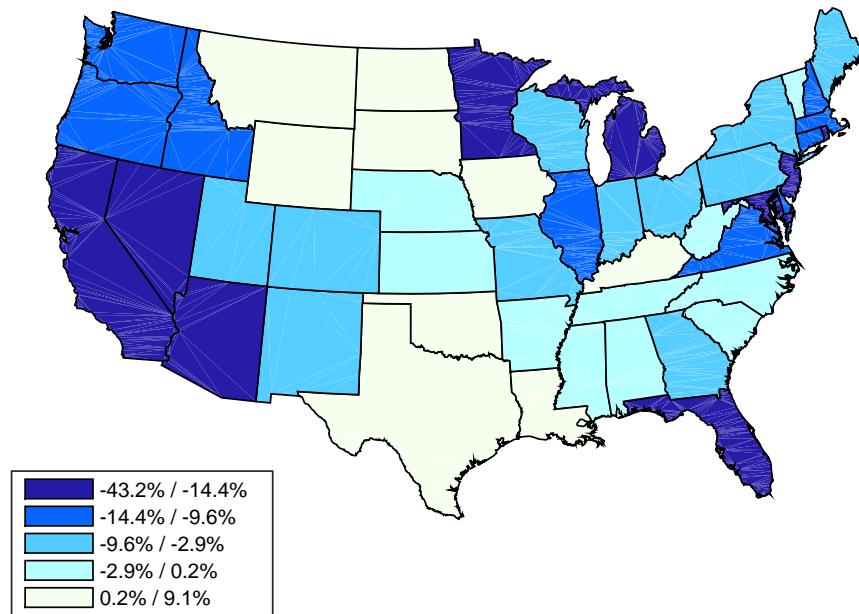
Panel B. Dummy Coefficients Regression without Controls



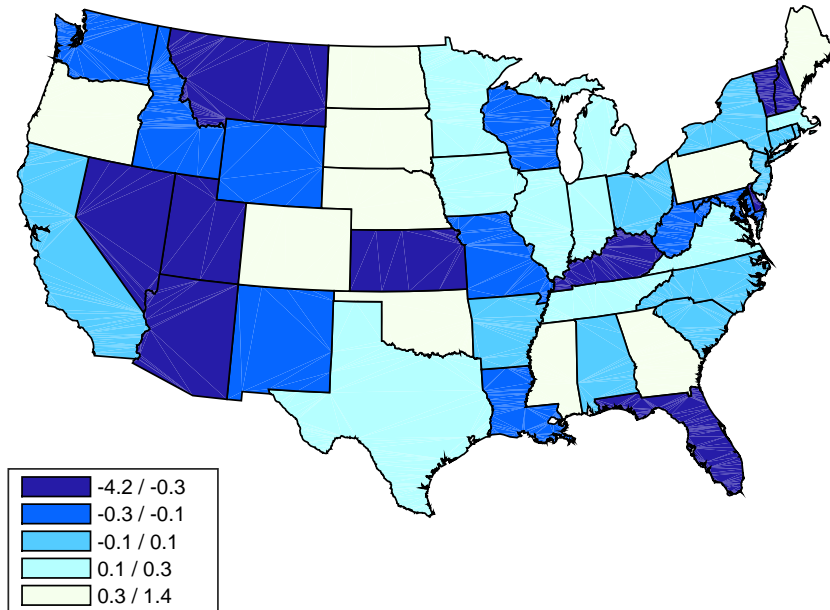
The map at the top colors states according to the quintiles of house price change between the fourth quarter of 2006 and the fourth quarter of 2009. Darker colors represent states with bigger house price declines. The map at the bottom colors states according to the coefficients on state-level dummy variables weighted by the concentration of mortgages of a given state in a given MBS from a regression of loss rates (cumulative loss as of December 2013 divided by original principal amount) on only the state dummy variables. The coefficients of the dummy variables are then colored by quintiles. Darker colors represent larger coefficients. The house price data comes from the Federal Housing Agency and corresponds to the State-Level All-transaction indexes available here <http://www.fhfa.gov/DataTools/Downloads/Pages/House-Price-Index-Datasets.aspx#qexx>.

Figure TA15: House Price Bust and State-Level Dummies on Loss Rates

Panel A. Bust: 2006-Q4 to 2009-Q4



Panel B. Dummy Coefficients Regression with Controls



The map at the top colors states according to the quintiles of house price change between the fourth quarter of 2006 and the fourth quarter of 2009. Darker colors represent states with bigger house price declines. The map at the bottom colors states according to the coefficients on state-level dummy variables weighted by the concentration of mortgages of a given state in a given MBS from a regression of loss rates (cumulative loss as of December 2013 divided by original principal amount) on state dummy variables, dummy variables representing credit ratings and dummy variables for Prime, Alt-A, Subprime to control for FICO score. The coefficients of the dummy variables are then colored by quintiles. Darker colors represent larger coefficients. The house price data comes from the Federal Housing Agency and corresponds to the State-Level All-transaction indexes available here <http://www.fhfa.gov/DataTools/Downloads/Pages/House-Price-Index-Datasets.aspx#qææ>.

Table TA7: Return Premium ( $\theta$ ) From Issuance to 2013 by Credit Rating

This table presents premium calculations for the RMBS in our database by credit rating using the 3-month Tbill rate as benchmark. The premium IRR solves equation 3. Here we report annualized rates. We present the computation under different assumptions about the terminal value of each security as of December 2013. The first 3 columns assume that the security is sold at 80%, 90% and 100% of the outstanding principal amount in December 2013 respectively. The fourth column assumes that the loss in the terminal value is equal to the loss as a fraction of principal suffered by the security up to that point. The fifth and sixth columns assume that the loss in the terminal value is equal to the mean and the median of the losses as a fraction of principal suffered by all securities with the same rating and the same vintage (issue year).

Return Statistic	Terminal Value Assumption					
	80% TV	90% TV	100% TV	Same Loss	Mean Loss	Median Loss
Panel A: Principal Value - Weighted						
<b>AAA-Rated</b>						
Mean	0.0	0.3	0.7	0.6	0.7	0.6
Median	1.3	1.6	2.1	2.1	2.1	1.9
Std. Dev.	20.1	20.2	20.2	20.2	20.2	20.2
<b>AA-Rated</b>						
Mean	-1.6	-1.6	-1.6	-1.7	-1.8	-1.7
Median	-0.4	0.7	1.8	1.7	-1.1	-1.0
Std. Dev.	52.5	52.4	52.6	52.6	51.9	51.8
<b>A-Rated</b>						
Mean	-1.2	-1.2	-1.2	-1.2	-1.3	-1.2
Median	-0.1	0.4	1.0	1.0	-4.4	-3.6
Std. Dev.	52.5	52.4	52.6	52.6	51.9	51.8
<b>BBB-Rated</b>						
Mean	-1.0	-1.0	-1.0	-1.0	-1.1	-1.1
Median	-5.3	-7.5	-7.4	-8.2	-18.1	-11.3
Std. Dev.	67.6	66.9	67.1	67.0	65.5	66.1

Table TA8: Return Premium ( $\theta$ ) From Issuance to 2013 by Vintage

*This table presents premium calculations for the RMBS in our database by vintage (year of issuance) using the 3-month Tbill rate as benchmark. The premium IRR solves equation 3. Here we report annualized rates. We present the computation under different assumptions about the terminal value of each security as of December 2013. The first 3 columns assume that the security is sold at 80%, 90% and 100% of the outstanding principal amount as of December 2013 respectively.*

Return Statistic	Terminal Value Assumption					
	80% TV	90% TV	100% TV	Same Loss	Mean Loss	Median Loss
<b><i>Vintage 2000</i></b>						
Mean	0.0	0.0	0.0	0.0	0.0	0.0
Median	5.1	5.1	5.1	5.1	5.1	5.1
Std. Dev.	22.1	22.1	22.1	22.1	22.1	22.1
<b><i>Vintage 2001</i></b>						
Mean	0.1	0.1	0.1	0.1	0.1	0.1
Median	5.4	5.4	5.4	5.4	5.4	5.4
Std. Dev.	19.8	19.8	19.7	19.7	19.7	19.7
<b><i>Vintage 2002</i></b>						
Mean	0.1	0.1	0.1	0.1	0.1	0.1
Median	3.9	3.9	3.9	3.9	3.9	3.9
Std. Dev.	21.5	21.5	21.5	21.5	21.5	21.5
<b><i>Vintage 2003</i></b>						
Mean	0.2	0.2	0.2	0.2	0.2	0.2
Median	3.4	3.6	3.7	3.7	3.7	3.7
Std. Dev.	10.6	10.7	10.7	10.7	10.7	10.7
<b><i>Vintage 2004</i></b>						
Mean	0.3	0.3	0.3	0.3	0.3	0.3
Median	3.2	3.3	3.5	3.5	3.5	3.5
Std. Dev.	17.1	17.1	17.2	17.2	17.2	17.2
<b><i>Vintage 2005</i></b>						
Mean	0.1	0.2	0.2	0.2	0.2	0.2
Median	3.4	3.8	4.0	4.0	4.0	4.0
Std. Dev.	16.7	16.6	16.5	16.6	16.5	16.5
<b><i>Vintage 2006</i></b>						
Mean	-1.9	-1.8	-1.7	-1.8	-1.9	-1.8
Median	1.6	2.2	2.8	2.7	2.8	2.5
Std. Dev.	33.8	33.9	34.0	34.0	34.6	34.0
<b><i>Vintage 2007</i></b>						
Mean	-1.3	-1.2	-1.1	-1.1	-1.2	-1.2
Median	1.3	1.9	2.5	2.4	2.3	2.0
Std. Dev.	39.9	40.0	40.2	40.2	40.2	40.1

Table TA9: Return Premium ( $\theta$ ) From Issuance to 2013 by Type of Mortgage Loan

*This table presents premium calculations for the RMBS in our database by type of mortgage loan using the 3-month Tbill rate as benchmark. The premium IRR solves equation 3. Here we report annualized rates. We present the computation under different assumptions about the terminal value of each security as of December 2013. The first 3 columns assume that the security is sold at 80%, 90% and 100% of the outstanding principal amount as of December 2013 respectively.*

Return Statistic	Terminal Value Assumption					
	80% TV	90% TV	100% TV	Same Loss	Mean Loss	Median Loss
Panel A: Principal Value - Weighted						
<b><i>Subprime</i></b>						
Mean	-2.2	-2.2	-2.1	-2.1	-2.4	-2.3
Median	0.0	0.6	1.5	1.5	1.4	0.9
Std. Dev.	35.0	35.2	35.3	35.4	35.8	35.3
<b><i>Alt-A</i></b>						
Mean	-1.5	-1.4	-1.3	-1.4	-1.3	-1.3
Median	0.8	1.3	2.0	1.9	1.9	1.7
Std. Dev.	35.4	35.6	35.7	35.7	35.7	35.6
<b><i>Prime</i></b>						
Mean	0.4	0.4	0.5	0.5	0.5	0.5
Median	3.2	3.5	3.8	3.8	3.8	3.7
Std. Dev.	15.2	15.4	15.2	15.3	15.3	15.3

Table TA10: Return Premium ( $\theta$ ) for AAA-rated RMBS by Vintage, Loan Type and Bond Type

*This table presents premium calculations for the AAA RMBS in our database by type of mortgage loan, vintage, and by type of bond (floating rate or fixed rate) using the 3-month Tbill rate as benchmark. The premium IRR solves equation 3. Here we report only median annualized rates, and the calculations are all weighting by the original principal amount. We present the computation under different assumptions about the terminal value of each security as of December 2013. The assumptions are that the security is sold at 80%, 90% and 100% of the outstanding principal amount as of December 2013 respectively.*

Loan Type	Fixed Rate			Floating Rate			3-Month
	80% TV	90% TV	100% TV	80% TV	90% TV	100% TV	Libor
<b><i>Vintage 2000</i></b>							
Subprime	4.5	4.5	4.5	1.6	1.6	1.6	
Alt-A	4.0	4.0	4.0	2.6	2.6	2.6	2.4
Prime	3.7	3.7	3.7	3.2	3.3	3.3	
<b><i>Vintage 2001</i></b>							
Subprime	2.9	2.9	2.9	0.3	0.4	0.4	
Alt-A	4.9	4.9	4.9	3.8	3.8	3.9	2.1
Prime	4.7	4.7	4.7	4.4	4.4	4.4	
<b><i>Vintage 2002</i></b>							
Subprime	2.8	2.8	2.8	-0.1	-0.1	-0.1	
Alt-A	4.6	4.7	4.7	1.1	1.2	1.2	2.0
Prime	4.4	4.4	4.4	3.0	3.0	3.0	
<b><i>Vintage 2003</i></b>							
Subprime	4.9	5.1	5.4	-0.7	-0.6	-0.6	
Alt-A	3.6	3.7	3.7	1.2	1.3	1.5	2.4
Prime	3.5	3.5	3.6	1.6	1.6	1.7	
<b><i>Vintage 2004</i></b>							
Subprime	4.4	4.6	4.7	-0.9	-0.8	-0.8	
Alt-A	4.0	4.1	4.2	0.6	0.9	1.2	2.0
Prime	3.9	4.0	4.1	2.1	2.4	2.7	
<b><i>Vintage 2005</i></b>							
Subprime	5.0	5.3	5.8	0.6	0.8	0.8	
Alt-A	3.9	4.4	4.8	0.9	1.5	2.0	2.1
Prime	4.2	4.5	4.8	2.5	3.0	3.5	
<b><i>Vintage 2006</i></b>							
Subprime	4.3	5.0	5.7	0.7	1.3	2.0	
Alt-A	3.1	3.9	4.6	-0.1	0.9	1.8	2.1
Prime	4.5	4.9	5.4	2.8	3.4	4.1	
<b><i>Vintage 2007</i></b>							
Subprime	4.3	5.0	5.8	-0.6	0.6	1.6	
Alt-A	2.9	3.8	4.6	-1.0	0.2	1.3	1.9
Prime	4.5	5.1	5.6	2.4	3.1	3.8	

## C.7 Prices

While we examined the returns to purchasing RMBS at issuance and holding them to maturity in the previous section, one may also wish to examine the returns when purchasing them at market prices, in particular at the height of the financial crisis of 2008. While individual price series for the RMBS do not seem to exist, time series for indices are available. On January 16th 2006, Markit launched a series of asset-backed credit default swap indexes on US home equity Asset Backed Securities. The indexes are tradable synthetic derivatives, which reference 20 subprime RMBS deals/bonds. There are four series of indexes, each of which corresponds to a different vintage of securities: series 06-01 references deals issued between June 2005 and January 2006, series 06-02 references deals issued between January 2006 and June 2006, series 07-01 references deals issued between June 2006 and January 2007, and series 07-02 references deals issued between January 2007 and June 2007. The 20 deals used in each series are determined at the inception of the index and they never change. These deals are selected among a list of fifty deals of the 25 largest issuers (2 deals per issuer) and they must meet the following main criteria: the deal size must be at least \$500 million, it must have tranches with all of 5 ratings (AAA, AA, A, BBB, and BBB-), it must have been rated by both S&P and Moody's, each tranche must have a weighted average life of at least 4 years with the AAA having a minimum of 5 years, the weighted average FICO credit score of the obligors on the assets backing the securities issued in the RMBS transaction must not exceed 660 as of its issuance date, and each Required Tranche must bear interest at a floating rate, with the base rate being one month LIBOR.

Each series corresponds to a set of 6 indexes by credit rating, from AAA to BBB-. In any transaction involving the index there is a protection buyer and a protection seller. The protection buyer makes two types of payments to the protection seller. One is a one-time payment upfront computed as the difference between par value and the index value multiplied by the notional amount<sup>18</sup> The second type of payment is a coupon or spread, payable monthly. This coupon is fixed for a given index. For example, for the AAA.06-1 index, the coupon is fixed at 18 basis points per annum, while for the BBB.07-01 is 224 basis points. The protection buyer receives payments from the protection seller in the event of interest shortfalls, principal shortfalls, and writedowns. Based on the value (or "price") of the index, one can compute excess returns between  $t$  and  $t + 1$  as

$$r^e = \frac{price_{t+1} - price_t}{price_t} + spread \times \frac{day\_count}{360}$$

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<sup>18</sup>the notional amount is adjusted by the so-called factor, which refers to the outstanding principal amount of the underlying bonds.

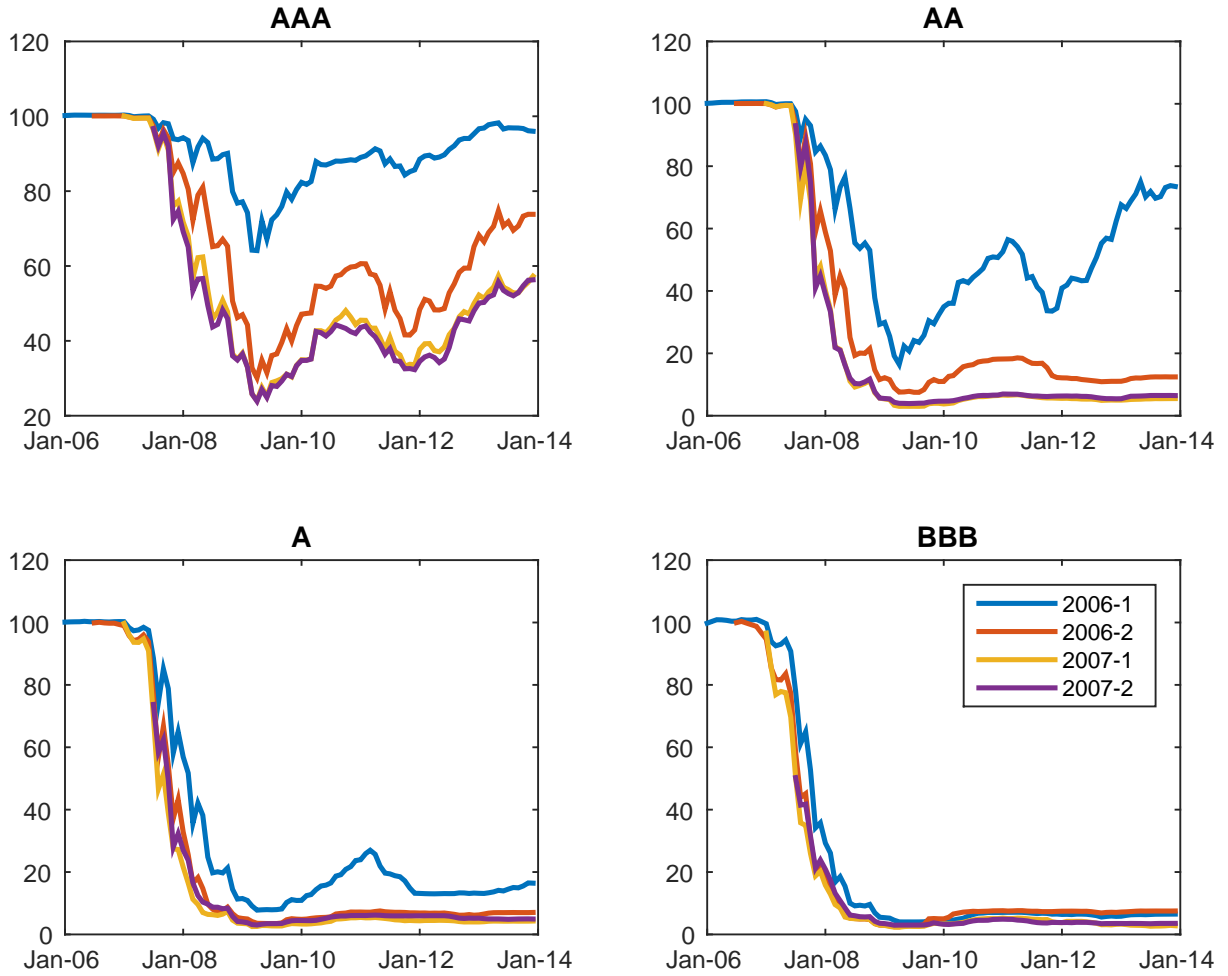


One can think of this as an excess return over some risk-free benchmark (for example Libor) by thinking about the funded transaction: the protection seller faces the risk up to 100% of the notional, if after entering the transaction he sets aside this amount at risk, he will earn some benchmark rate like the libor. The running coupon and the index appreciation will make up the rest of the return.

Figure TA16 plots the prices of indexes of the different series (vintages) by credit rating. Only the AAA tranches and the AA tranche of the 2006-01 vintage recover strongly after the crisis. The corresponding annualized returns computed with the formula above are shown in Table TA11. What these numbers as well as figure TA16 reveal is that substantial returns were earned by investors purchasing these securities in May 2009 and holding them to December 2013. On the other hand, excess returns were near zero or negative, when the purchase was made in June 2007. The excess returns on AAA rated securities was substantially negative for anyone purchasing them in, say, June 2007 and selling them in May 2009, implying losses of up to 6 percent per month, while for any long term investor, who held out until December 13, we obtain the still modest losses of 0.41 percent on a monthly basis as the worst of the AAA securities, i.e. the vintage 2007-2. Securities further down in the rating scale performed considerably worse. These results are generally in line with our findings of the payoff streams in the other sections.

[Insert Figure TA16 and Table TA11]

Figure TA16: Subprime RMBS Price Indexes



*This figure plots the prices of ABX.HE indexes by Markit. Each line represents a vintage of subprime RMBS and the Index. Each panel shows the evolution of prices over time by credit rating. These indexes are constructed based on 20 deals.*

Table TA11: Subprime RMBS Returns for Deals Underlying ABX.HE Indexes

*This table reports monthly returns computed from the evolution of prices of the ABX.HE indexes. The calculations shows three time periods. The first period is the entire period of analysis, 2006-2013. The second period runs from January 2006 through May 2009, when the prices of AAA bonds bottomed out. The third period goes from May 2009 through December 2013.*

	AAA	AAAp	AA	A	BBB	BBB-
<b><i>Vintage 2006-1</i></b>						
From Jan 06 to Dec 13	0.00	-0.37	0.09	-1.35	-2.36	-2.62
From Jan 06 to May 09	-1.08	-1.37	-4.11	-5.52	-7.07	-7.28
From May 09 To Dec 13	0.76	-0.17	3.01	1.54	0.92	0.63
<b><i>Vintage 2006-2</i></b>						
From June 06 to Dec 13	-0.09	-0.11	-1.77	-2.31	-2.17	-2.40
From June 06 to May 09	-3.30	-4.56	-6.55	-8.46	-9.70	-9.84
From May 09 To Dec 13	1.79	0.77	1.05	1.32	2.27	1.98
<b><i>Vintage 2007-1</i></b>						
From Jan 07 to Dec 13	-0.38	0.05	-2.73	-3.05	-3.62	-4.49
From Jan 07 to May 09	-4.76	-8.01	-10.86	-11.50	-12.13	-12.15
From May 09 To Dec 13	1.73	1.64	1.19	1.02	0.49	-0.80
<b><i>Vintage 2007-2</i></b>						
From June 07 to Dec 13	-0.41	0.24	-2.76	-2.86	-2.94	-2.83
From June 07 to May 09	-6.00	-7.94	-12.56	-12.98	-11.83	-11.31
From May 09 To Dec 13	1.68	1.85	0.91	0.94	0.39	0.35