

## **Internet Appendix to “Credit Ratings across Asset Classes: A Long-Term Perspective”<sup>1</sup>**

October 13, 2016

This Internet Appendix contains a detailed computational explanation of transition metrics and additional analyses omitted from the body of the paper for brevity. For example, we further analyze the broad class of structured products by subcategories based on underlying assets. Figure A.1 displays the number of tranches issued and tranche size by initial credit rating through time, for each subcategory. We plot default frequencies over calendar time in Figure A.2. Figure A.3 plots empirical hazard functions by asset class. Figure A.4 presents discretized transition statistics by asset class and year of issuance. Table A.1 displays complete descriptive statistics for broad asset classes as well as the subcategories of structured products. Table A.2 displays correlation coefficients. Finally, Table A.3 displays transition matrices for the subcategories of structured products.

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<sup>1</sup> Cornaggia, Jess, Kimberly J. Cornaggia, and John E. Hund, 2016, Internet Appendix to “Credit Ratings across Asset Classes: A Long-Term Perspective” available on SSRN: [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1909091](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1909091)

### **1. Detailed Numerical Example of the Transition Statistics Employed in Section 3.3.**

We begin by creating five-year transition matrices for each asset class and each year of issuance. For example, we construct matrices that reveal how the credit ratings of each cohort of corporate bonds issued each year from 1980 to 2005 transition over the course of five years after issuance. Next, we convert these matrices into probability matrices according to the proportions of credit ratings that migrate off the diagonal for each initial credit rating. As a hypothetical example, assume there were 100 corporate bonds issued with Aa ratings in 1999. After five years, assume 10 migrated up to Aaa, 60 maintained their Aa ratings, 10 migrated down to A, 10 migrated down to Baa, and 10 defaulted. The second row (corresponding to an initial credit rating of Aa) of the probability transition matrix would contain: 0.10, 0.60, 0.10, 0.10, 0.00 (corresponding to a final rating of Aaa), 0.00 (A), 0.00 (Baa), 0.00 (B), 0.00 (Caa), 0.00 (Ca), 0.00 (C), and 0.10. We construct similar probabilities for all rows (initial credit ratings).

The next step implements a weighting procedure similar to that in Trück and Rachev (2005). We multiply each probability by the difference between its corresponding row and column in the matrix. Continuing the hypothetical example, the 10 bonds that migrated up to Aaa reside in the second row and first column. Therefore, we multiply 0.10 corresponding to these bonds by 1. The 60 bonds that maintained their Aa ratings reside in the second row and second column. Therefore, we multiply 0.60 corresponding to these bonds by zero. We multiply 0.10 corresponding to the 10 bonds that were issued with Aa ratings, the second row, and migrated to A, the third column, by -1. We multiply 0.10 corresponding to the 10 bonds that migrated to Baa, the fourth column, by -2. Finally, we multiply 0.10 corresponding to the 10 bonds that defaulted, that is, migrated into the tenth column, by -8.

This procedure accomplishes two objectives. First, it attaches a positive sign to upward transitions and a negative sign to downward transitions. The 10 bonds that migrated up to Aaa receive a weight of 1, and the ten bonds that migrated down to A receive a weight of -1. Second, distant migrations receive more weight than proximal migrations. In our example, 10 bonds migrated downward one notch to A, and 10 bonds migrated downward eight notches into the

default column. The 10 bonds that default receive a weight (-8) much larger in magnitude than the bonds that only migrated down one notch (-1).

Next, we sum the weighted probabilities for each row of the matrix. Continuing the hypothetical example, the sum for the Aa row would be:  $0.10 \times 1 + 0.60 \times 0 + 0.10 \times -1 + 0.10 \times -2 + 0.10 \times -8 = -1.00$ . Finally, we multiply these sums by weights according to the number of bonds in the row and sum them for the final statistic. Continuing the example, if there were 100 bonds issued with Aa ratings, 300 bonds issued with Baa ratings, and no other bonds, the example sum of -1.00 would receive a weight of 0.25 and the sum of the Baa-row would receive a weight of 0.75. Hypothetically, if the Baa row had a sum of -0.40, the final statistic for this example would be:  $-1.00 \times 0.25 + -0.40 \times 0.75 = -0.55$ . This statistic succinctly conveys that Moody's generally downgraded the 400 corporate bonds issued in 1999. If the statistic had been positive, this would indicate Moody's generally upgraded the bonds. The domain of this statistic is [-9, 8]. A statistic of -9 requires all bonds to be issued with Aaa ratings, and all of them must default within five years (i.e., they must migrate down nine notches). A statistic of 8 requires all bonds to be issued with C ratings, and Moody's must upgrade all of them to Aaa within five years (i.e., they must migrate up eight notches).

We calculate these statistics for each asset class and each year of issuance. We then calculate bootstrapped standard errors for each transition statistic. We perform 1,000 bootstrap replications for each transition statistic, each with a sample size equal to the number of bonds issued in a given year for a given asset class. Returning to the hypothetical example, we would calculate 1,000 transition statistics for corporate bonds issued in 1999. Each statistic would be based on 400 random draws (with replacement) from the original sample of corporate bonds issued in 1999.

## **2. Additional Sample Description and Empirical Analyses**

### *2.1 Sample description*

We provide complete descriptive statistics, by asset class and by structured product type, in Table A.1. The correlation matrix in Table A.2 indicates significant correlations among the

bond characteristics and asset classes. Table A.1 indicates that sovereign issues have the highest face values; indeed there is little intersection between sovereign and non-sovereign bonds along this dimension. Likewise, there is little intersection between structured and non-structured issues in terms of years to maturity. As expected, Table A.2 indicates structured products are significantly positively correlated with initial ratings, downgrades, and defaults. Although they are also significantly positively correlated with initial ratings, municipals are negatively correlated with downgrades and defaults. This effect leads to the somewhat counterintuitive negative correlation between initial rating and downgrades. Ratings migration matrices reported in the paper help explain this finding. We observe upward ratings momentum among municipals, sovereigns, and PF tranches that are issued with higher ratings than the average corporate bond.

Figure 2 of the manuscript provides greater detail of initial ratings for each asset class and how these evolved over time. We break down the broad structured finance category here in Panels E.1 through E.10 of Figure A.1. In each panel, the proportions are cumulative with the issues rated Aaa appearing at the top, Aa second from top, and so on. These individual figures display similar qualitative patterns to the pooled figure representing the broad structured finance class observed in the paper.

## *2.2 Defaults by asset class through time*

We provide more detail regarding default frequency over time in Figure A.2. Prior to the year 2000, the graph depicts low default frequency in general, with corporations defaulting at a higher rate than financial institutions and a trivial incidence among municipalities. Corporate defaults correspond generally with NBER business cycles.<sup>2</sup> In the year 2001, we observe a spike in the sovereign default frequency (approaching 3%) followed by an uptick (1%) among municipals in 2002. The recent financial crisis is most apparent in the default frequency of tranches of structured products, although corporate issues and financial institutions also reach in-sample peaks during the crisis.

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<sup>2</sup> NBER reports an eight month contraction July 1990 – March 1991, an eight month contraction March – November 2001, and an 18 month contraction December 2007 – June 2009. Complete cycle data are available at the NBER's website: [www.nber.org/cycles.html](http://www.nber.org/cycles.html)

Next, we examine the probability of default as bonds mature. Figure A.3 displays the monthly probability of default for each asset class from the month of issuance to 20 years after issuance. For each observation, the numerator is the number of bonds that default within a given month and the denominator is the number of bonds that are outstanding in the month. Bonds exit the sample after defaulting. We construct plots for corporates, sovereigns, financial institutions, and structured products. We do not plot municipal issues because almost none of these bonds default. Overall, the plots in this figure reveal that the asset classes face different default risks over their life cycles. Corporate bonds that remain outstanding for more than 10 years, for example, display increasing probabilities of default as they mature. Structured products, on the other hand, display decreasing probabilities of default after surviving three years. The apparent spike in the plot of sovereign issuers reflects defaults by Uruguay and Belize in 2003 and 2007, respectively.

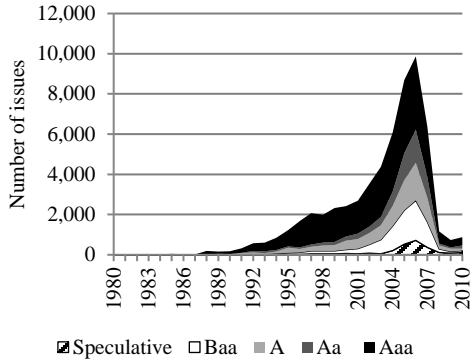
### *2.3 Transition matrices and metrics*

The transition matrices reported in the paper suggest that the structured finance products enjoyed the most inflated initial ratings of the broad asset classes. We break these down into subcategories in Panels E.1 through E.5 of Table A.3.

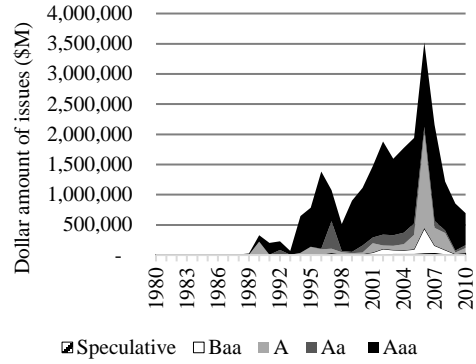
Finally, Figure A.4 presents an alternative version of the transition statistics reported in Figure 4 of the paper. These figures display transition metrics that summarize the information in five-year transition matrices. The difference here is that we use a discretized approach to creating the transition metrics instead of a continuous approach. Specifically, instead of incorporating the number of notches a bond's rating upgrades or downgrades. Instead, we ascribe a value of 1 to bonds that upgrade any amount, a value of -1 to bonds that downgrade any amount, and a value of 0 to bonds whose ratings do not change. We then re-compute the transition metrics for each vintage of each asset class following the same approach as before. Resulting metrics and plots are qualitatively similar to those in the paper.

## **Reference**

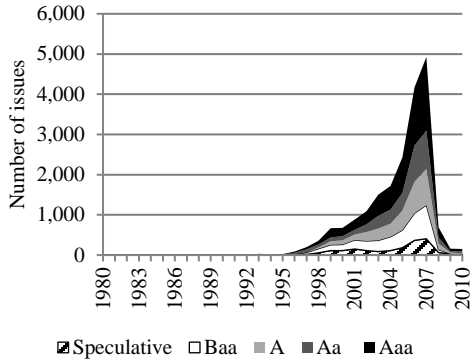
Trück, Stefan, and Svetlozar T. Rachev, 2005, Changes in migration matrices and credit VaR – a new class of difference indices, Working paper.



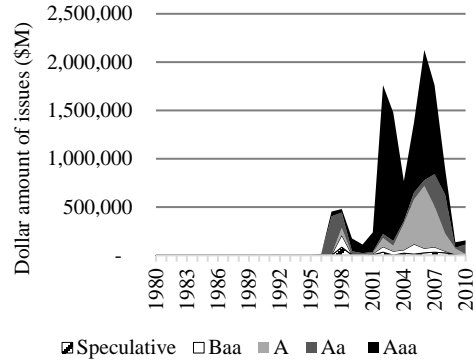
**Panel E.1. N Structured issues – ABS**



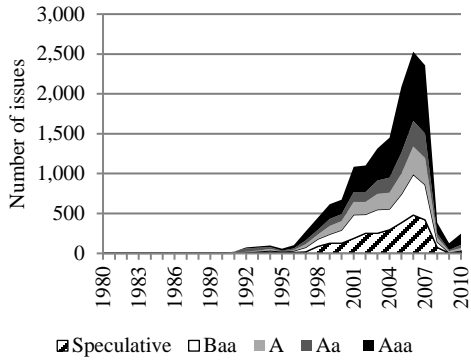
**Panel E.2. \$M Structured issues – ABS**



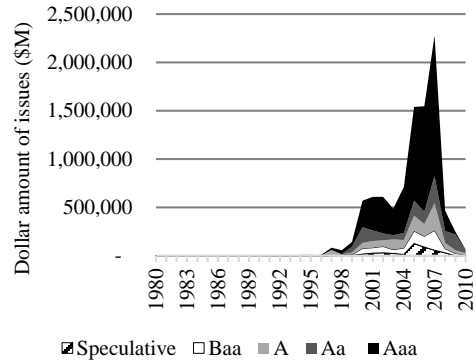
**Panel E.3. N Structured issues – CDO**



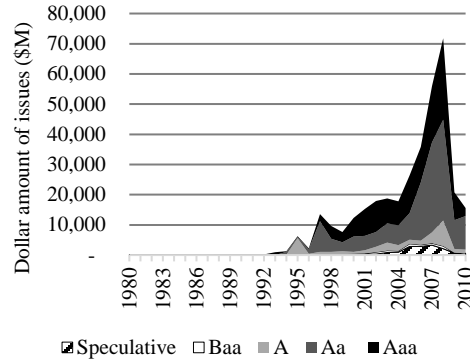
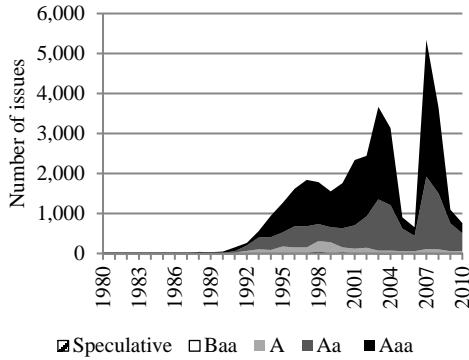
**Panel E.4. \$M Structured issues – CDO**



**Panel E.5. N Structured issues – CMBS**

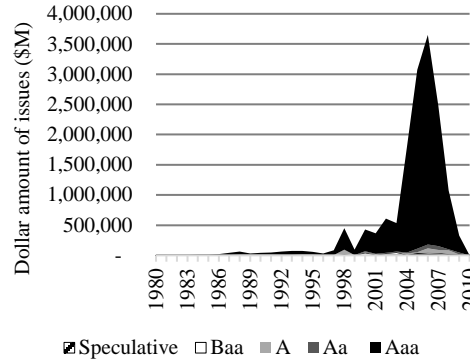
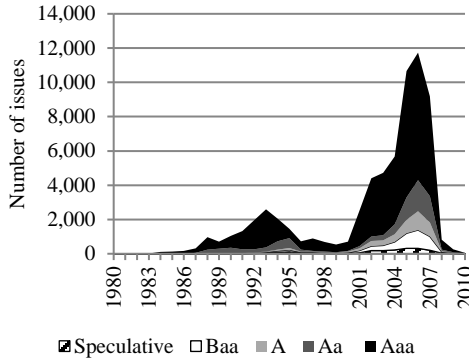


**Panel E.6. \$M Structured issues – CMBS**



**Panel E.7. N Structured issues – PF**

**Panel E.8. \$M Structured issues – PF**



**Panel E.9. N Structured issues – RMBS**

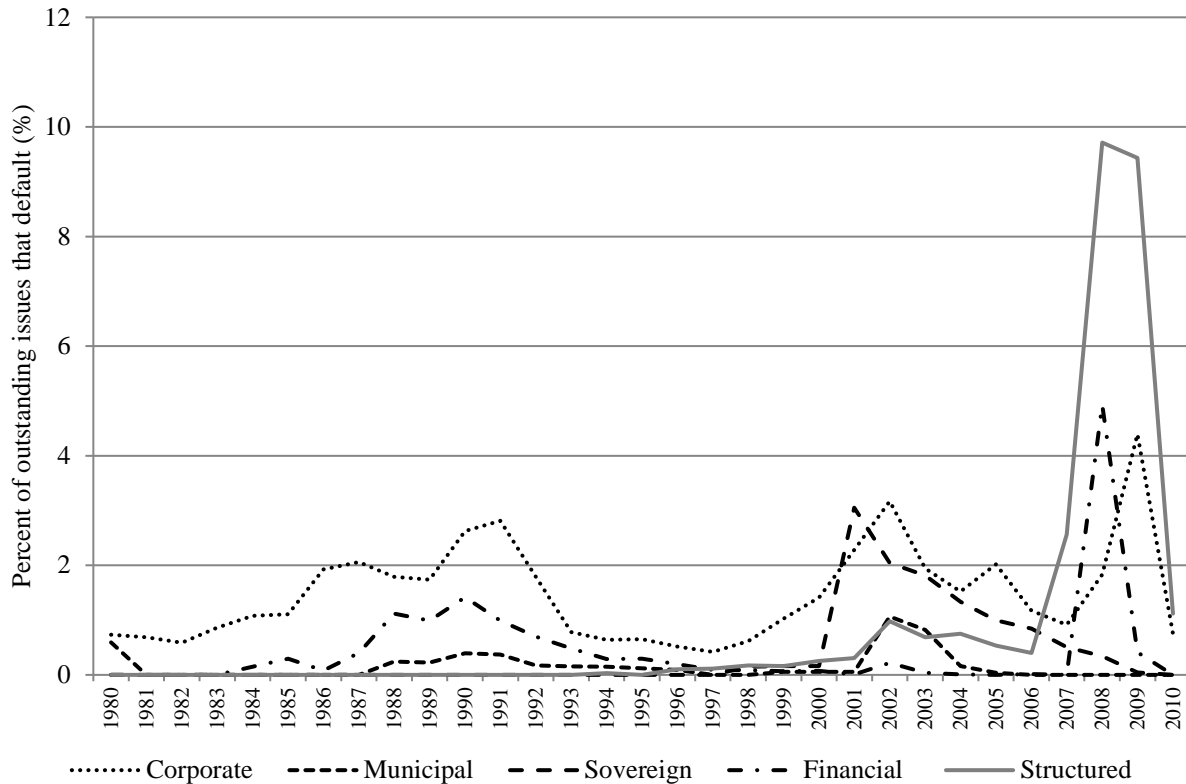
**Panel E.10. \$M Structured issues – RMBS**

**Figure A.1**

**New tranches of structured finance products by initial credit rating through time**

This figure displays the number and dollar amount of newly issued structured products rated by Moody’s every year from 1980 to 2010 by initial credit rating. Panels E.1, E.3, and so forth display the number of new tranches. Panels E.2, E.4, and so forth display the dollar amount of new issues. The types of structured finance products include Asset Backed Securities, Collateralized Debt Obligations, Commercial Mortgage Backed Securities, Public Finance, and Residential Mortgage Backed Securities. The data come from Moody’s Structured Finance Default Risk Service Database. The rating scale in this figure is a simplified version of Moody’s traditional 21-point alphanumeric scale. For example, we combine initial issues with credit ratings of Aa1, Aa2, and Aa3 into one bin, Aa.

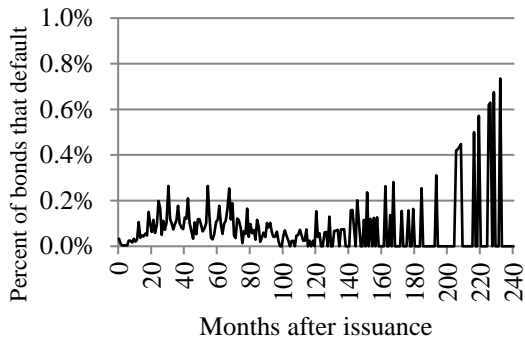




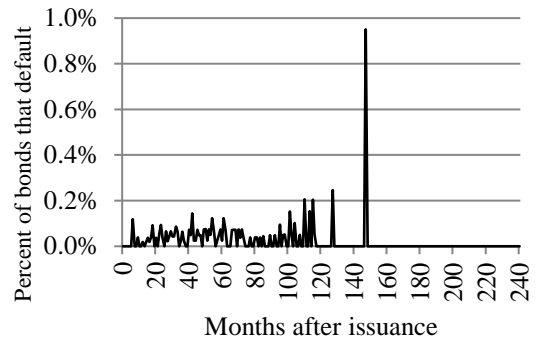
**Figure A.2**

**Percentage of outstanding issues that default by asset class through time**

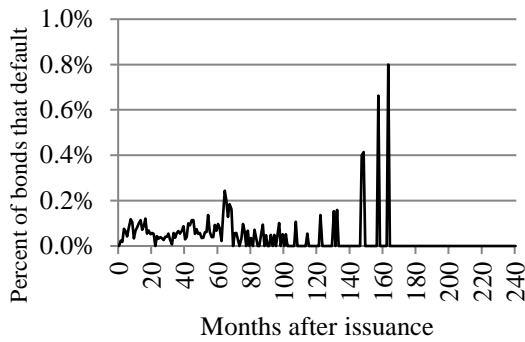
This figure displays the percentage of outstanding issues of each asset class that default within calendar years 1980 to 2010. The data come from Moody’s Default and Recovery Database, and Moody’s Structured Finance Default Risk Service Database.



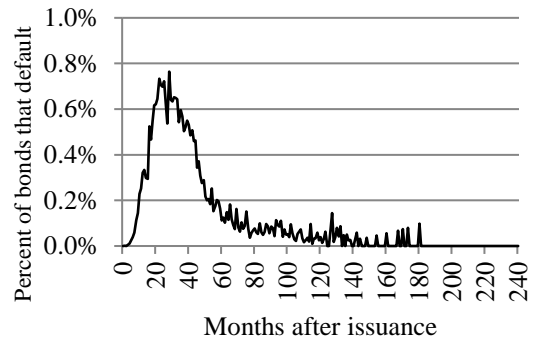
**Panel A. Corporate issues**



**Panel B. Sovereign issues**



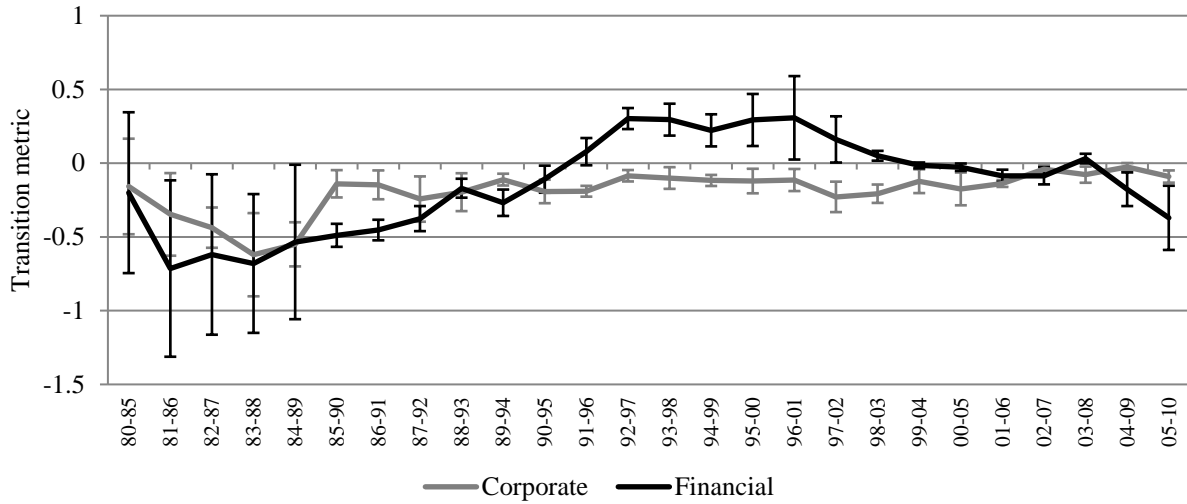
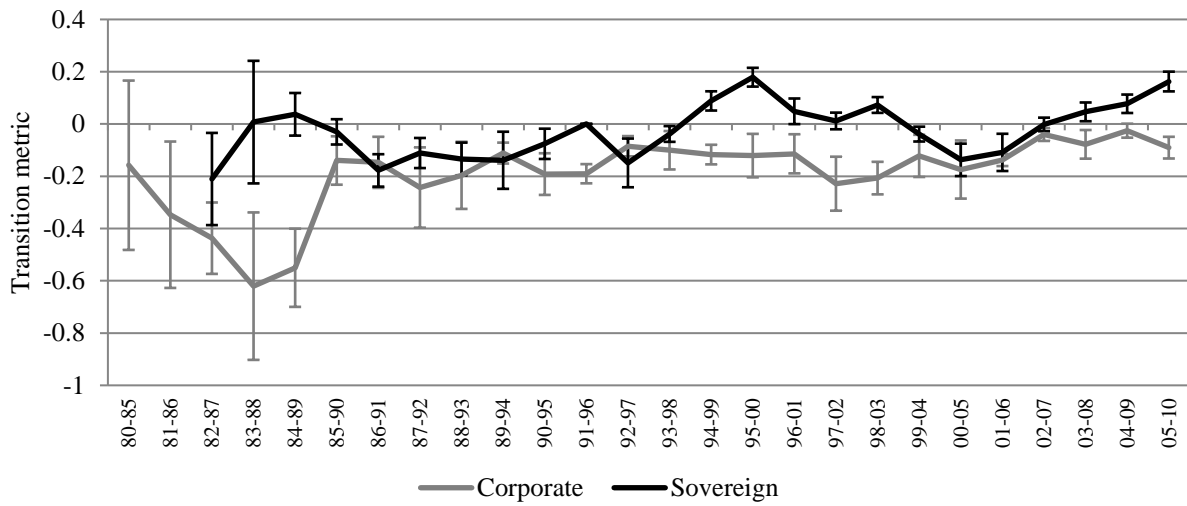
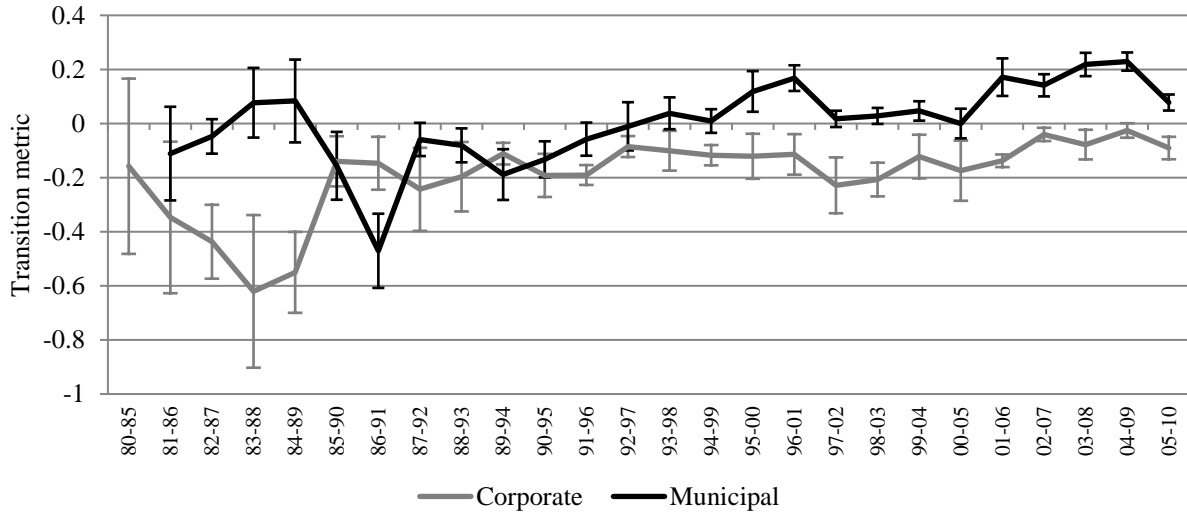
**Panel C. Financial issues**

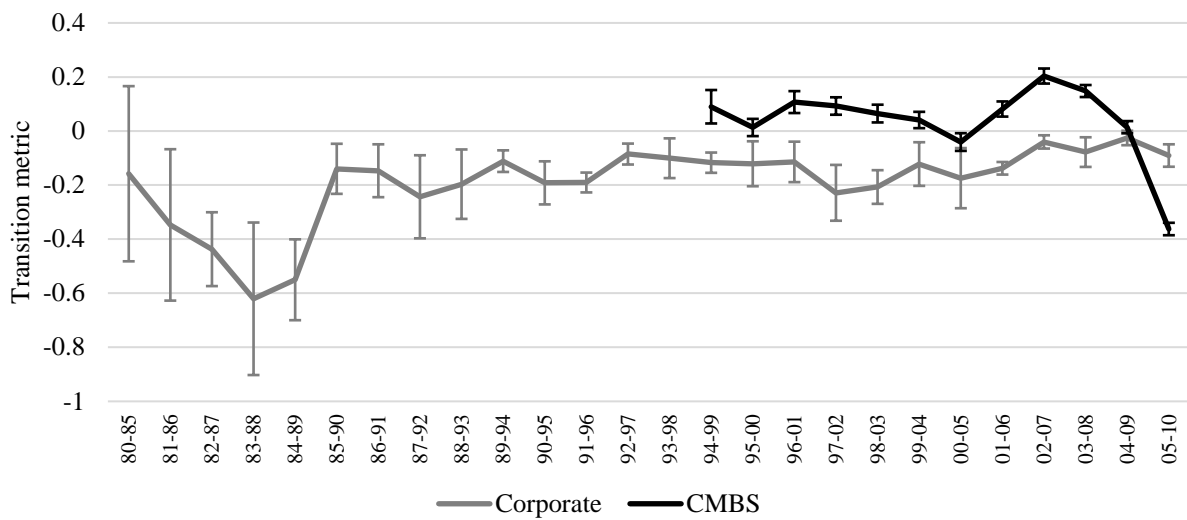
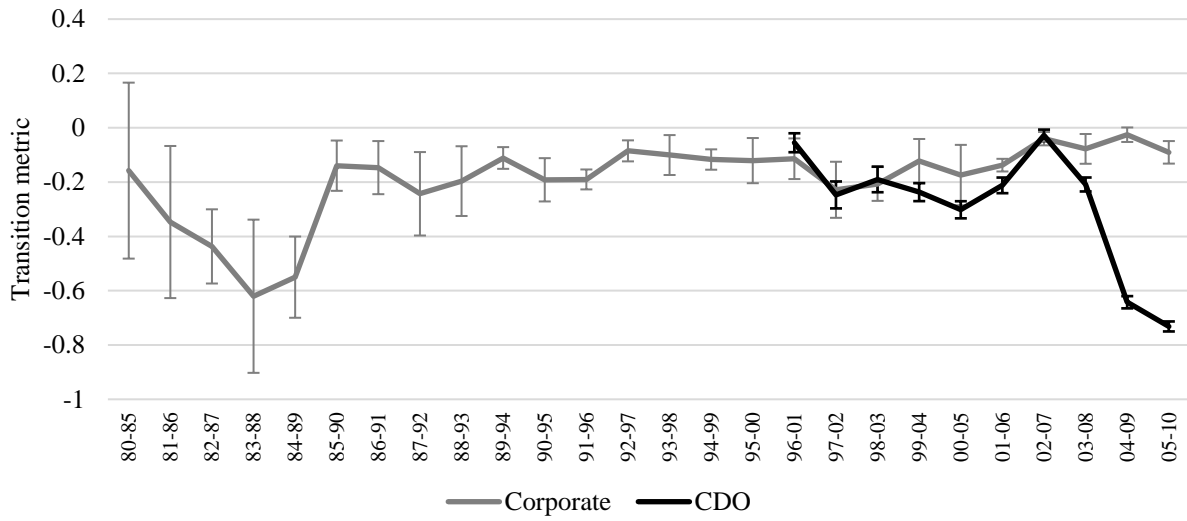
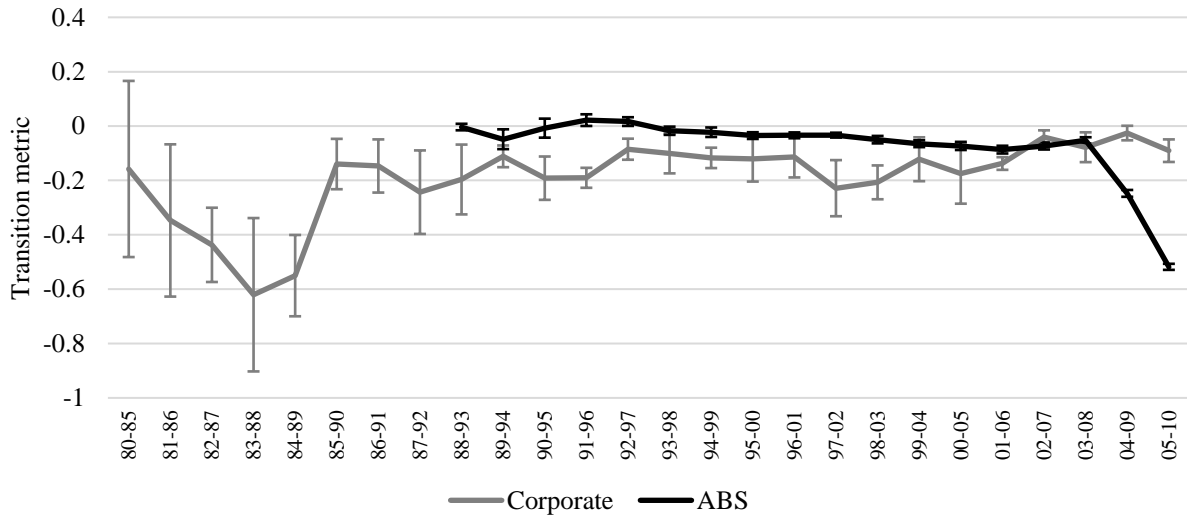


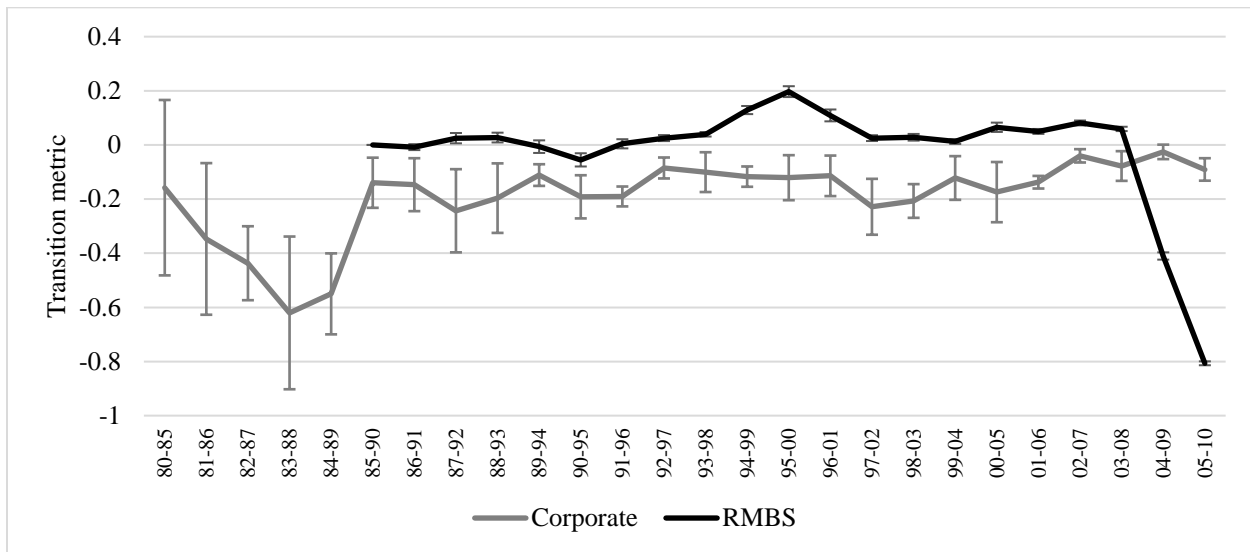
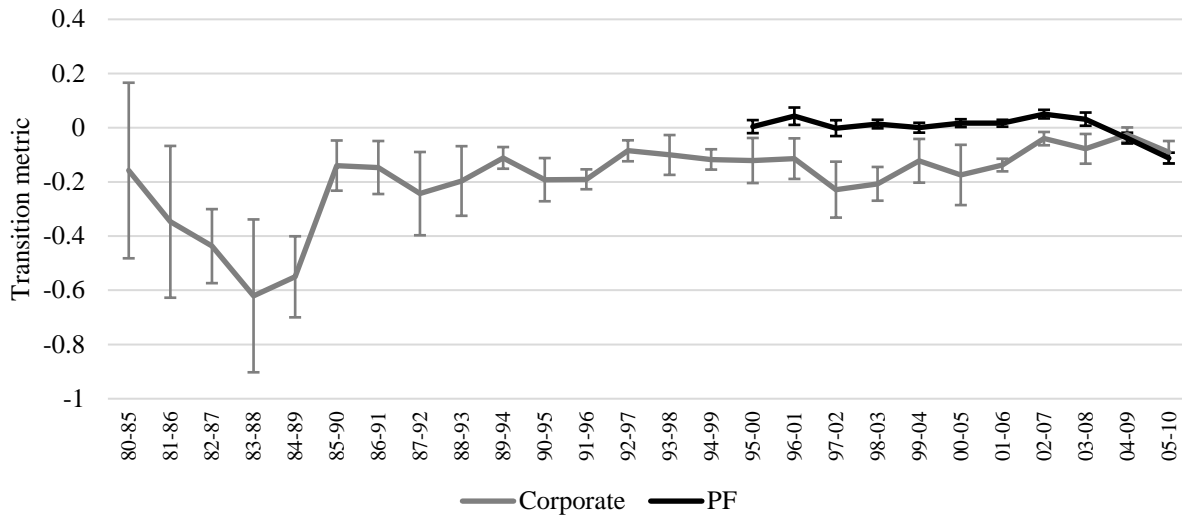
**Panel D. Structured issues**

**Figure A.3  
Empirical hazard functions**

This figure displays the monthly probability of default for each asset class from the month of issuance to 20 years after issuance. For each observation, the numerator is the number of bonds that default within a given month and the denominator is the number of bonds that are outstanding in the month. (Bonds exit the sample after defaulting.) The data come from Moody's Default and Recovery Database, and Moody's Structured Finance Default Risk Service Database.







**Figure A.4**  
**Discretized transition statistics by asset class and year of issuance**

This figure displays transition metrics that summarize the information in five-year transition matrices. This figure is similar to Figure 4 in the paper, except we use a discretized approach to creating the transition metrics instead of a continuous approach. The transition period is year of issuance to five years hence. We compute these transition statistics for bonds belonging to each asset class and year of issuance. Each plot includes corporate issues' transition statistics for comparison. Vertical bars represent 95 percent confidence intervals. We describe the computations behind the transition metrics and their standard errors in the text.

**Table A.1**  
**Descriptive statistics**

Panels A through E display descriptive statistics for debt issues by asset class. The asset classes include bonds issued by corporations, municipalities, sovereign nations, and financial institutions (U.S. banks, U.S. bank holding companies, securities companies, and insurance companies), and tranches of structured products. Panels E.1 through E.5 partition the issues in Panel E by deal type: Asset Backed Securities, Commercial Mortgage Backed Securities, Collateralized Debt Obligations, Public Finance, or Residential Mortgage Backed Securities. *Face* represents the face value of debt obligations measured in millions of dollars. *Maturity* represents the number of years between when the debt obligation was issued and when it matures, assuming it does not default. *Coupon* represents the coupon rate expressed as a percentage. *Initial rating* is a numeric translation of an obligation's first Moody's credit rating. The highest credit rating, Aaa, equals 21 and the lowest credit rating, C, equals 1. *Downgrade (Upgrade)* is a dummy variable taking a value of one if Moody's downgrades (upgrades) the issue between the date of issuance and the earlier of the issue's maturity date, default date, or the end of the sample, and zero otherwise. *Rating change* represents the difference between the numeric translation of an issue's credit rating when the issue matures, defaults, or the sample ends and the initial rating. *Default* is a dummy variable taking a value of one if the issue defaults, and zero if it matures or has not defaulted by the end of the sample period. Panels E and E.1 through E.5 contain summary statistics for the number of tranches per deal, the percentage of tranches per deal that receive Aaa ratings at issuance, the face value of deals measured in millions of dollars, and the percentage of deals' face value that receive Aaa ratings at issuance. The data come from Moody's Default and Recovery Database, and Moody's Structured Finance Default Risk Service Database.

Panel A. Corporate issues

	N	Mean	SD	25%	Median	75%
Face	32,440	282.8	717.1	46	132	300
Maturity	31,588	9.0	8.7	4	7	10
Coupon	27,235	6.7	3.2	4.9	6.5	8.8
Initial rating	32,440	14.2	4.2	12	15	17
Downgrade	32,440	0.36	0.48	0	0	1
Upgrade	32,440	0.15	0.36	0	0	0
Rating change	32,440	-0.7	2.3	-1	0	0
Default	32,440	0.04	0.20	0	0	0

Panel B. Municipal issues

	N	Mean	SD	25%	Median	75%
Face	5,534	221.0	684.3	9	64	191
Maturity	5,494	9.1	7.6	4	7	10
Coupon	4,788	5.5	2.6	4	5.3	7
Initial rating	5,534	19.2	2.2	18	20	21
Downgrade	5,534	0.12	0.33	0	0	0
Upgrade	5,534	0.30	0.46	0	0	1
Rating change	5,534	0.4	1.3	0	0	1
Default	5,534	0.00	0.01	0	0	0

Panel C. Sovereign issues

	N	Mean	SD	25%	Median	75%
Face	10,493	3,137.4	4,186.5	146	769	5,292
Maturity	10,422	9.3	7.8	4	7	11
Coupon	9,302	5.7	3.8	3	5.6	8.3
Initial rating	10,493	16.9	4.4	14	18	21
Downgrade	10,493	0.14	0.35	0	0	0
Upgrade	10,493	0.26	0.44	0	0	1
Rating change	10,493	0.1	1.6	0	0	1
Default	10,493	0.02	0.12	0	0	0

Panel D. Financial issues

	N	Mean	SD	25%	Median	75%
Face	26,224	156.2	466.3	5	25	110
Maturity	26,080	7.1	7.3	2	5	10
Coupon	15,368	5.1	3.0	3.6	5.6	6.8
Initial rating	26,224	17.1	1.8	16	17	18
Downgrade	26,224	0.41	0.49	0	0	1
Upgrade	26,224	0.23	0.42	0	0	0
Rating change	26,224	-1.1	3.3	-2	0	0
Default	26,224	0.02	0.16	0	0	0

Panel E. Structured issues

	N	Mean	SD	25%	Median	75%
Deal characteristics						
N tranches	38,523	4.8	6.7	1	2	6
% N tranches rated Aaa	38,523	53.2	41.9	0.0	50.0	100.0
Face	38,523	929.6	3,732.9	15	151	556
% Face rated Aaa	38,523	61.8	44.4	0.0	87.8	100.0
Tranche characteristics						
Face	185,340	193.2	981.8	4	19	69
Maturity	184,379	24.3	11.1	14	29	30
Coupon	0	--	--	--	--	--
Initial rating	185,340	18.6	3.5	17	21	21
Downgrade	185,340	0.40	0.49	0	0	1
Upgrade	185,340	0.06	0.23	0	0	0
Rating change	185,340	-3.5	5.8	-6	0	0
Default	185,340	0.15	0.36	0	0	0

Panel E.1. Structured issues – Asset Backed Securities

	N	Mean	SD	25%	Median	75%
Deal characteristics						
N tranches	10,621	5.5	7.2	1	3	8
% N tranches rated Aaa	10,621	57.9	35.9	33.3	50.0	100.0
Face	10,621	1,488.2	4,915.1	195	489	970
% Face rated Aaa	10,621	78.2	33.3	80.1	91.8	100.0
Tranche characteristics						
Face	58,888	268.4	1,091.7	12	36	133
Maturity	58,174	21.7	11.2	9	29	30
Coupon	0	--	--	--	--	--
Initial rating	58,888	18.3	3.5	16	21	21
Downgrade	58,888	0.36	0.48	0	0	1
Upgrade	58,888	0.03	0.18	0	0	0
Rating change	58,888	-3.2	5.2	-7	0	0
Default	58,888	0.20	0.40	0	0	0

Panel E.2. Structured issues – Collateralized Debt Obligations

	N	Mean	SD	25%	Median	75%
Deal characteristics						
N tranches	5,487	3.6	3.6	1	2	6
% N tranches rated Aaa	5,487	35.6	35.7	0.0	28.6	50.0
Face	5,487	993.6	3,128.5	50	277	518
% Face rated Aaa	5,487	53.8	41.3	0.0	73.4	90.0
Tranche characteristics						
Face	19,810	275.2	1,262.9	13	30	90
Maturity	19,735	19.2	14.5	9	13	34
Coupon	0	--	--	--	--	--
Initial rating	19,810	17.1	3.9	13	19	21
Downgrade	19,810	0.56	0.50	0	1	1
Upgrade	19,810	0.04	0.19	0	0	0
Rating change	19,810	-5.5	6.6	-11	-3	0
Default	19,810	0.29	0.45	0	0	1



Panel E.3. Structured issues – Commercial Mortgage Backed Securities

	N	Mean	SD	25%	Median	75%
Deal characteristics						
N tranches	1,647	9.2	8.0	3	7	14
% N tranches rated Aaa	1,647	37.2	29.4	20.0	33.3	48.0
Face	1,647	3,732.3	8,592.3	281	702	1,706
% Face rated Aaa	1,647	65.2	32.9	55.3	76.8	88.7
Tranche characteristics						
Face	15,178	405.0	1,569.6	7	24	102
Maturity	15,161	26.6	12.5	13	32	36
Coupon	0	--	--	--	--	--
Initial rating	15,178	16.1	4.7	12	16	21
Downgrade	15,178	0.30	0.46	0	0	1
Upgrade	15,178	0.15	0.35	0	0	0
Rating change	15,178	-1.1	3.8	-2	0	0
Default	15,178	0.04	0.19	0	0	0

Panel E.4. Structured issues – Public Finance

	N	Mean	SD	25%	Median	75%
Deal characteristics						
N tranches	13,261	1.9	2.9	1	1	2
% N tranches rated Aaa	13,261	51.9	49.8	0.0	100.0	100.0
Face	13,261	26.5	102.1	3	9	22
% Face rated Aaa	13,261	39.2	48.7	0.0	0.0	100.0
Tranche characteristics						
Face	25,034	14.0	61.3	0	3	12
Maturity	25,011	19.3	10.2	11	19	29
Coupon	0	--	--	--	--	--
Initial rating	25,034	19.9	1.6	19	21	21
Downgrade	25,034	0.32	0.47	0	0	1
Upgrade	25,034	0.11	0.32	0	0	0
Rating change	25,034	-0.7	1.9	-1	0	0
Default	25,034	0.00	0.00	0	0	0

Panel E.5. Structured issues – Residential Mortgage Backed Securities

	N	Mean	SD	25%	Median	75%
<b>Deal characteristics</b>						
N tranches	7,507	8.8	9.0	2	6	13
% N tranches rated Aaa	7,507	65.2	34.8	40.0	71.4	100.0
Face	7,507	1,073.3	3,216.1	166	379	786
% Face rated Aaa	7,507	83.6	32.7	92.0	97.0	100.0
<b>Tranche characteristics</b>						
Face	66,430	121.3	747.2	2	13	51
Maturity	66,298	29.4	7.0	29	30	30
Coupon	0	--	--	--	--	--
Initial rating	66,430	19.5	3.0	20	21	21
Downgrade	66,430	0.44	0.49	0	0	1
Upgrade	66,430	0.04	0.20	0	0	0
Rating change	66,430	-4.7	6.6	-10	0	0
Default	66,430	0.15	0.35	0	0	0

**Table A.2**  
**Correlation matrix**

This table displays correlation coefficients for issue characteristics and dummy variables representing asset class. *Face* represents the face value of debt issues measured in millions of dollars. *Maturity* represents the number of years between when the debt obligation was issued and when it matures, assuming it does not default. *Coupon* represents the coupon rate expressed as a percentage. *Initial rating* is a numeric translation of an issue's first Moody's credit rating. The highest credit rating, Aaa, equals 21 and the lowest credit rating, C, equals 1. *Downgrade (Upgrade)* is a dummy variable taking a value of one if Moody's downgrades (upgrades) the issue between the date of issuance and the earlier of the issue's maturity date, default date, or the end of the sample, and zero otherwise. *Rating change* represents the difference between the numeric translation of an issue's credit rating when the issue matures, defaults, or the sample ends and the initial rating. *Default* is a dummy variable taking a value of one if the issue defaults, and zero if it matures or has not defaulted by the end of the sample period. *Corporate* is a dummy variable taking a value of one if an industrial or transportation firm issued the bond, and zero otherwise. *Municipal* is a dummy variable taking a value of one if a local or regional government issued the bond, and zero otherwise. *Sovereign* is a dummy variable taking a value of one if a sovereign nation issued the bond, and zero otherwise. *Financial* is a dummy variable taking a value of one if a U.S. bank, U.S. bank holding company, securities company, or insurance company issued the bond, and zero otherwise. *Structured* is a dummy variable taking a value of one if the bond is a tranche of a structured product, and zero otherwise. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The data come from Moody's Default and Recovery Database, and Moody's Structured Finance Default Risk Service Database.

	Face	Maturity	Coupon	Initial rating	Downgrade	Upgrade	Rating change	Default
Maturity	-0.02***							
Coupon	0.03***	0.17***						
Initial rating	0.00	0.15***	-0.40***					
Downgrade	-0.01***	0.22***	0.03***	-0.10***				
Upgrade	0.01***	-0.15***	0.02***	-0.21***	-0.26***			
Rating change	0.01***	-0.36***	-0.03***	-0.07***	-0.74***	0.30***		
Default	-0.01***	0.28***	0.17***	-0.24***	0.41***	-0.12***	-0.54***	
Corporate	-0.01***	-0.32***	0.21***	-0.36***	-0.02***	0.06***	0.14***	-0.09***
Municipal	-0.00	-0.12***	-0.04***	0.05***	-0.08***	0.10***	0.09***	-0.05***
Sovereign	0.09***	-0.17***	-0.04***	-0.05***	-0.10***	0.11***	0.11***	-0.06***
Financial	-0.01***	-0.34***	-0.17***	-0.07***	0.02***	0.14***	0.10***	-0.10***
Structured	-0.03***	0.57***	--	0.32***	0.07***	-0.22***	-0.24***	0.17***

**Table A.3****Transition matrices by structured product type**

This table displays five-year transition matrices for tranches of structured products partitioned by deal type. Subcategories include Asset Backed Securities, Collateralized Debt Obligations, Commercial Mortgage Backed Securities, Public Finance, and Residential Mortgage Backed Securities. The rating scale in this table is a simplified version of Moody's traditional 21-point scale. For example, we combine credit ratings of A1, A2, and A3 into one bin, A. The vertical axis represents the issues' initial credit ratings and the horizontal axis represents the issues' credit ratings five years later. The data come from Moody's Structured Finance Default Risk Service Database.

Panel E.1. Structured issues – Asset Backed Securities

	Aaa	Aa	A	Baa	Ba	B	Caa	Ca	C	Default	Sum	% Down	% Up
Aaa	25,318	840	573	548	389	571	967	803	223	583	30,815	17.84	
Aa	355	3,064	360	300	167	172	213	91	565	2,024	7,311	53.23	4.86
A	245	434	4,009	673	348	189	197	108	506	2,494	9,203	49.06	7.38
Baa	111	68	204	2,705	453	337	278	117	250	3,681	8,204	62.36	4.67
Ba	7	5	11	35	464	58	67	28	64	1,432	2,171	75.96	2.67
B			1	1	8	143	11	6	7	339	516	70.35	1.94
Caa	1						73		8	149	231	67.97	0.43
Ca							1	40	4	87	132	68.94	0.76
C									211	94	305	30.82	0.00
Sum											58,888	36.30	2.53

Panel E.2. Structured issues – Collateralized Debt Obligations

	Aaa	Aa	A	Baa	Ba	B	Caa	Ca	C	Default	Sum	% Down	% Up
Aaa	3,078	1,044	353	179	195	146	239	117	23	1,277	6,651	53.72	
Aa	87	1,280	664	332	137	82	176	73	26	902	3,759	63.63	2.31
A	30	167	1,009	444	479	142	124	61	43	985	3,484	65.38	5.65
Baa	11	18	81	997	410	543	310	108	62	1,014	3,554	68.85	3.10
Ba	3	1	5	26	507	132	425	84	37	545	1,765	69.29	1.98
B					1	68	22	20	19	132	262	73.66	0.38
Caa					1	2	30		2	144	179	81.56	1.68
Ca			1		1			12		101	115	87.83	1.74
C									35	6	41	14.63	0.00
Sum											19,810	62.39	2.20

Panel E.3. Structured issues – Commercial Mortgage Backed Securities

	Aaa	Aa	A	Baa	Ba	B	Caa	Ca	C	Default	Sum	% Down	% Up
Aaa	4,349	308	167	130	68	40	63	23	43	6	5,197	16.32	
Aa	444	894	122	155	114	104	91	31	81	7	2,043	34.51	21.73
A	173	244	904	125	133	126	179	70	140	51	2,145	38.41	19.44
Baa	75	63	234	1,460	193	168	267	100	337	84	2,981	38.54	12.48
Ba	4	8	13	52	761	129	119	35	351	117	1,589	47.26	4.85
B	2		1	5	13	529	163	19	259	161	1,152	52.26	1.82
Caa						2	30	5		8	45	28.89	4.44
Ca								8			8	0.00	0.00
C									18		18	0.00	0.00
Sum											15,178	32.23	8.78

Panel E.4. Structured issues – Public Finance

	Aaa	Aa	A	Baa	Ba	B	Caa	Ca	C	Default	Sum	% Down	% Up
Aaa	11,099	2,077	369	65	5		6				13,621	18.52	
Aa	361	6,533	995	118	67						8,074	14.61	4.47
A	79	583	1,627	15	11						2,315	1.12	28.60
Baa	18	79	43	186	35	1		1			363	10.19	38.57
Ba	7	37	15		53	1					113	0.88	52.21
B		37	7	2		46					92	0.00	50.00
Caa	7	45	19	1	2		69				143	0.00	51.75
Ca	3	38	19	1				53			114	0.00	53.51
C	8	71	28						92		199	0.00	53.77
Sum											25,034	15.04	6.03

Panel E.5. Structured issues – Residential Mortgage Backed Securities

	Aaa	Aa	A	Baa	Ba	B	Caa	Ca	C	Default	Sum	% Down	% Up
Aaa	27,049	1,422	1,015	730	779	2,245	8,424	2,068	931	1,733	46,396	41.70	
Aa	1,205	3,027	359	231	114	132	137	192	527	2,952	8,876	52.32	13.58
A	140	311	1,431	134	122	90	116	70	130	1,991	4,535	58.50	9.94
Baa	33	76	259	1,434	100	106	142	138	93	2,095	4,476	59.74	8.22
Ba	3	4	54	122	495	34	45	74	53	491	1,375	50.69	13.31
B		1	3	13	64	279	17	36	28	166	607	40.69	13.34
Caa	1			1			43	1	3	14	63	28.57	3.17
Ca							1	24	9	5	39	35.90	2.56
C									59	4	63	6.35	0.00
Sum											66,430	45.61	3.45