Credit Ratings across Asset Classes: A ≡ A?

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JEL classification: G14, G24, G28, G32

Keywords: Credit Ratings, NRSRO, Municipal Bonds, Sovereign Bonds, CDOs, Capital Markets Regulation

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"We have always had one scale, a consistent scale that we have tried to adopt across all our asset classes."

-- Deven Sharma, President, Standard & Poor's, July 27, 2011[1]

Credit ratings produced by Nationally Recognized Statistical Ratings Organizations (NRSROs) play an essential role in the economy. Credit ratings that are publicly observable and easy to interpret reduce contracting costs for creditors and other counterparties and provide information to a host of market participants. Credit ratings are also important to debt issuers. Issuers who do not receive 'investment grade' credit ratings face liquidity premiums (in addition to higher credit risk premiums) because regulations prohibit banks, pension funds, and insurance companies from holding 'speculative grade' debt or require these parties to hold higher reserves when doing so. Corporations that are unable to secure investment grade credit ratings face higher borrowing costs and therefore may forgo marginal investments. Likewise, municipalities or sovereign nations will forgo marginal investments or will raise taxes to cover the higher borrowing costs. Credit ratings, therefore, have important implications for capital allocation and economic growth.

Underpinning all of these functions is the assumption that credit ratings contain the same information irrespective of the asset class to which they are assigned. For example, regulations drawing hard lines at the investment grade cutoff make no distinction between Baa3-rated municipal bonds, Baa3-rated corporate bonds, or Baa3-rated structured products. But this assumption ignores variation in risk profiles of the underlying assets and credit-quality shocks common to a particular sector. The expanding economy of 1990-2007, for example, kept tax receipts (and thus municipal bond ratings) high. Corporations similarly benefited from the expansion, but they borrowed more money to repurchase shares in order to maintain financial leverage. More recently, the financial crisis began with deterioration in Residential Mortgage Backed Securities (RMBS), was then compounded in the Collateralized Debt Obligations (CDOs) formed from the poorly–performing RMBS, and ultimately affected corporation

[1] Testimony before the U.S. House of Representatives, Committee on Financial Services, Oversight and Investigations Subcommittee, 2129 Rayburn Office Building, Washington DC, July 27, 2011.

financing through the distressed financial institutions. Because these sectors respond differently (in time and magnitude) to changes in underlying state variables, it is not obvious that similarly-rated obligations can be viewed equally across asset classes at any point in time.

The fact that credit ratings reflect expected losses, rather than unconditional default probabilities, further complicates such comparison. Taxing authority and implied support from higher-level government may reduce the probability of a municipal default, relative to corporations, but conditional on default the illiquidity of assets funded by municipal bonds (sewage systems, transportation, public schools, athletic arenas, etc.) result in lower expected recovery; see Trzcinka (1982). Add the conflict of interest in the issuer-pays rater compensation model, where certain asset classes represent more influential (i.e., higher rating revenue) issuers, and one must question the assumption of ratings comparability across asset classes.

To be fair, financial regulators relying on credit ratings appear to have been misinformed rather than uninformed. The rating agencies have persistently maintained that their ratings are indeed comparable across sectors and asset classes. Appendix A.1 exhibits such assertions by Moody's Investor Service (Moody's), Standard & Poor's (S&P), and Fitch Ratings (Fitch), collectively referred to as the Big 3 credit rating agencies (CRAs). Despite these assertions, we demonstrate that credit ratings contain different information across asset classes.

For each asset class, we report default frequencies by initial rating, we construct transition matrices and transition metrics for annual cohorts of issues, we investigate the distribution of times to upgrade and downgrade via hazard rate models, and we estimate rating change regression models. Our sample runs from 1980 through 2010. The evidence reveals that while ratings of structured products are significantly more generous (optimistic) than those of corporate bonds, those of municipal and sovereign bonds are significantly less generous (more pessimistic). Further, we document significant differences within the broad category of structured products. Tranches of collateralized debt obligations (CDOs) and residential mortgage

backed securities (RMBS) receive the most generous ratings at issuance, whereas public finance (PF) tranches receive the least generous ratings of all structured products.

Financial regulation assuming comparability across asset classes thus results in misallocation of capital, either due to asset mispricing, or to regulatory arbitrage. To the extent that investors relied on rating agencies as information intermediaries (Grossman and Stiglitz, 1980) they were unknowingly over-exposed to structured products. To the extent that investors relied on more sophisticated internal bond pricing models to price risk, any misallocation of regulated capital follows from regulatory arbitrage. For example, consider NAIC guidelines for insurance company reserves over our sample period:

Credit ratings	Capital charge
AAA, AA, A	0.30%
BBB	0.96% (3.2 x Category 1)
BB	3.39% (11.3 x Category 1)
B	7.38% (24.6 x Category 1)
CCC	16.96% (56.5 x Category 1)
CC or lower	19.50% (65.0 x Category 1)

An insurance company holding only single A rated RMBS (45.7% default in our 1980-2010 sample) faced the same capital requirements as an insurance company holding only single A rated municipal bonds (0.5% default) or only single A rated corporate bonds (1.8% default). Assuming securities are priced using information beyond credit ratings, the first insurance company circumvents the spirit of the regulatory constraints and earns higher yields on its RMBS. Similar yield chasing on the part of banks and pension funds, backed implicitly by the federal government, and the misallocation of regulated capital is economy wide.[2]

Moody's (2002, 2007) analysts discuss the municipal rating dichotomy, although they assert that Moody's assesses sovereign and structured issues according to the same scale as corporate issues. To our knowledge, we are the first to document comprehensively the apparent differences in rating standards across all major asset classes. This is the primary contribution of

[2] Institutional investors hold approximately 40% of corporate bonds and asset-backed securities; SIFMA (2007).

the paper. We hope it will aid investors, debt issuers, and regulators as they reconsider appropriate risk metrics for establishing bank capital requirements and prudent investments by pension funds and insurance companies.

Our evidence that rating performance varies by asset class is consistent with existing literature addressing inflated credit ratings (particularly among structured finance products) and their contribution to the recent financial crisis (e.g., Coval, Jurek, and Stafford, 2009). Indeed, our evidence of rating inflation among structured products is strongest in the crisis years. However, our sample reveals robust differences in credit ratings across asset classes outside of the crisis years. For bonds issued in all but one year of the sample (1992), transition metrics demonstrate that corporate issues exhibit ratings inflation relative to sovereign issues. Similarly, for bonds issued in every year of the sample but 1986, corporate issues exhibit ratings inflation relative to municipal issues. Based on these results, we conclude that the difference in ratings behavior reflects differences in ratings standards at the CRAs as well as differential reactions to unexpected economic shocks. Potential shocks resulting in upgrades of municipal and sovereign issues and simultaneous downgrades of corporations and structured products are possible, but unlikely observed in 24 of 25 draws.

Differences in rating standards across asset classes may result for multiple reasons. The first is the regulatory reliance itself; see Opp, Opp and Harris (2012). Asset opacity is another potential factor. For example, synthetic CDOs are more opaque than corporations with audited financial statements. This opacity could result in greater dispersion among credit assessment by competing CRAs. This dispersion could result in a greater opportunity for ratings shopping by the issuers of the CDOs which, in turn, could result in CDOs having higher credit ratings than corporate bonds with the same risk.[3] In the model of Skreta and Veldkamp (2009), ratings inflation results from issuer opacity even if all CRAs endeavor to produce accurate ratings.

[3] Sangiorgi, Sokobin, and Spatt (2009) provide a detailed discussion of rating shopping. Becker and Milbourn (2010) and Bongaerts, Cremers, and Goetzman (2012) provide evidence that is consistent with the notion that increased ratings shopping is an unintended consequence of increased competition in the credit ratings industry.

Further, Mathis, McAndrews, and Rochert (2009) suggest that CRAs' concerns over reputation capital diminish in issuer opacity.

We submit that issuer opacity is a more compelling explanation for ratings inflation among synthetic CDOs backed by credit default swaps than for traditional RMBS or ABS. Indeed, one could argue that a pool of mortgages or credit card receivables should be less opaque than corporate issuers with synthetic leases and other exotic off-balance-sheet liabilities.[4] However, we find even these more transparent structured products exhibit significant ratings inflation relative to corporate bonds.

Moreover, to the extent that issuer opacity is a compelling explanation for ratings inflation, it should also apply to municipal and sovereign issuers. Dispersion in the qualitative credit assessment of sovereign nations should, like complex structured products, be greater than the dispersion in the qualitative assessment of corporations with audited financial statements.[5] Regarding local governments, Ingram, Brooks, and Copeland (1983) conclude that, "*financial accounting information about municipalities is generally less reliable, less comparable cross-sectionally, and less timely than information about corporations*" (page 997). However, we find that ratings among municipal and sovereign bonds do not reflect the same inflation exhibited by the ratings of structured products. To the contrary, our battery of tests indicates municipal and sovereign bonds' ratings are deflated at issuance relative to ratings of corporate bonds.

The body of evidence appears more consistent with a conflict of interest in the issuer-pays compensation structure. In the model of Fulghieri, Strobl, and Xia (2010), raters enhance both their revenues and their reputations by issuing lower (pessimistic) unsolicited ratings to non-paying issuers. We posit that such a phenomenon need not be binary. If pessimistic ratings

[4] See Beatty et al. (2010) and Zechman (2010) regarding financial reporting quality and off-balance-sheet financing.

[5] Moody's (2008) Sovereign Analytics Report describes the wide variety of risks associated with sovereign debt that corporate bonds do not share. The report reviews extensive case studies of sovereign crises, discusses deposit freezes and debt moratoria, transfer and convertibility risk, country debt ceilings, the distinction between sovereign and country risk, changing legal provisions in various countries, correlation of sovereign defaults and banking crises, and Moody's qualitative approach to sovereign bond ratings.

enhance rater reputation, and the lowest ratings are awarded to non-paying issuers, raters should rationally apply more stringent standards to issuers paying the least. Consistent with this hypothesis, we find ratings optimism (leniency or inflation) increases in the revenues generated by asset classes. Revenues generated from structured products are significantly higher than those generated from corporate issuers which are, in turn, higher than those generated from sovereign issuers and municipalities. We lack sufficient data to document variation in profit margin by asset class, which would be more compelling than correlations with revenues (i.e., deal volume). Still, we note that unlike corporations and municipalities that commonly issue debt at lower ratings, the market for structured products would not exist without sufficient Aaa tranches.[6] Thus, rater revenues are contingent on ratings for these structured products. All things considered, we conclude that our results are more consistent with a conflict of interest than the more benign interpretation of CRAs' best efforts to rate opaque issuers.

Our results are important and timely given the current U.S. Securities and Exchange Commission (SEC) mandate to consider the feasibility and desirability of standardizing credit ratings. Our results do not imply that ratings should be (or even could be) standardized across asset classes.[7] Rather, our results imply that reliance on ratings irrespective of asset class results in over-allocation of regulated funds in higher risk structured products (particularly in recent years) and under-allocation to less risky sovereign and municipal bonds.

The paper proceeds as follows. Section II provides institutional details, Section III describes the sample, Section IV discusses the empirical results pertaining to credit rating performance across asset classes, and Section V concludes.

II. Institutional Detail

[6] "'*The rating is what gives birth to the structure in the first place*,' explains Sylvain Raynes, a financial modeling expert who was with Moody's in the 1990s. Ratings are often known before the bonds have even been inked. '*You start with a rating and build a deal around a rating*,' Brian Clarkson (head of Moody's mortgage bond division)." See *When Junk Was Gold* by Sam Jones, FT.com 10/17/08.

[7] The CRAs argue that it is not feasible and some market participants suggest that it is not desirable; www.sec.gov/comments/4-622/4-622.shtml.

A. Dichotomous municipal rating scales

In contrast to Moody's public assertion of comparable ratings (Appendix A.1), their analysts report a lower default rate among all municipals when compared to Aaa-rated corporate issues; Moody's (2002).[8] This 2002 report explains that their *municipal* bond rating scale is distinct from the *corporate* bond rating scale, though the report attests that the corporate scale is applicable to non-U.S. sovereign issuers and all structured products. As of 2007, Moody's refers to this latter scale "used to rate all bonds outside of the U.S. public finance market" as the Global Rating Scale; Moody's (2007). Moody's attributes the duality in part to the tax-exempt nature of municipal bonds to U.S. investors and in part to a finer gradation in the more stringent municipal rating scale. Unlike the global rating scale which measures "expected loss" among corporate and other non-municipal issuers, the municipal rating scale reflects the probability that the municipality will need support from higher levels of government. Historically, state governments cover bond payments for distressed municipalities resulting in trivial expected losses among municipal bonds. Trivial expected losses suggest Aaa ratings according to the corporate rating scale.

New rules imposed by the SEC (2011) in response to the Dodd-Frank Wall Street Reform and Consumer Protection Act (hereafter, Dodd-Frank) now explicitly require "*consistent application of ratings symbols and definitions*". Moody's reports that in moving away from the dichotomous municipal rating scales, General Obligation (GO) bond ratings would rise by two notches on average, with a range of zero to three notches, most among those rated below Aa3 on the municipal scale.[9] Likewise, S&P (2009) discusses changes in their rating criteria for CDOs and RMBS intended to improve the comparability of ratings going forward. But the extent to which these reported new ratings criteria will improve rating comparability and performance

[8] Moody's reports five- and ten-year cumulative default rates for all rated municipal bond issuers of 0.0233% and 0.0420%, respectively, over the 1970-2000 period. These default rates compare to 0.1237% and 0.6750% for Aaa rated corporate bonds over the same period.

[9] Source: www.bondbuyer.com/issues/119_300/moodys-moving-to-global-muni-scale-1009615-1.html

remains to be seen. In December 2010, S&P announced it had "incorrectly analyzed" 1,196 ABS due to a methodological error and in September 2011 S&P received a formal warning from the SEC regarding civil fraud charges over ABS ratings (Wall Street Journal, 2011). Also in September 2011, federal regulators identified and reported continual failures to adhere to stated methodologies among the NRSROs (SEC, 2011). Most recently, the collapse of MF Global while it had investment grade ratings from the Big 3 demonstrates reluctance on the part of the Big 3 to downgrade large, influential issuers.[10]

B. Implications for regulatory compliance and capital allocation

We assume that large institutional investors rely on more sophisticated risk metrics than credit ratings to price assets; see Cornaggia and Cornaggia (2012). However, credit ratings influence their asset allocation as financial regulators have long relied on ratings to establish reserve requirements.[11] Because regulated financial institutions dominate fixed income markets (SIFMA, 2007) such regulations have important implications for capital allocation in the U.S. economy.[12] Dodd-Frank calls for the removal of NRSRO ratings in SEC rules and other federal regulations; see Appendix A.2. However, state (i.e., insurance) and international (i.e., Basel) regulators are not subject to Dodd-Frank mandates.[13]

Efficient capital allocation requires risk metrics that reflect cardinal (absolute) credit risk – at least contemporaneously and preferably consistently through time. Prior literature explores

[10] MF Global filed a bankruptcy petition October 31, 2011. Former Goldman Sachs CEO, U.S. Senator, and New Jersey Governor, MF Global CEO Jon Corzine resigned November 4, 2011 as the Department of Justice began its investigation of the firm. The Big 3 began downgrading the firm after the peak of the financial crises in January 2009, but sustained the firm's investment grade rating until days prior to the bankruptcy. Moody's Baa3 rating on October 24 is the lowest investment grade rating. Of the Big 3, Fitch Ratings was first to downgrade to speculative grade on October 27.

[11] See Cantor and Packer (1997) and Cornaggia and Cornaggia (2012) regarding the pervasive reliance on credit ratings in regulation of banks, money market and pension funds, and insurance companies.

[12] For example, Ellul, Jotikasthira, and Lundblad (2010) document fire sales of downgraded bonds induced by regulatory constraints imposed on insurance companies. Regarding the dominance by institutional investors, see the Securities Industry and Financial Markets Association at SIFMA.org.

[13] See for example, *Dodd-Frank Ban on Ratings Delays U.S. Implementing Basel Rule* by Yalman Onaran, Bloomberg.com September 24, 2010.

the consequence of regulatory reliance on ratings that are ordinal (relative), based on qualitative analysis, paid for by issuers, and intentionally slow to update.[14] Another strand of literature considers variation in credit standards for corporate bonds over time; Blume, Lim, and MacKinlay (1998), Jorion, Si, and Zhang (2009), and Baghai, Servaes, and Tamayo (2012). We consider here the potential misallocation of capital resulting from reliance (regulatory or otherwise) on ratings with standards that vary by asset class.[15]

The investment- versus speculative-grade cutoff (drawn at Baa3 on the Moody's rating scale) is the most prominent rating threshold, but some regulations draw lines elsewhere along the rating scale. For example, the SEC has historically required money market funds to hold Aaa-rated commercial paper, and the Basel accords have required that bank reserves vary with borrower ratings. However, to date none of the ratings-based regulations differentiate thresholds according to asset class. Given variation in absolute credit risk, regulated institutional investors can to some extent circumvent regulatory constraints by directing funds to the higher risk asset classes with lower (risk-adjusted) capital requirements.

III. Sample Description

We employ Moody's Default and Recovery Database (DRD) and Moody's Structured Finance Default Risk Service Database (SFD).[16] The DRD contains Moody's credit ratings histories for debt obligations issued by corporations (industrials and transportation companies), financial institutions (U.S. banks, U.S. bank holding companies, securities companies, and insurance companies), sovereign nations, and local and regional governments. We only include

[14] See Partnoy (1999), Griffin and Tang (2012), Kraft (2010), Xia (2010), Bruno et al. (2012), and Cornaggia and Cornaggia (2012).

[15] A U.S. District Court recently denied Moody's and S&P dismissal of a claim brought by investors alleging fraudulent ratings resulted in misallocated capital; No. 08 Civ. 7508, 2009 U.S. Dist. LEXIS 79607 (S.D.N.Y. Sept. 2, 2009).

[16] Ideally, we would like to examine the difference across asset classes for each NRSRO. However, previous work indicates that ratings by the Big 3 are highly correlated suggesting that results for S&P or Fitch would likely be similar to those reported here (Bongaerts, Cremers, and Goetzman, 2012). Thus, the cost of purchasing a complete ratings history from each CRA likely outweighs the potential benefit of any cross-CRA analysis.

regular bonds from the DRD in order to make comparisons across asset classes straightforward (e.g., we exclude convertible or callable bonds). The SFD includes Moody's ratings histories for structured finance products including Asset Backed Securities (ABS are backed by various receivables including credit cards, auto loans, student loans, equipment leases, etc.), Collateralized Debt Obligations (CDOs), Commercial Mortgage Backed Securities (CMBS), structured Public Finance (PF) deals, and Residential Mortgage Backed Securities (RMBS). While the SFD should contain a comprehensive universe of Moody's rated structured products and the DRD a comprehensive universe of corporations, financial institutions, and sovereign nations, the DRD contains only a sample (N= 6,410) of municipal issues. This sample contains the only municipal issues Moody's was willing to make commercially available to us. We contemplate potential sample selection biases and conclude that if issues contained in the DRD were in any way 'cherry picked' such a selection bias should work against our primary results.

We examine Moody's credit ratings from both databases that fall along a 21-point alphanumeric scale. The scale ranges from most creditworthy to least creditworthy: Aaa, Aa1, Aa2 Aa3, A1, A2, A3, Baa1, Baa2, Baa3, Ba1, Ba2, Ba3, B1, B2, B3, Caa1, Caa2, Caa3, Ca, and C. We map alphanumeric ratings Aaa, …, C to numeric ratings 21, …, 1 such that ratings are increasing in credit quality and decreasing in credit risk. Obligations with credit ratings equal to Baa3 or higher (12 through 21) are "investment grade" and obligations with credit ratings equal to Ba1 or lower (1 – 11) are "speculative grade." Our analysis focuses on ratings issued between 1980 and 2010.

A. Sample description

We describe the sample, by asset class, in Table I. The median face value of corporate bonds ($132M) is more than twice the size of the median municipal issue ($64M). Sovereign issues are the largest by a wide margin; $769M at the median. Financial issues and structured tranches are considerably smaller; $25M and $19M at the median, respectively. However, as noted above, the broad "structured finance" category includes securities backed by a variety of

underlying assets. The face values of ABS tranches are the largest sub category ($36M median) followed by CDOs ($30M), CMBS ($24M), RMBS ($13M). Public finance (PF) tranches are the smallest ($3M median). The asset classes exhibit large differences in maturity length. Tranches of structured products have an average maturity of 24.3 years with a median of 29 years. The other asset classes have means and medians in the range of 5 to 9 years.

[Insert Table I here.]

Initial ratings vary by asset class, as do frequencies of ratings changes. The median corporate issue is initially rated A3 (15), which is investment grade. Further, these bonds are more likely to be downgraded (36% probability over the life of the bond) than upgraded (15% probability over the life of the bond). Conversely, the sample of municipal bonds are almost three times more likely to be upgraded than downgraded (30% versus 12%), and are more likely to be upgraded than corporate bonds even though the median is issued at a higher rating (Aa1) than the median corporate bond. Sovereign issues are similar to the municipals in this regard. They are almost twice as likely to be upgraded than downgraded even though the median bond has a higher rating at issuance (Aa3) than the median corporate bond. Conversely, structured tranches behave more like corporates, but with an even greater frequency of downgrades and an even lower frequency of upgrades. The median structured tranche was issued with an Aaa rating. Finally, the financial issues are similar to the corporate bonds in that they exhibit a greater probability to downgrade instead of upgrade (41% versus 23%).

Frequency of default also varies by asset class. Four percent of our benchmark corporate bonds default over the sample period. Only 2% of municipal, sovereign, and financial bonds default, but an astonishing 14% of structured tranches default. This percentage varies considerably by the underlying asset type: 20% of ABS, 29% of CDOs, 15% RMBS and only 4% of CMBS default. No tranches of the PF deals default over our sample period. We provide greater detail on defaults by asset class over time in Figure 4.

[Insert Table II here.]

The correlation matrix in Table II suggests multicolinearity among the descriptive variables and asset classes. Table I 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 maturity length. As expected, structured products are strongly 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 presented in Table IV below 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.

[Insert Figure 1 here.]

We plot annual issuance volume in our sample by asset class in Figure 1. Because the sample of municipal issues is incomplete, this figure represents our sample, not the overall fixed income market. However, we believe our structured products sample is complete and Figure 1 clearly indicates the growth in this sector. Figure 2 provides greater detail of initial ratings for each asset class and how these evolved over time. In each panel, the proportions are cumulative with the issues rated Aaa appearing at the top, Aa second from top, and so on.

[Insert Figure 2 here.]

Several interesting patterns emerge from Figure 2. Sovereign issues (Panel C) were generally investment grade (Baa or higher) prior to the wave of sovereign crises beginning in the

mid-1990's.[17] Panel E contains tranches of all structured issues and provides detail regarding the change in initial ratings of these products over time. Proportionally, the greatest increase is in the Baa tranches, which are the lowest investment grade ratings. As explained above, the investment grade threshold has important implications for regulatory compliance for financial institutions and other institutional investors. Virtually nonexistent prior to 1990, the Baa tranches represent 10.2% of structured issues in 1999, grow to 15% in 2000 and peak at 26% in 2006 before declining back to 5 and 7% in 2009 and 2010. Conversely, 95% to 100% of tranches in the earliest years of the sample received Aaa ratings. This proportion declined to 52% in 1995, ranging from 50% to 65% thereafter.[18] We break down the broad structured finance category in Panels E.1 through E.5. These individual figures display similar qualitative patterns to the pooled figure in Panel E. The one clear departure from typical is Panel E.4 containing Public Finance issues which are consistently rated Aaa or Aa.

B. Moody's revenue by asset class

In Figure 3, we plot annual revenue by asset class as reported in Moody's 10-K filings.[19] By 2005, revenues generated by rating structured products ($709M) are 2.5 times revenues generated by rating corporate bonds ($277M). By 2008, the difference became smaller ($405M and $307M, respectively). By 2009 revenues from corporate bonds once again surpassed those

[17] See Bartram, Brown, and Hund, (2007) for details on the Mexican crisis (December 1994), Asian crisis (July 1997), Russian crisis (August 1998), LTCM crisis (September 1998), the Brazilian crisis (January 1999) and the disruption to the financial system following the appalling attacks on the U.S. in September 2001.

[18] Although the proportion of Aaa decreased over our sample period, the total volume of Aaa rated structured products increased (combine Figure 1 and Figure 2) consistent with the predictions of Opp, Opp, and Harris (2012).

[19] Prior to 2007, Moody's combined revenue from financial and sovereign issuers into one asset class, "Financials and Sovereigns". In 2007, Moody's began including revenue from sovereign issuers in "Public Finance" along with revenues from local governments. In an effort to display consistent revenue classifications through time, we estimate the revenues attributable to sovereign issuers in 2007-2010 and add it to financial institutions to estimate "Financials and Sovereigns" as reported by Moody's prior to 2007. Specifically, we note that in 2006, the last year before the switch, revenue from sovereign (financial) issuers constituted 10.5 (89.5) percent of "Financials and Sovereigns". Assuming a constant proportion going forward, we reconstitute "Financials and Sovereigns" for the years 2007 through 2010 by dividing "Financial Institutions" by 0.895. For the same years, we subtract from "Public Finance" an amount of revenue equal to the difference between our estimate of "Financials and Sovereigns" and "Financial Institutions" as reported by Moody's. Ignoring the reclassification does not alter relative rankings throughout the entire 2000-2010 period; public finance remains the lowest source of revenues with or without the sovereign segment and corporate issues and structured products remain the top-two revenue generating asset classes.

of structured products. Taken together, Figures 1, 2, and 3 suggest that Moody's greatest reliance on structured products occurred between 2000 and 2007. Following the collapse of the structured finance market in 2008 (Figure 2), corporate issuers are again the primary source of revenue generation (Figure 3). Public Finance is always the least relevant source of Moody's revenue. Motivated by the model of Fulghieri, Strobl, and Xia (2010), we hypothesize that raters enhance revenue and reputation through more stringent rating standards of lower-paying clients. Figure 3 is consistent with this hypothesis.

[Insert Figure 3 here.]

C. Defaults by asset class through time

We provide more detail regarding default frequency over time in Figure 4. Prior to the year 2000, the graph depicts low default frequency in general, with corporates higher than financial services and a trivial incidence among municipals. Corporate defaults correspond generally with NBER business cycles.[20] 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 most recent financial crisis is apparent in the default frequency of tranches of structured products, although corporate issues and financial institutions also reach in-sample peaks.

[Insert Figure 4 here.]

IV Ratings Performance and Comparability across Asset Classes

In this section, we compare asset classes according to various rating performance metrics. In order to ease interpretation, we employ bonds issued by corporations (industrials and transportation firms) as our benchmark. Although we find that they perform similarly in general, we consider financial institutions' issues separately from corporate issues because Moody's reports them as a separate category (see Figure 3). We analyze structured finance deals at the

[20] NBER reports an 8 month contraction July 1990-March 1991, an 8 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

tranche level because it is possible for tranches to perform differently; i.e., Moody's could downgrade a B1-rated tranche without downgrading the Aaa-rated tranches in the same deal. Distinct types of underlying assets may vary in terms of deal complexity and the various issuer types also contribute differently to CRA revenue. We thus break structured products into various deal types in most analyses. Further, we recognize that the tranches of any particular deal are not entirely independent of one another. Thus, in regression models, we cluster standard errors at the issuer level (for corporate, municipal, sovereign, and financial issues) and deal level (for tranches of structured products).

A. Default percentages by asset class and initial credit ratings

We document the frequency of default by initial ratings across asset classes in Table III. That is, we report the percentage of bonds issued Aaa (or Aa, etc.) that later default within our sample period separately for each class. To avoid small sample biases, we required at least 100 issues per asset class-initial rating for admission to this analysis. Moody's intends its ratings to be ordinal in nature; Moody's (2002b). If properly ordinal, we should find the default frequency strictly decreasing in credit ratings. This pattern appears to be the case for the corporate issues and, to a general extent, the other asset classes. The 4.13% default rate among A-rated financial bonds is striking, as are the high default rates among investment grade tranches of the structured products, including Aaa.

[Insert Table III here.]

Table III clearly indicates a material difference in the absolute credit risk implied by any given rating across asset classes. For example, consider the default frequencies in the A range: corporations 0.51%, municipals 0.00%, sovereigns 0.00%, financials 4.13%, and structured tranches 26.97%. The decomposed structured products better indicate the problematic issue types. The pervasive defaults of investment grade tranches are primarily among ABS, RMBS and CDO tranches. The defaulting CMBS tranches were largely issued with speculative grade ratings. There are no defaults among any of the Public Finance tranches.

B. Transition matrices

In order to better understand the path from investment grade to default, and to better appreciate the variation in ratings migration by asset class, we report ratings transition matrices in Table IV. Transition probability matrices sometimes report ratings migration frequencies as percentages of the initial rating total. We choose instead to report ratings migration using the number of issues in each ratings bin five years after the original date of issue. Reporting the number of issues rather than percentages allows the reader to better visualize the relative mass across asset classes and across ratings bins within each class. The sum column conveys the relative likelihood of each initial rating and allows for comparisons across asset classes. We also summarize the percentages of upgrades and downgrades by initial rating in the rightmost columns.

[Insert Table IV here.]

We begin by reporting migration of ratings among corporate issues (Panel A) as they serve as our benchmark for comparison. First, we note the disparity between upgrade (6.63%) and downgrade (19.06%) frequencies which is consistent with a bias at the time of issuance in favor of issuing corporations from whom Moody's receives compensation. This bias is consistent with the conclusions that Moody's caters to issuing firms (Kraft, 2010 and Bruno et al., 2012) and that Moody's favors Type I classification errors (Cornaggia and Cornaggia (2012)). We also note a higher downgrade frequency among the higher ratings and higher upgrade frequency among the lower ratings. This apparently "contrarian" rating migration is not surprising as both ends of the rating distribution (Aaa and C) can only change in one direction.

The migration of municipal bond ratings in Panel B is remarkably different from that of corporate bonds. First, we note that although municipal issues have a higher percentage of initial ratings in the upper echelon (33.65% Aaa and 50.80% Aa), they are far less likely to downgrade (2.64%) than corporates and more likely to upgrade (9.14%) than corporates. Moreover, unlike the "contrarian" ratings changes among corporate issues (higher downgrade frequency among

the higher ratings and higher upgrade frequency among the lower ratings) the municipal bonds exhibit ratings changes better characterized as "momentum" (higher downgrade frequency among the lower ratings and higher upgrade frequency among the higher ratings). Nearly one half of municipal bonds initially rated A are subsequently upgraded to Aa. It is important to note that our sample precedes Moody's advertised recalibration following the introduction of Dodd-Frank legislation. The upgrades we document between 1980-2010 are on the original, more granular, municipal scale.

The migration of sovereign issues in Panel C more closely resembles that of municipal bonds than corporates with a 8.40% (11.08%) frequency of downgrades (upgrades) and a relatively high incidence of upgrades among the upper echelons (13.90% of Aa-rated issues and 19.90% of A-rated issues are upgraded). Financial issues in Panel D behave similarly to corporates (23.11% downgrade with a "contrarian" migration pattern), although the frequency of upgrades is higher (12.00%). The ratings migration in Panel E suggests 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. The rating inflation appears most severe among the CDOs (62.39% downgraded versus 2.20% upgraded) followed by RMBS (45.61% downgraded versus 3.45% upgraded) and ABS (36.30% downgraded versus 2.53% upgraded). The inflation among CMBS at issuance (32.23% downgraded versus 8.78% upgraded) appears slightly less egregious than the aforementioned structured product types, and the Public Finance tranches appear more evenly split (15.04% downgraded versus 6.03% upgraded).

C. Transition metrics

A drawback of the transition matrices in the previous section is they combine the performance of credit ratings over the entire sample period. This analysis clearly demonstrates that ratings of asset classes have behaved differently over the last three decades, but it does not allow us to specify the periods of time in which the individual asset classes experienced the

greatest and least amounts of transition, nor whether the differences in transitions across asset classes are statistically significant. This section extends the analysis in the previous section by calculating annual transition metrics – scalars that summarize the amount of transition exhibited by the ratings of each asset class and each year of issuance – and standard errors to assess statistical significance.

We begin by creating five-year transition matrices similar to those in Table IV, but for each asset class and each year of issuance. For example, instead of creating one five-year transition matrix for all corporate issues as in Panel A of Table IV, we separately create 26 five-year transition matrices for corporate issues. That is, 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 to A, 10 migrated 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 Ba), 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 things. 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 add them together for the final metric. 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 metric for this example would be: $-1.00 \times 0.25 + -0.40 \times 0.75 = -0.55$. This metric succinctly conveys that Moody's generally downgraded the 400 corporate bonds issued in 1999. If the metric had been positive, this would indicate Moody's generally upgraded the bonds. The domain of this metric is [-9,8]. A metric 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 metric 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 metrics for each asset class and each year of issuance and plot them in Figure 5. To avoid clutter, we separately plot each asset class' time series of transition metrics in separate panels along with the transition metrics for corporate issues for comparison. We

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

[Insert Figure 5 here.]

Panel A plots the transition metrics for municipal and corporate issues. The results indicate Moody's tends to downgrade corporate issues more than it downgrades municipal issues over the entire sample period. Indeed, for 24 of the 25 years of issuance, corporate issues exhibit greater downward transitions. In 18 of those years, the difference between the municipal and corporate transition metrics is statistically significant. Only for the 1986 vintage do municipal issues experience greater downgrades than corporate issues, and the difference is not statistically significant. Panel B plots the transition metrics for sovereign and corporate issues. Similar to the results for municipal issues, the results indicate Moody's tends to downgrade corporate issues more than it downgrades sovereign issues. For 23 of 24 years of issuance activity, corporate issues exhibit greater downward transitions. In ten of those years, the difference between sovereign and corporate transition metrics is statistically significant. Taken together, the results indicate corporate issues receive more generous ratings at issuance than municipal or sovereign issues, and this pattern is pervasive throughout our sample period. Panel C does not suggest systematic ratings inflation of corporate issues relative to financial issues over the sample period—in some years corporate bonds tend to downgrade more, in other years they tend to downgrade less. Panel D suggests little ratings surveillance (or few changes in credit quality) among the early vintages of structured products. However, structured products issued in the later years of the sample experienced massive downgrades.

D. Hazard rate models

This section formally tests differences in probabilities of ratings changes across asset classes by comparing hazard rates for downgrades and upgrades. Specifically, we denote the instantaneous downgrade (or upgrade) rate for bond j as $h_j(t)$ and estimate:

$$h_j(t) = h_0(t)\exp(\beta X) \quad (1)$$

for a vector of covariates X. This approach is a single-failure Cox proportional hazard model with "failure" denoting a downgrade (upgrade), the unit of observation being the time until a downgrade (upgrade) for each rating change, and allowing observations to exit or censor upon upgrade (downgrade), maturity, default, or the end of the sample period. For the vector of covariates X representing dummy variables corresponding to membership in various asset classes, the coefficient β represents the proportional shift in the instantaneous baseline downgrade/upgrade intensity, which we set to correspond to corporate bonds. For example, β_i = 2 would indicate asset class i has a downgrade rate which is twice that of corporate bonds; β_i = .5 would indicate that asset class i has a downgrade rate half that of corporate bonds.[21] Coefficients for all asset classes statistically insignificant from 1 imply strict ratings comparability in the sense that the distributions of ratings changes are indistinguishable from those of corporate issues.

Table V presents the results of Cox regressions on ratings changes over the full sample period for all ratings changes and for subsamples of ratings changes originating from investment and speculative grades. We recognize that ratings changes are not independent within or across asset classes. We cluster standard errors separately by year, by issue, by issuer, and report the most conservative (largest standard errors are obtained by clustering at the issue-level) in Table V. We observe that ratings change intensities differ across asset classes. All but two coefficients in the table are significant, most are different from the baseline at the 1% level. Insignificant coefficients are reported only for the 1.4% of municipal bonds and the 15.7% of sovereign issues that are issued with speculative grade ratings.

[21] This specification implies that significance testing is versus the null of $\beta_i = 1$.

[Insert Table V here]

Note the pattern across the full sample of low relative downgrade intensities and high relative upgrade intensities for municipal and sovereign bonds and exactly the opposite pattern for structured products, with ABS and CDOs exhibiting especially high downgrade intensities. The full sample results clearly reflect the 98.6% of municipals and 84.3% of sovereign issues that are issued with investment grade ratings.

Instances where upgrade and downgrade intensities are both greater than the baseline corporate issues point to highly volatile yet unbiased (relative to corporate issues) ratings changes, which is the case for the financial asset class. Such a pattern might emerge if these bonds were more opaque than corporate issues; it is much harder to reconcile the pattern of higher downgrade and lower upgrade intensities exhibited by all the other asset classes with theories of asymmetric information. Overall, this table suggests that initial ratings for municipal and sovereign bonds are too low relative to corporate bonds, ratings for structured products, especially CDOs, are too high, and financial institutions are more volatile.

A potential drawback of using all ratings changes as observations is that the estimation could be skewed by differences in ratings momentum across asset classes.[22] In Table VI we limit the sample to the first rating change after issuance to more directly measure the potential implied bias in the initial rating. The results are broadly similar to the results in Table V. The first ratings changes of municipal and sovereign bonds are significantly lower for downgrades and higher for upgrades relative to corporate issues. The evidence also strongly suggesting initial ratings were biased in favor of at least the CDO class of structured products. Other structured products fare much better, although ABS and RMBS securities have skewed upgrade and downgrade relative intensities. Financial bonds continue to have much higher upgrade and downgrade relative intensities, again consistent with higher issuer opacity in this asset class. Overall, the results

[22] Lando and Skodeberg (2002) document significant ratings momentum using a method similar to our Cox regressions.

strongly reject the idea that ratings changes are comparable across asset classes, and also support the notion that initial ratings on municipal and sovereign classes were too low, and those on CDOs were too high relative to corporate issues.

[Insert Table VI here.]

Differential ratings changes are obviously dominated by changes during the financial crisis period of 2007-2010 where large numbers of downgrades clearly affect the downgrade intensity rate. Table VII confirms this effect by presenting results for ratings changes for full samples by time period. Nearly half of the ratings changes occur after 2006, reflecting both the massive waves of issuance in the 2000-2006 period and the rush to downgrade during the financial crisis. During the crisis, all structured products and financial institutions face far higher downgrade intensities than the baseline corporate intensity. Municipal and sovereign bonds maintain significantly lower downgrade intensities than corporate bonds across all periods. Sovereigns face higher upgrade intensities in all periods. Municipals' relative upgrade intensity varies across periods.[23] The high-revenue-generating CDOs appear over-rated even in the pre-crisis period with their downgrade intensity only decreasing to that of corporates during the "boom" period of 2000-2006 and their upgrade intensity significantly lower than that of corporate issues throughout the entire sample period.

[Insert Table VII here.]

Results from the Cox proportional regression framework overwhelmingly reject the hypothesis of ratings comparability, and are highly suggestive of bias in initial ratings for municipal, sovereign, and structured products relative to the corporate benchmark. These biases correspond directly to the fees associated with rating each asset class, with municipal and sovereign bonds persistently underrated and structured products (especially CDOs) persistently

[23] The upgrade probabilities would be dramatically higher if our sample included the re-calibration of Moody's bond scale for municipals and the concomitant upgrade of virtually all municipal bonds.

overrated. In addition, asset classes differ not only in levels of ratings and default behavior, but also in their distributions of ratings changes and their volatility. Credit risk models (such as CreditMetrics) that use ratings transition matrices as an input yet ignore asset classes will not only under- or over-estimate ratings volatility, they will also have biased distributions of rating change intensities.

E. Rating change regressions

Table IV demonstrates migration from initial rating by asset class and summarizes upgrades and downgrades in a binary sense. We further explore the extent of these ratings changes by asset class using discrete (but not binary) ratings changes as the dependent variable in the regression models found in Table VIII. For ease of interpretation, corporate issues are again employed as the benchmark class. The dependent variable in Panel A is a discrete variable capturing the magnitude and direction of ratings changes (measured in ratings notches) for each issue from the time of issuance until the bond matures, defaults, or until the end of available data. Our numeric conversions of ratings are increasing in credit quality; i.e. Aaa = 21 and C = 1. Therefore, if a bond was issued with a rating of Aaa (21) and matured with a rating of Aa2 (19), its rating change would be -2. This specification means positive coefficients correspond to upgrades over the life of the bond and negative coefficients correspond to downgrades over the life of the bond.

Results from the full sample indicate that, relative to corporate issues, municipal and sovereign bonds are significantly more likely to be upgraded. The corporate bond coefficient is negative and significant (-1.935) suggesting an average downgrade of nearly 2 notches over the life of the bonds. The municipal coefficient is positive and significant (1.484) suggesting an average upgrade of about a notch and a half over the life of the bonds. We confirm that the 3.419 notch difference between the two asset classes is significant. Sovereign issues are also significantly more likely to be upgraded than corporate bonds, and, like municipals, the difference is significant across all time periods.

Although these results hold throughout the sample period for the municipal and sovereign issuers, there is a marked change in the year 2000 for the structured products. In fact, the negative coefficient in the full sample is driven by bonds issued after Moody's went public in the year 2000. Tranches of structured products issued between 2000 and 2006 downgrade an average of 3.219 notches; tranches issued after 2006 downgrade 5.226 notches over the life of the issue. Prior to 2000, structured products generally experienced upgrades (0.763 notches). Each of these ratings changes differs significantly from the corporate bonds issued in the same time periods. In the full sample, ratings of financial institutions appear similar to those of the corporate issues but again with variation over time. Given the financial crisis of the era, it is not surprising that bonds issued by financial institutions after 2006 were more likely downgraded.

[Insert Table VIII here.]

The independent variable in Panel B is a binary variable indicating a downgrade from investment to speculative grade. Therefore, only bonds issued with investment grade ratings participate in the tests that follow. (One can get a sense for the large fraction of the sample that has investment grade ratings by comparing the sample sizes in Panels A and B of Table VII.) Panel A suggested significant downgrade activity among corporate issues, but here we see that corporate issues are less likely to be downgraded to speculative grade than sovereign, financial, and structured issues in the full sample. Crossing the investment grade threshold has important consequences for regulated institutional investors (Ellul, et al., 2010). Only municipal bonds were less likely downgraded into speculative territory than were corporate bonds. While the differences in coefficients suggest that corporate bonds are less likely downgraded into speculative territory in each time period than structured products, we again observe a marked difference in structured products issued after the year 2000.

[Insert Table IX here.]

The dependent variable in Table IX is the same as in Panel A of Table VIII. However, in Table IX, we decompose structured products based on their underlying assets. We again employ corporations as the benchmark asset class. This table indicates that the higher downgrade intensity of structured products relative to corporate issues is driven by CDOs, RMBS, and to a lesser extent ABS. Conversely, ratings of CMBS and Public Finance tranches are more likely to be upgraded than corporate issues. Overall, the regression results reported in Tables VIII and IX generally are consistent with more stringent ratings of the municipal and sovereign issues at issuance and more generous rating of structured products, those issued after 2000 in particular.

F. Cumulative distributions of default prediction ability and accuracy ratios

Perhaps the most common metrics of ratings performance are empirical cumulative distributions of default prediction and accuracy ratios (see Cantor and Mann (2003)). Figure 6 displays cumulative distributions of default and the corresponding accuracy ratios for the five main asset classes in our sample (Panel A), as well as individual structured product types (Panel B). For each asset class and type of structured product we count the number of bonds with a given credit rating as of January 1 of any year of the sample and the number of those bonds that default over the following year. For each credit rating, we divide the full sample count of defaulted bonds by the full sample count of bonds. This approach calculates a default percentage associated with each rating. Panels A and B plot the cumulative distribution of these percentages for each asset class and type of structured product, moving from the lowest credit rating to the highest. The solid black line in both panels represents the cumulative distribution of ratings that have no predictive content. In other words, if Moody's randomly assigned credit ratings, then we would expect equal percentages of defaults among the ratings, and the solid black line representing a uniform cumulative distribution function would emerge.

[Insert Figure 6 here.]

In Panel A, the cumulative distribution for municipal bonds lies higher and further to the left than the other four asset classes. Table I indicates that the default rate among our municipal bonds is only 2%. Figure 6 suggests that Moody's does a good job identifying them. Closest to the cumulative distribution for municipal bonds is that of corporate bonds. The cumulative distribution for tranches of structured products lies closest to the "randomly assigned" cumulative distribution. This pattern obtains because more of the highest-rated tranches of structured products default than similarly highly-rated bonds of other asset classes. Moody's ratings for municipal bonds outperform Moody's ratings of other asset classes in terms of ordinal performance, with ratings of corporate bonds performing second best and ratings of structured products performing the worst. We compute accuracy ratios in order to formally express the difference between these cumulative distributions. Accuracy ratios measure the area between the cumulative distribution and the dashed line. The larger the ratio, the more accurate the ratings are in an ordinal sense. To be concrete, we calculate the accuracy ratios as follows:

$$\textit{Accuracy ratio} = \sum_{k=1}^{N}\left[\sum_{j=1}^{k}\left[\frac{\frac{\textit{Number of issues that default over the next year}_j}{\textit{Number of issues}_j}}{\sum_{i=1}^{N}\frac{\textit{Number of issues that default over the next year}_i}{\textit{Number of issues}_i}} - \frac{j}{N}\right]\right] \qquad (2)$$

N = the number of credit rating classifications (we combine ratings of Caa1, Caa2, Caa3, Ca, and C since so few bonds have these ratings) and i, j, and k are numerical translations of issues' credit ratings. The accuracy ratios for the five asset classes are as follows: municipal bonds = 0.44, corporate bonds = 0.40, sovereign bonds = 0.36, financial bonds = 0.30, and tranches of structured products = 0.16. The accuracy ratios of the individual structured products are as follows: CMBS = 0.33, ABS = 0.17, RMBS = 0.14, and CDO = 0.09. We cannot calculate an accuracy ratio for PF tranches because none defaulted in our sample.

Taken together, the accuracy ratios provide additional evidence that credit ratings across asset classes behave differently. The credit ratings of municipal bonds perform best in terms of ordinal performance, with those of corporate bonds performing second best. The credit ratings of

structured products perform worst in an ordinal sense, with those of CDOs exhibiting the worst performance of the asset class.

V Conclusion

We examine the differential performance of credit ratings across asset classes. We find that rating standards are inversely correlated with revenue generation. Relative to traditional corporate issues, structured finance products generate higher revenues for credit rating agencies and receive significantly higher (more optimistic) ratings. Conversely, municipalities and sovereign issuers generate the least revenue for credit rating agencies and receive significantly lower (more stringent) ratings relative to their corporate counterparts.

Our results contribute to the debate surrounding regulatory reliance on credit ratings that do not reflect absolute credit risk and the associated misallocation of capital. Failure of regulators to distinguish the credit risk associated with A-rated Collateralized Debt Obligations (31.26% default frequency) compared to A-rated corporate issues (0.51% default frequency) and A-rated municipals (none defaulted in our sample) allowed banks, money market and pension funds, and insurance companies to circumvent regulatory safeguards.

Prior research documents the inflated ratings of structured products and their contribution to the financial crisis. Our results and conclusions are robust outside of the crisis period. For bonds issued in all but one year of our 30-year sample, corporate issues exhibit ratings inflation relative to both municipal and sovereign issues. Overall, we conclude that the difference in ratings behavior reflects differences in ratings standards as well as differential reactions to unexpected economic shocks.

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Appendix

A.1. CRA assertion of comparable rating standards across asset classes[24]

"Standard & Poor's strives to make its rating symbols reflect a broadly comparable view of creditworthiness wherever they appear. Standard & Poor's believes that maximizing comparability makes Standard & Poor's' ratings more useful to investors. Thus, when Standard & Poor's assigns a given rating symbol to multiple issuers, it intends to connote roughly the same opinion of creditworthiness, irrespective of whether the issuers are a Canadian mining company, a Japanese financial institution, an Illinois school district, a British mortgage-backed security, or a sovereign nation."

- Deven Sharma, President, Standard & Poor's, February 7, 2011

"To meet needs over time, credit ratings have developed important attributes including insightful, robust and independent analysis, symbols that succinctly communicate opinions, and broad coverage across markets, industries and asset classes. These attributes have enabled credit ratings to serve as a point of reference and common language of credit that is used by financial market professionals worldwide to compare risk across jurisdictions, industries and asset classes, thereby facilitating the efficient flow of capital worldwide."

- Farisa Zarin, Managing Director, Moody's Investors Service, February 18, 2011.

"Fitch's first and primary goal is that over the longer term, default rates will be broadly similar for like-rated securities across all asset classes. As a secondary goal, Fitch aspires to greater comparability of ratings transition/volatility across asset classes, especially at the highest end of the rating scale."

- John S. Olert, Chief Credit Officer, Fitch Ratings, March 7, 2011. (Reference is taken from appended "Ratings Comparability" Special Report dated June 21, 2010, and co-authored by Mr. Olert.)

[24] We collect these quotes from comment letters written in response to the SEC's proposed Credit Rating Standardization: www.sec.gov/comments/4-622/4-622.shtml

A.2. Relevant Sections of Dodd-Frank Wall Street Reform and Consumer Protection Act

SEC. 939A. REVIEW OF RELIANCE ON RATINGS.

(a) AGENCY REVIEW.—Not later than 1 year after the date of the enactment of this subtitle, each Federal agency shall, to the extent applicable, review—
(1) any regulation issued by such agency that requires the use of an assessment of the credit-worthiness of a security or money market instrument; and
(2) any references to or requirements in such regulations regarding credit ratings.

(b) MODIFICATIONS REQUIRED.—Each such agency shall modify any such regulations identified by the review conducted under subsection (a) to remove any reference to or requirement of reliance on credit ratings and to substitute in such regulations such standard of credit-worthiness as each respective agency shall determine as appropriate for such regulations. In making such determination, such agencies shall seek to establish, to the extent feasible, uniform standards of credit-worthiness for use by each such agency, taking into account the entities regulated by each such agency and the purposes for which such entities would rely on such standards of credit-worthiness.

(c) REPORT.—Upon conclusion of the review required under subsection (a), each Federal agency shall transmit a report to Congress containing a description of any modification of any regulation such agency made pursuant to subsection (b).

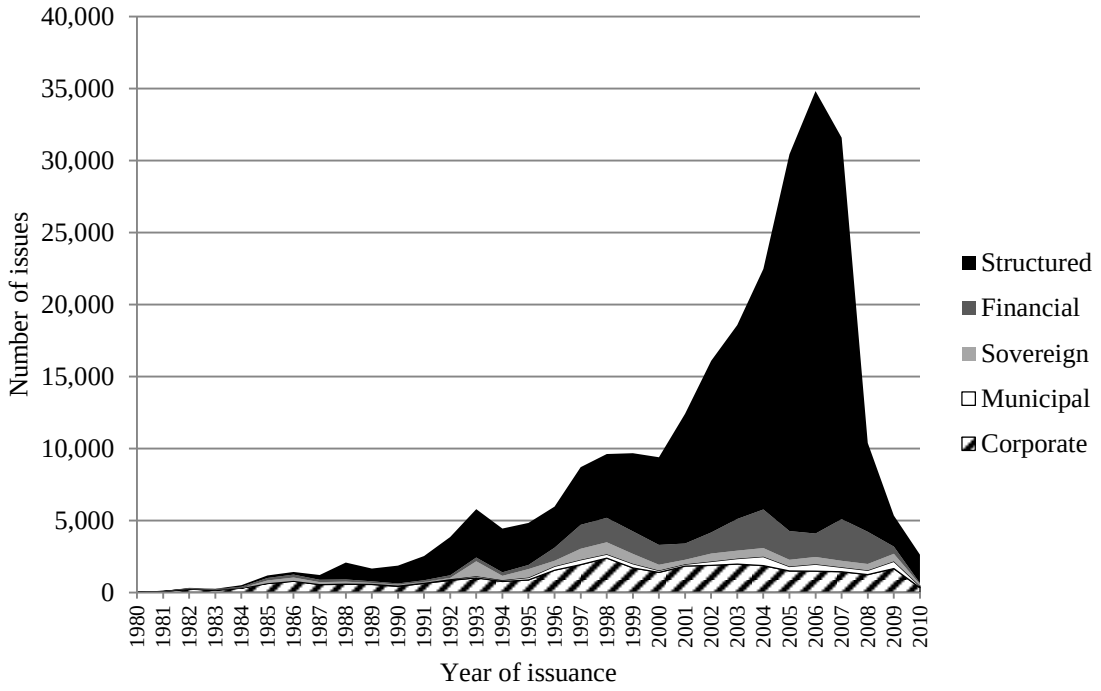
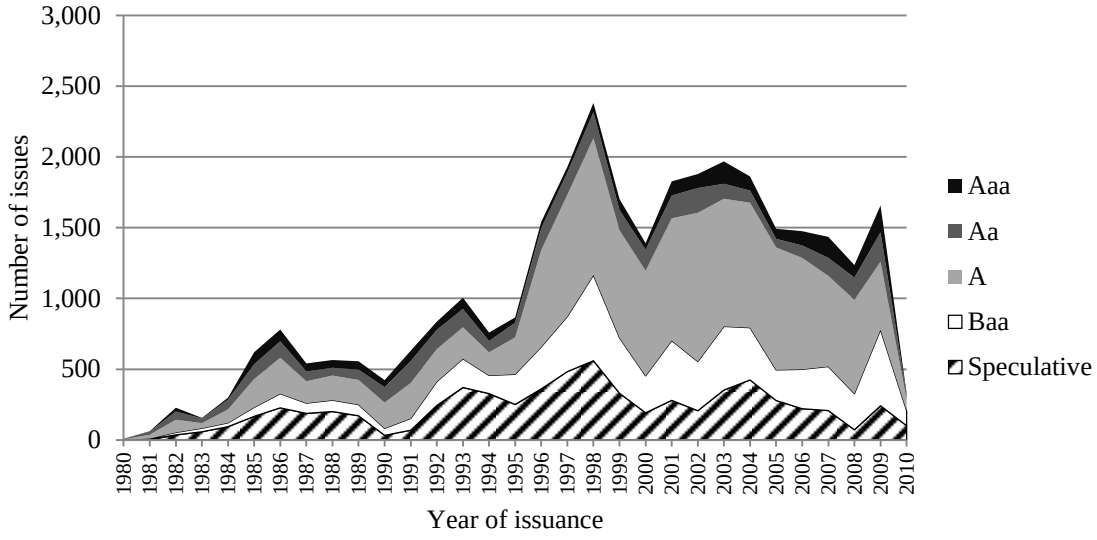
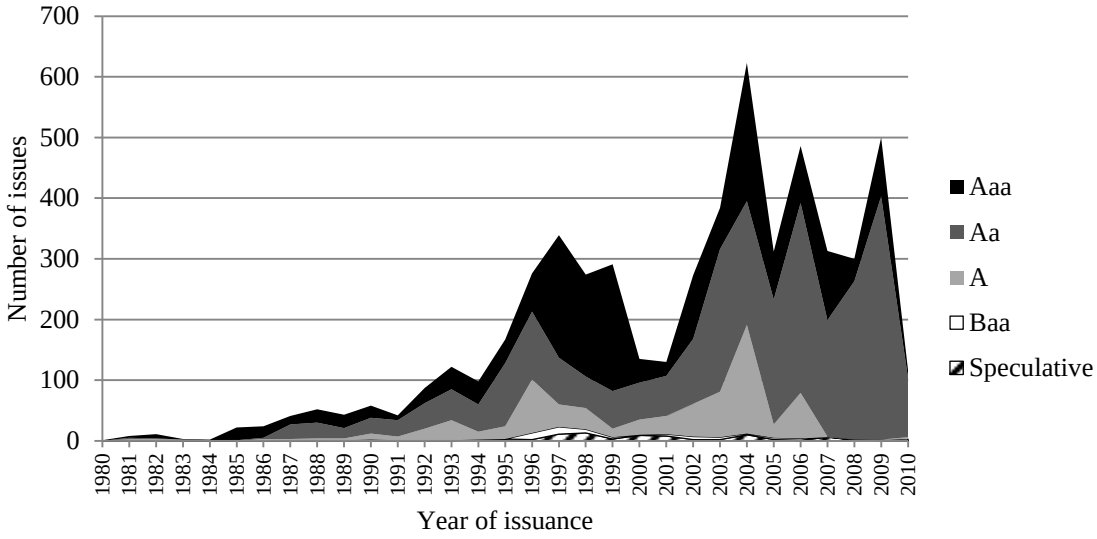


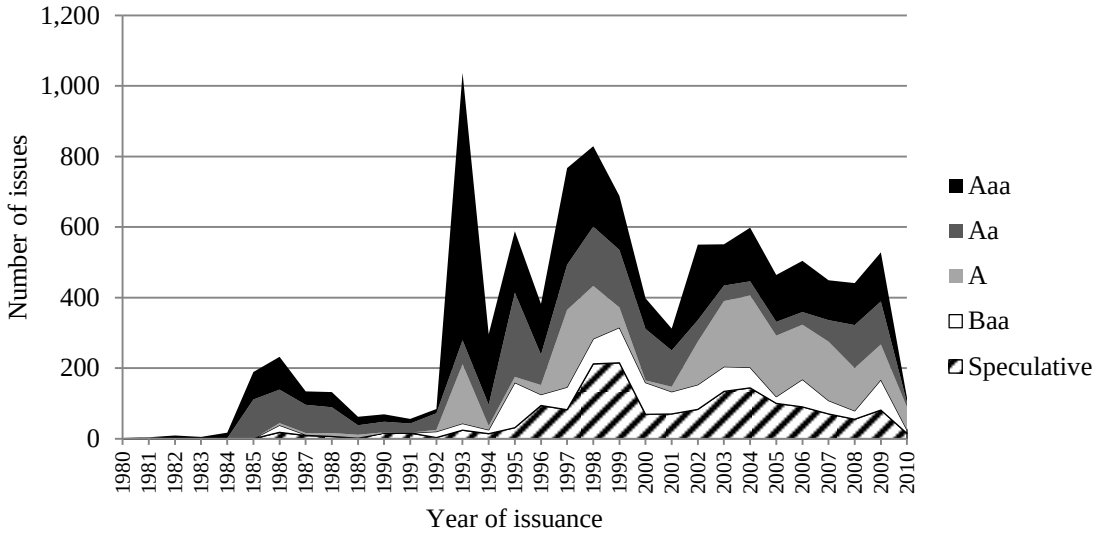
Figure 1
Number of issues by asset class through time
This figure displays the number of issues in our sample rated by Moody's Investors Service every year from 1980 to 2010 partitioned by asset class. The asset classes include tranches of structured products, bonds issued by financial companies (U.S. banks, U.S. bank holding companies, securities companies, and insurance companies), bonds issued by sovereign nations, bonds issued by municipalities, and bonds issued by corporations (industrials and transportation companies). The data come from Moody's Default and Recovery Database, and Moody's Structured Finance Default Risk Service Database.



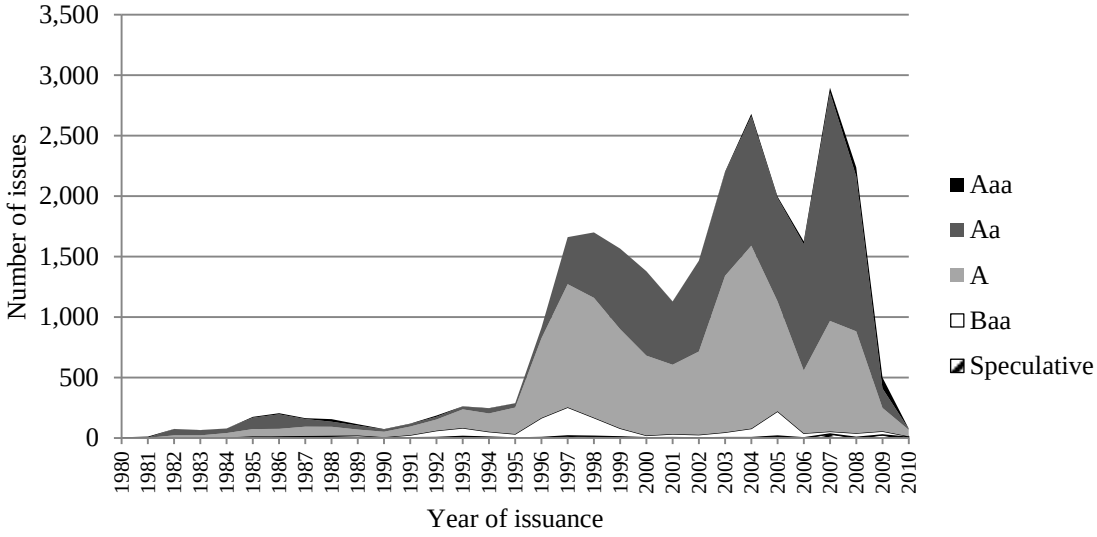
Panel A. Corporate issues



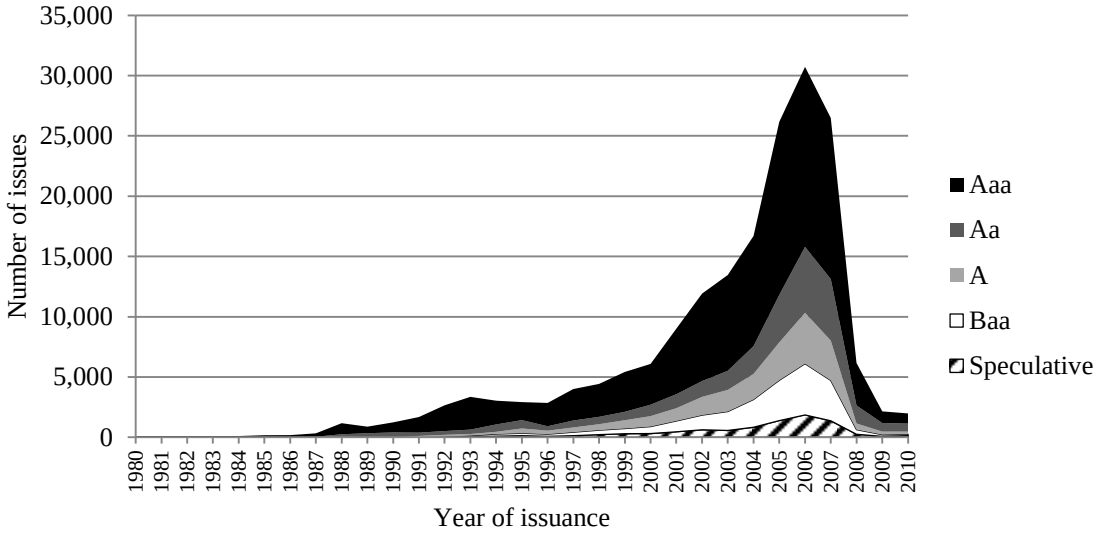
Panel B. Municipal issues



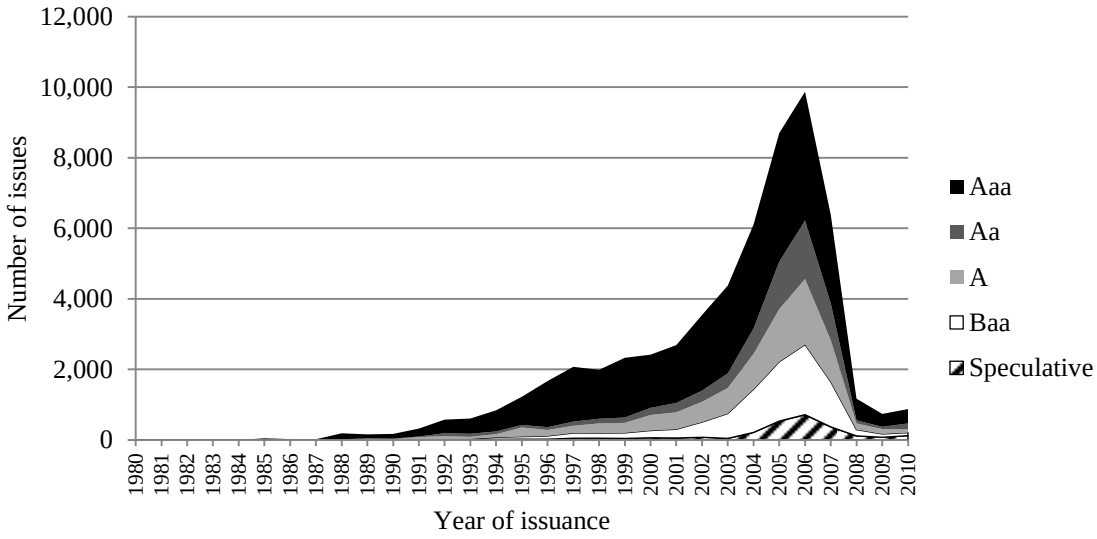
Panel C. Sovereign issues



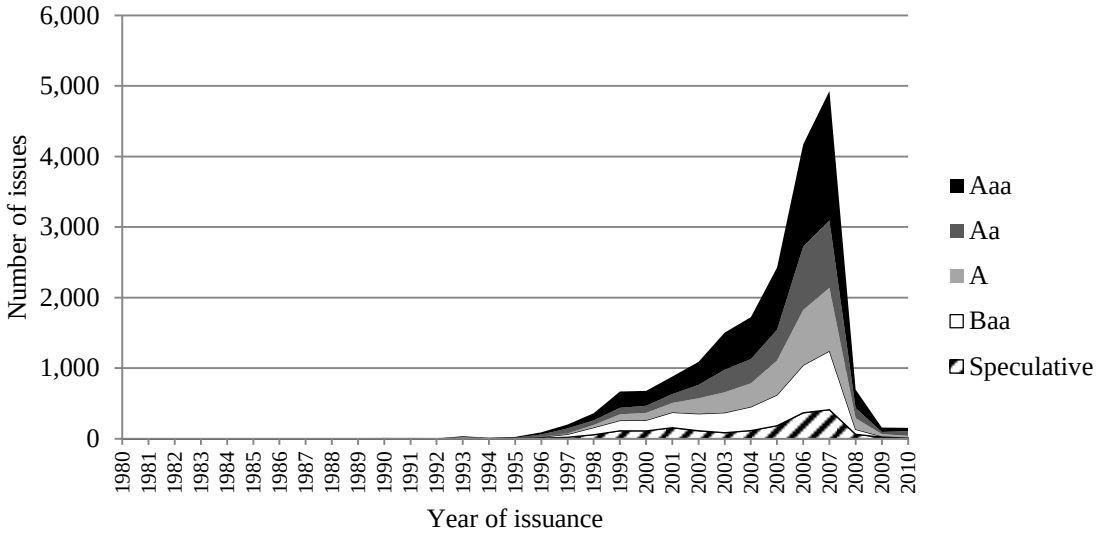
Panel D. Financial issues



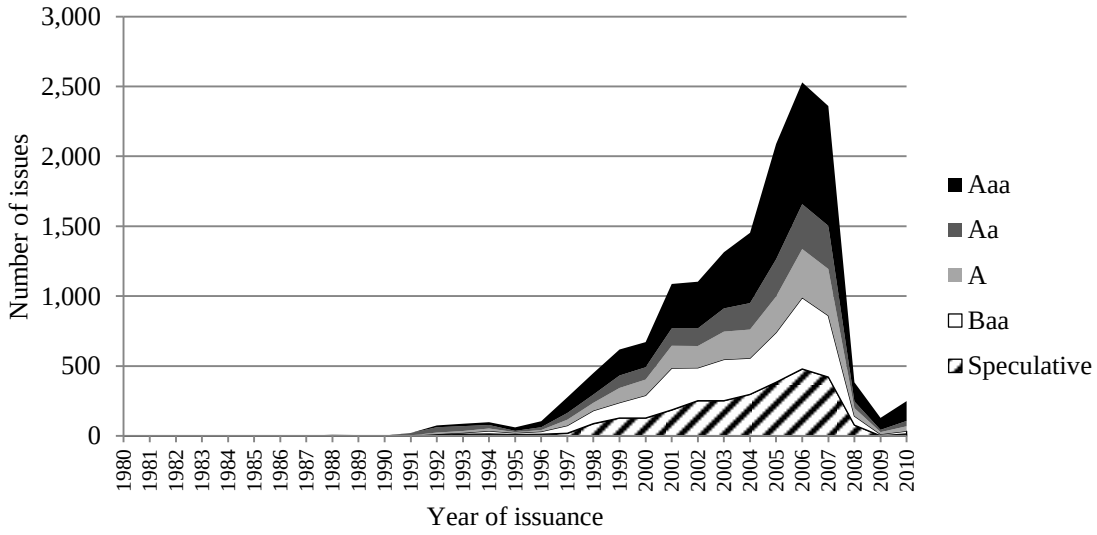
Panel E. Structured issues



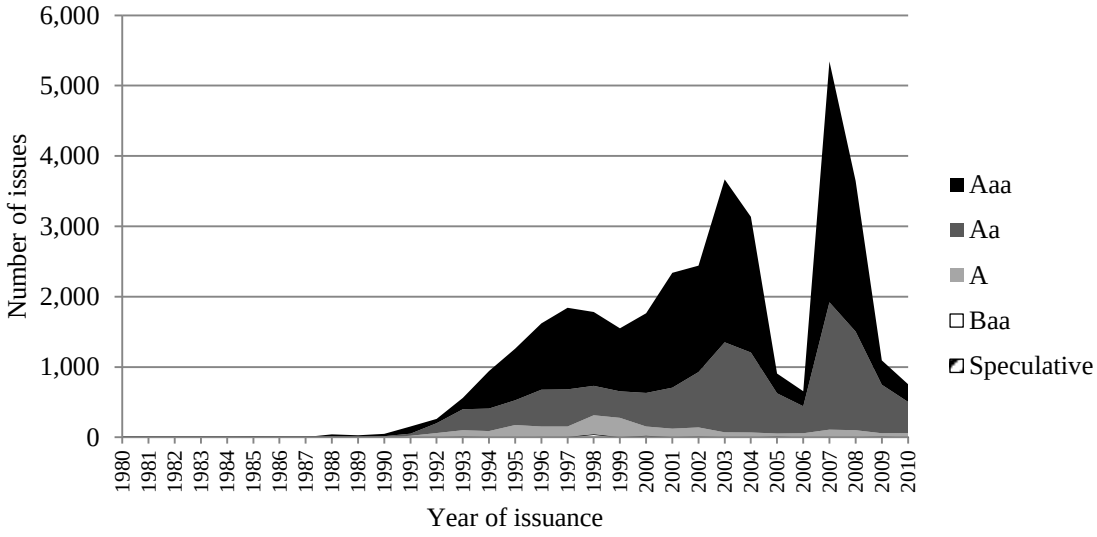
Panel E.1. Structured issues – Asset Backed Securities



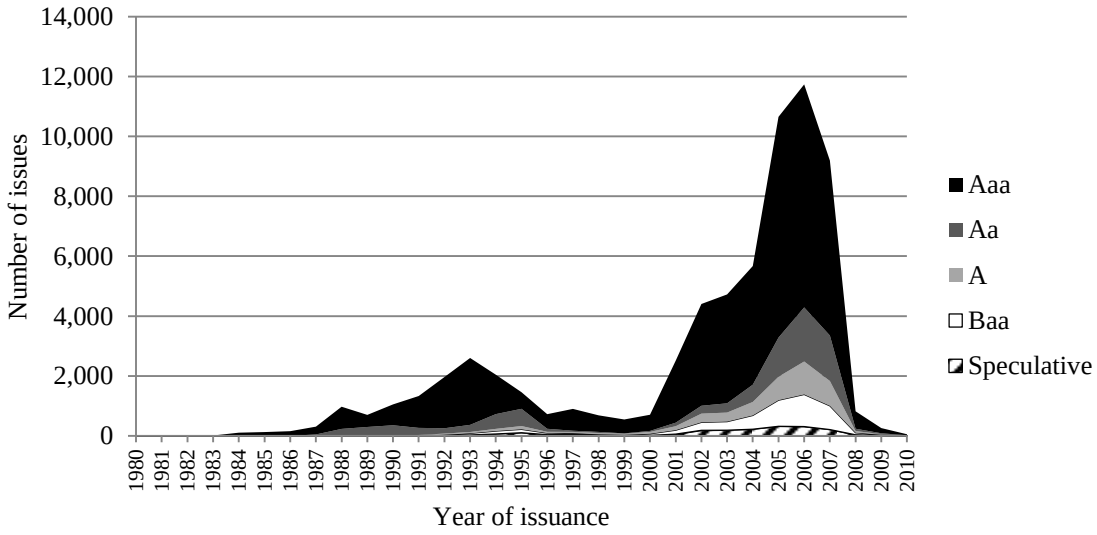
Panel E.2. Structured issues – Collateralized Debt Obligations



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



Panel E.4. Structured issues – Public Finance



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

Figure 2
Number of issues by initial credit rating through time
Panels A through E display the number of new issues rated by Moody's Investors Service every year from 1980 to 2010 for each asset class and initial credit rating. The asset classes include tranches of structured products, bonds issued by financial companies (U.S. banks, U.S. bank holding companies, securities companies, and insurance companies), bonds issued by sovereign nations, bonds issued by municipalities, and bonds issued by corporations (industrials and transportation companies). Panels E.1. through E.5. display the tranches of structured products decomposed into their respective product types: Asset Backed Securities, Collateralized Debt Obligations, Commercial Mortgage Backed Securities, Public Finance, and Residential Mortgage Backed Securities. The data come from Moody's Default and Recovery Database, and 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.

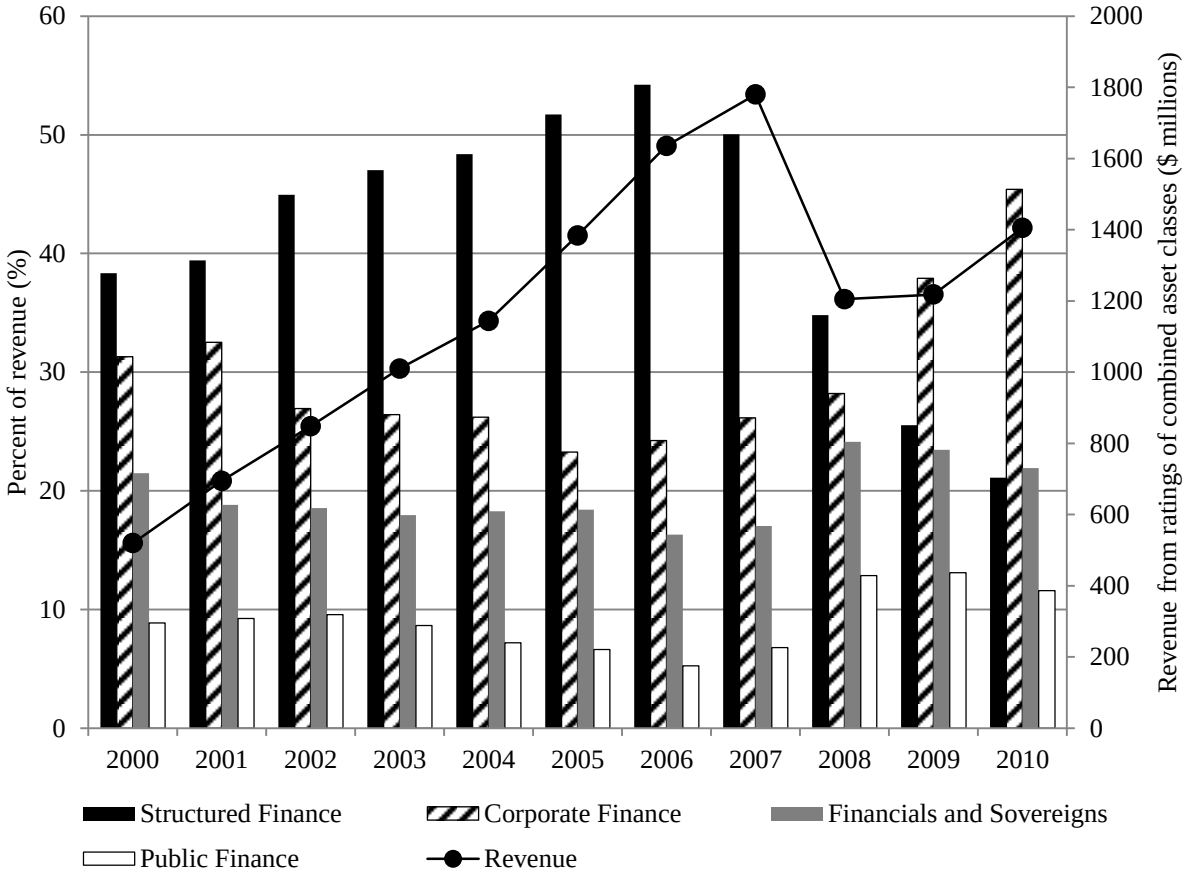


Figure 3
Moody's revenue by asset class through time
This figure displays revenue generated by Moody's from 2000 to 2010 decomposed by asset class. We collect this information from Moody's 10-k filings. Prior to 2007, Moody's combined revenue from financial and sovereign issuers into one asset class, "Financials and Sovereigns". In 2007, Moody's began including revenue from sovereign issuers in "Public Finance" along with revenues from local governments. In an effort to display consistent revenue classifications through time, we estimate the revenues attributable to sovereign issuers in 2007-2010 and add it to financial institutions to estimate "Financials and Sovereigns" as reported by Moody's prior to 2007. Specifically, we note that in 2006, the last year before the switch, revenue from sovereign (financial) issuers constituted 10.5 (89.5) percent of "Financials and Sovereigns". Assuming a constant proportion going forward, we reconstitute "Financials and Sovereigns" for the years 2007 through 2010 by dividing "Financial Institutions" by 0.895. For the same years, we subtract from "Public Finance" an amount of revenue equal to the difference between our estimate of "Financials and Sovereigns" and "Financial Institutions" as reported by Moody's.

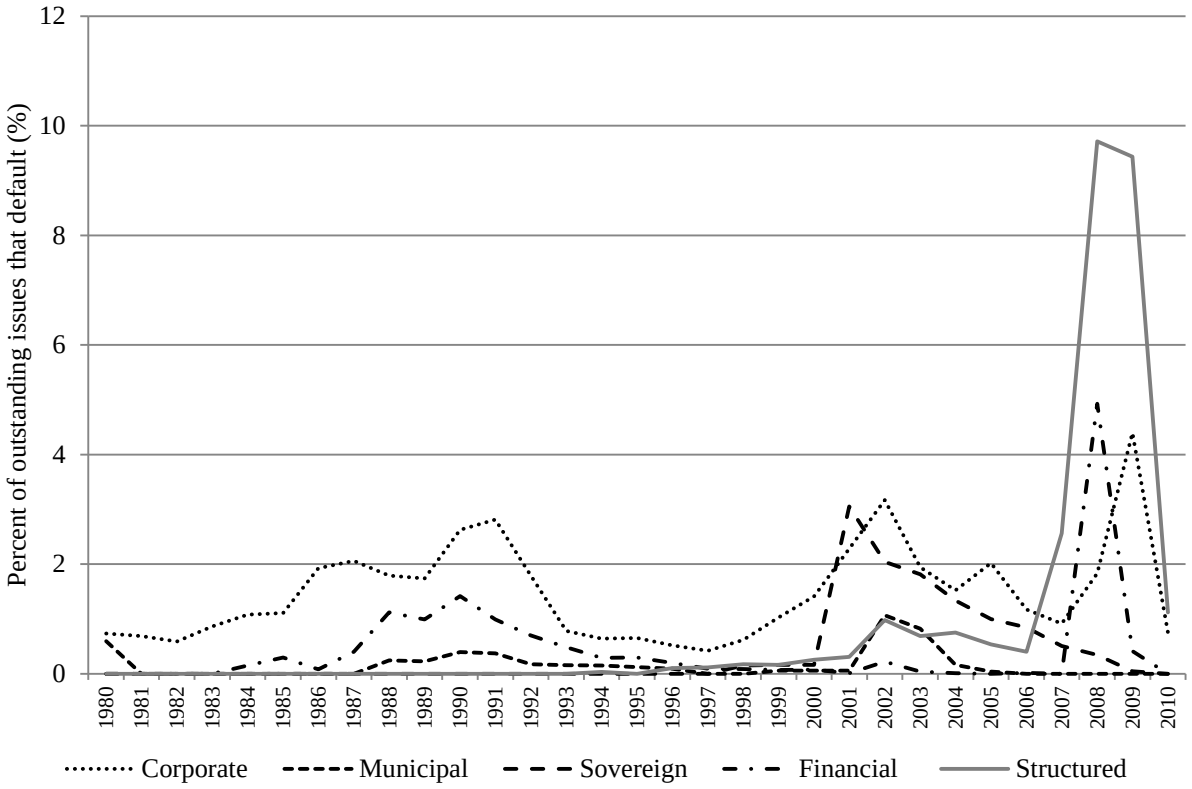
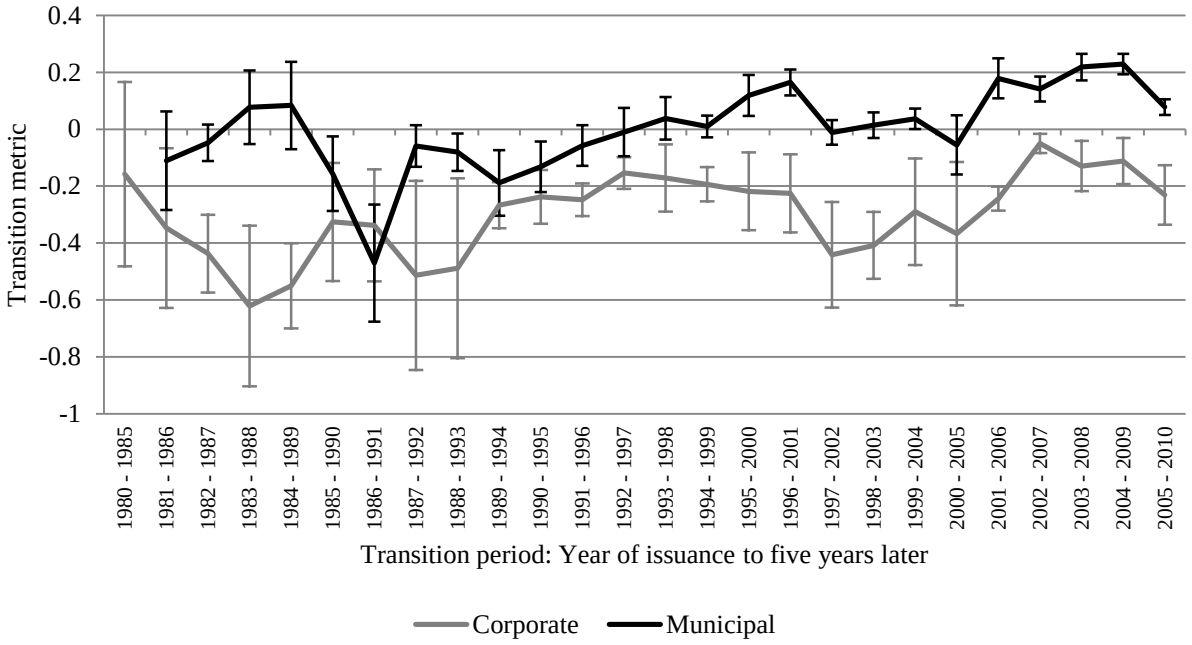


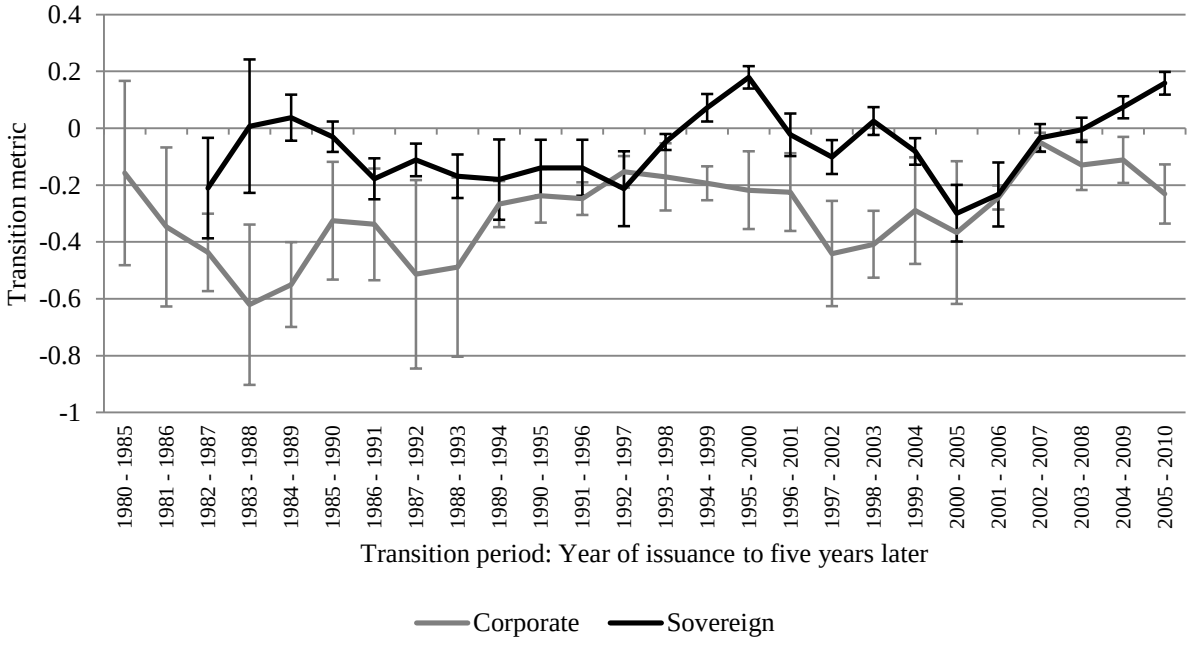
Figure 4

Percent of outstanding issues that default by asset class through time

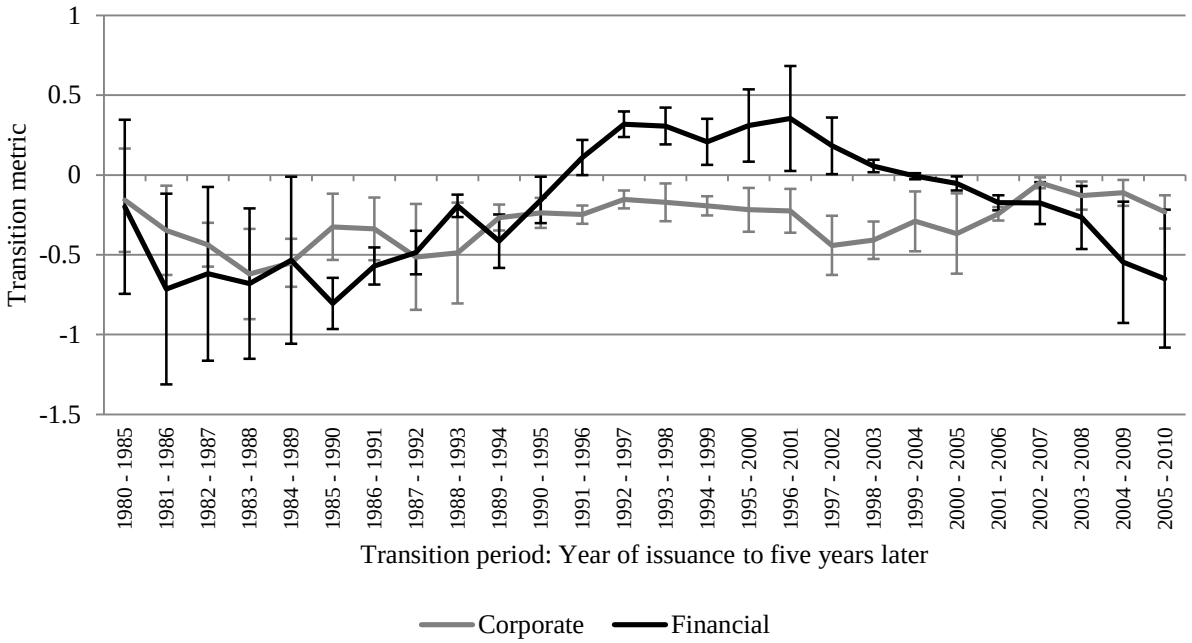
This figure displays the percentage of outstanding issues of each asset class that default within calendar years 1980 to 2010. The asset classes include tranches of structured products, bonds issued by financial companies (U.S. banks, U.S. bank holding companies, securities companies, and insurance companies), bonds issued by sovereign nations, bonds issued by municipalities, and bonds issued by corporations (industrials and transportation companies). The data come from Moody's Default and Recovery Database, and Moody's Structured Finance Default Risk Service Database.



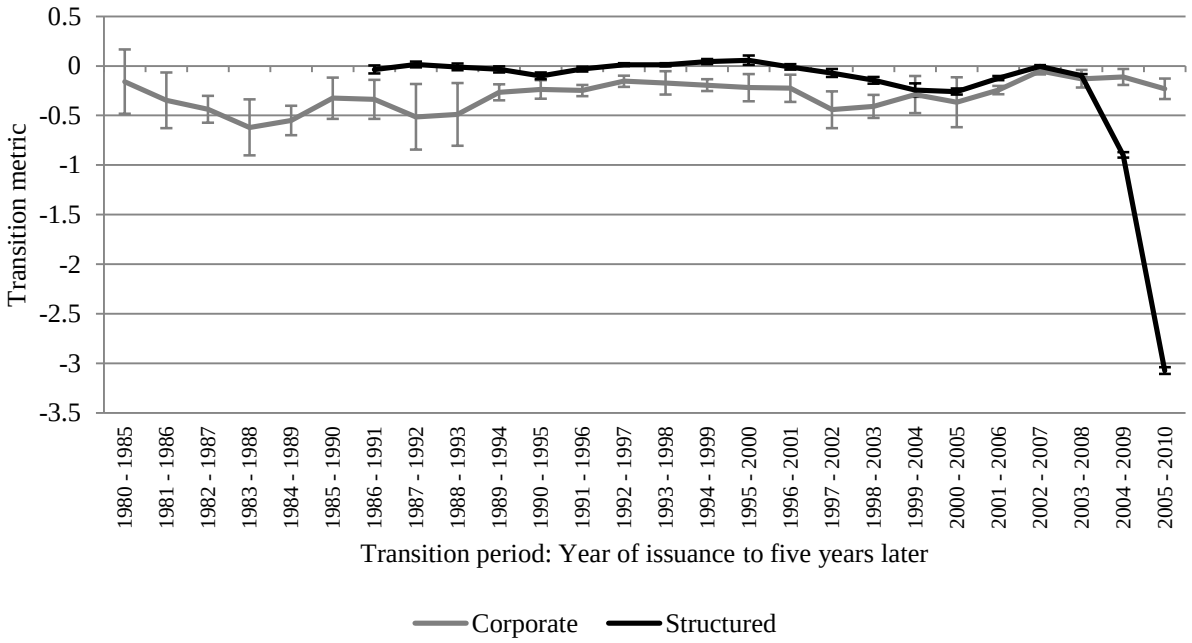
Panel A. Municipal and corporate issues' transition metrics



Panel B. Sovereign and corporate issues' transition metrics

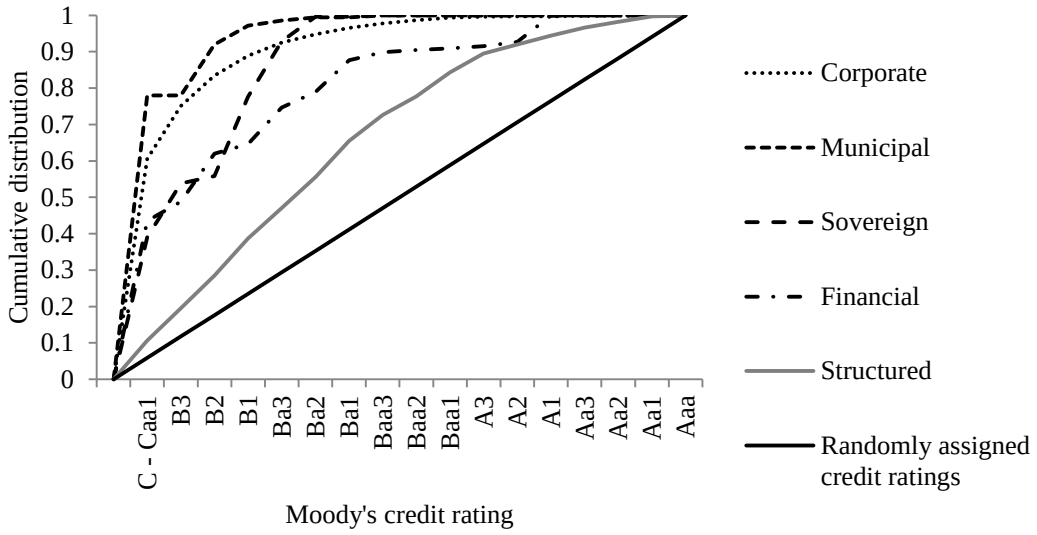


Panel C. Financial and corporate issues' transition metrics

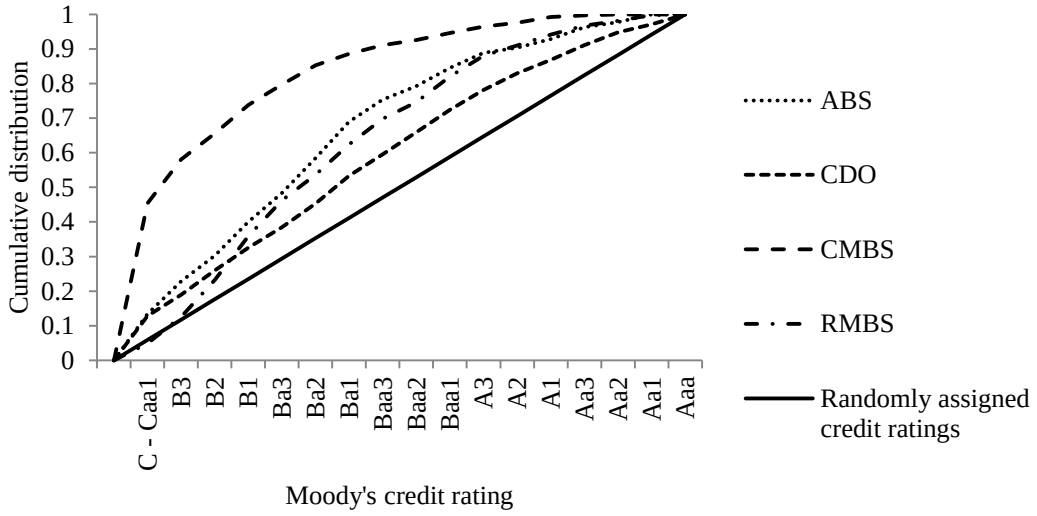


Panel D. Structured and corporate issues' transition metrics

Figure 5
Transition metrics by asset class and year of issuance
This figure displays transition metrics based on five-year transition matrices for each asset class and year of issuance. Each panel includes the transition metrics for corporate issues for comparison purposes. The vertical bars represent 95 percent confidence intervals. We provide a complete description of how we compute the transition metrics and their standard errors in the text.



Panel A. Cumulative distributions of default prediction ability by asset class



Panel B. Cumulative distributions of default prediction ability for structured issues decomposed by product type

Figure 6
Cumulative distributions of default prediction ability

Panel A of this figure plots empirical cumulative distributions of default prediction ability for each asset class (corporate bonds; bonds issued by local and regional governments; sovereign bonds; bonds issued by U.S. banks, U.S. bank holding companies, insurance companies, and securities firms; and tranches of structured products). For each asset class we count the number of bonds with a given credit rating as of January 1 of any year of the sample and the number of those bonds that default over the following year. For each credit rating classification, we then divide the full sample count of defaulted bonds by the full sample count of bonds. The figure plots the cumulative sum of these values, moving from the lowest credit rating to the highest. Panel B plots the same for different types of structured products (Asset Backed Securities, Collateralized Debt Obligations, Commercial Mortgage Backed Securities, and Residential Mortgage Backed Securities).

Table I
Summary Statistics

Panels A through E display summary statistics for debt issues by asset class. The asset classes include bonds issued by corporations (industrials and transportation companies), bonds issued by municipalities, bonds issued by sovereign nations, bonds issued by financial companies (U.S. banks, U.S. bank holding companies, securities companies, and insurance companies), and tranches of structured products. Panels E.1. through E.5. decompose 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 numerical 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 numerical 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. 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	0.02	0.12	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%
Deal characteristics						
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
Tranche characteristics						
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 II
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 the date of issuance and when the debt it matures, assuming it does not default. *Coupon* represents the coupon rate expressed as a percentage. *Initial rating* is a numerical 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 numerical 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 municipality 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 III
Default Percentages by Asset Class and Initial Credit Rating

The table displays default percentages for issues by asset class and initial Moody's credit rating. The asset classes include bonds issued by corporations (industrials and transportation companies), bonds issued by municipalities, bonds issued by sovereign nations, bonds issued by financial companies (U.S. banks, U.S. bank holding companies, securities companies, and insurance companies), and tranches of structured products. The types of structured products include Asset Backed Securities, Collateralized Debt Obligations, Commercial Mortgage Backed Securities, Public Finance, and Residential Mortgage Backed Securities. We require at least 100 issues per asset class-initial rating for admission to this table. The rating scale in this table is a simplified version of Moody's traditional 21-point scale. For example, we combine initial credit ratings of A1, A2, and A3 into one bin, A. The data come from Moody's Default and Recovery Database, and Moody's Structured Finance Default Risk Service Database.

Panel A. Major asset classes

	Corporate		Municipal		Sovereign		Financial		Structured	
Initial rating	N	Dflt %	N	Dflt %	N	Dflt %	N	Dflt %	N	Dflt %
Aaa	1,867	0.16	1,862	0.05	3,541	0.00	395	0.25	102,680	3.64
Aa	3,480	0.34	2,811	0.00	2,251	0.00	11,113	0.56	30,063	20.21
A	13,635	0.51	715	0.00	1,965	0.00	12,750	4.13	21,682	26.97
Baa	6,875	1.69			1,092	2.29	1,562	2.18	19,578	39.52
Ba	2,140	7.52			941	5.74	322	5.59	7,013	40.98
B	3,798	21.30			612	10.95			2,629	38.00
Caa	560	26.79							661	50.53
Ca									408	48.28
C									626	36.58

Panel B. Tranches of structured products decomposed by product type

	ABS		CDO		CMBS		PF		RMBS	
Initial rating	N	Dflt %	N	Dflt %	N	Dflt %	N	Dflt %	N	Dflt %
Aaa	30,815	2.02	6,651	20.52	5,197	0.12	13,621	0.00	46,396	3.75
Aa	7,311	28.71	3,759	26.76	2,043	0.34	8,074	0.00	8,876	33.38
A	9,203	29.02	3,484	31.26	2,145	2.70	2,315	0.00	4,535	44.76
Baa	8,204	51.46	3,554	34.86	2,981	3.22	363	0.00	4,476	48.73
Ba	2,171	71.58	1,765	36.43	1,589	8.56	113	0.00	1,375	39.35
B	516	71.32	262	62.21	1,152	22.40	92	0.00	607	34.60
Caa	231	67.53	179	81.01			143	0.00		
Ca	132	66.67	115	90.43			114	0.00		
C	305	69.51					199	0.00		

Table IV
Transition Matrices

This table displays five-year transition matrices for issues by asset class. The asset classes include bonds issued by corporations (industrials and transportation companies), bonds issued by municipalities, bonds issued by sovereign nations, bonds issued by financial companies (U.S. banks, U.S. bank holding companies, securities companies, and insurance companies), and tranches of structured products. The types of structured products 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 access represents the issues' initial credit ratings and the horizontal access represents the issues' credit ratings five years later. The data come from Moody's Default and Recovery Database, and Moody's Structured Finance Default Risk Service Database.

Panel A. Corporate issues

		Rating five years after issuance												
		Aaa	Aa	A	Baa	Ba	B	Caa	Ca	C	Default	Sum	% Down	% Up
Initial rating	Aaa	1,162	508	55	120	18	1	1			2	1,867	37.76	
	Aa	123	2,440	799	77	16	15	6			4	3,480	26.35	3.53
	A	47	377	11,097	1,741	237	81	29	4		22	13,635	15.50	3.11
	Baa	1	27	630	5,368	592	151	38	21	4	43	6,875	12.35	9.57
	Ba	1	3	28	421	1,238	254	70	25	12	88	2,140	20.98	21.17
	B	2		13	76	321	2,407	318	106	11	544	3,798	25.78	10.85
	Caa				8	3	62	342	22	6	117	560	25.89	13.04
	Ca					3	3	1	47	2	23	79	31.65	8.86
	C									5	1	6	16.67	0.00
	Sum											32,440	19.06	6.63

Panel B. Municipal issues

		Rating five years after issuance												
		Aaa	Aa	A	Baa	Ba	B	Caa	Ca	C	Default	Sum	% Down	% Up
Initial rating	Aaa	1,781	81									1,862	4.35	
	Aa	141	2,633	37								2,811	1.32	5.02
	A		346	367	2							715	0.28	48.39
	Baa		1	14	51							66	0.00	22.73
	Ba				3	11		6	2			22	36.36	13.64
	B						24	1	17			42	42.86	0.00
	Caa					1		7				8	0.00	12.50
	Ca								6			6	0.00	0.00
	C									2		2	0.00	0.00
	Sum											5,534	2.64	9.14

Panel C. Sovereign issues

		Rating five years after issuance												
		Aaa	Aa	A	Baa	Ba	B	Caa	Ca	C	Default	Sum	% Down	% Up
Initial rating	Aaa	3,247	269	21	4							3,541	8.30	
	Aa	313	1,774	164								2,251	7.29	13.90
	A		391	1,531	42	1						1,965	2.19	19.90
	Baa			131	773	65	117				6	1,092	17.22	12.00
	Ba			10	78	730	82	1	26		14	941	13.07	9.35
	B				18	164	366	7	24		33	612	10.46	29.74
	Caa						53	21			1	75	1.33	70.67
	Ca					3	1	1	7		4	16	25.00	31.25
	C											0		
	Sum											10,493	8.40	11.08

Panel D. Financial issues

		Rating five years after issuance												
		Aaa	Aa	A	Baa	Ba	B	Caa	Ca	C	Default	Sum	% Down	% Up
Initial rating	Aaa	303	56	7	28	1						395	23.29	
	Aa	15	7,944	3,043	92	14	2		2		1	11,113	28.38	0.13
	A	1	2,565	7,904	1,362	410	13		1	102	392	12,750	17.88	20.13
	Baa	7	140	357	641	189	12	2	156	51	7	1,562	26.70	32.27
	Ba		1	16	18	176	77	3	13	13	5	322	34.47	10.87
	B			1	1	5	41	1	1		4	54	11.11	12.96
	Caa						3	4				7	0.00	42.86
	Ca						17		2			19	0.00	89.47
	C									2		2	0.00	0.00
	Sum											26,224	23.11	12.00

Panel E. Structured issues

		Rating five years after issuance												
		Aaa	Aa	A	Baa	Ba	B	Caa	Ca	C	Default	Sum	% Down	% Up
Initial rating	Aaa	70,893	5,691	2,477	1,652	1,436	3,002	9,699	3,011	1,220	3,599	102,680	30.96	
	Aa	2,452	14,798	2,500	1,136	599	490	617	387	1,199	5,885	30,063	42.62	8.16
	A	667	1,739	8,980	1,391	1,093	547	616	309	819	5,521	21,682	47.49	11.10
	Baa	248	304	821	6,782	1,191	1,155	997	464	742	6,874	19,578	58.35	7.01
	Ba	24	55	98	235	2,280	354	656	221	505	2,585	7,013	61.61	5.87
	B	2	38	12	21	86	1,065	213	81	313	798	2,629	53.44	6.05
	Caa	9	45	19	2	3	4	245	6	13	315	661	50.53	12.41
	Ca	3	38	20	1	1		2	137	13	193	408	50.49	15.93
	C	8	71	28						415	104	626	16.61	17.09
	Sum											185,340	39.22	3.81

Panel E.1. Structured issues – Asset Backed Securities

		Rating five years after issuance												
		Aaa	Aa	A	Baa	Ba	B	Caa	Ca	C	Default	Sum	% Down	% Up
Initial rating	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

		Rating five years after issuance												
		Aaa	Aa	A	Baa	Ba	B	Caa	Ca	C	Default	Sum	% Down	% Up
Initial rating	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

		Rating five years after issuance												
		Aaa	Aa	A	Baa	Ba	B	Caa	Ca	C	Default	Sum	% Down	% Up
Initial rating	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

		Rating five years after issuance												
		Aaa	Aa	A	Baa	Ba	B	Caa	Ca	C	Default	Sum	% Down	% Up
Initial rating	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

		Rating five years after issuance												
		Aaa	Aa	A	Baa	Ba	B	Caa	Ca	C	Default	Sum	% Down	% Up
Initial rating	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

Table V
Cox Proportional Hazard Regressions on Credit Rating Adjustments

This table presents regression results from Cox proportional hazards regressions to estimate the relative downgrade and upgrade intensities of bonds by asset class. The asset classes include bonds issued by corporations (industrials and transportation companies), bonds issued by municipalities, bonds issued by sovereign nations, bonds issued by financial companies (U.S. banks, U.S. bank holding companies, securities companies, and insurance companies), and tranches of structured products. The types of structured products include Asset Backed Securities, Collateralized Debt Obligations, Commercial Mortgage Backed Securities, Public Finance, and Residential Mortgage Backed Securities. The coefficients represent the hazard rate of each asset class relative to the baseline hazard of the corporate asset class, and the unit of observation is a rating change. Standard errors appear below coefficient estimates in parentheses. *, **, 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.

	Downgrades			Upgrades		
	Full sample	Investment grade	Speculative grade	Full sample	Investment grade	Speculative grade
Corporate	1	1	1	1	1	1
Municipal	0.324***	0.272***	3.115***	1.570***	1.989***	1.057
	(0.010)	(0.009)	(0.231)	(0.033)	(0.044)	(0.157)
Sovereign	0.472***	0.341***	1.024	1.410***	1.609***	1.175***
	(0.008)	(0.008)	(0.030)	(0.023)	(0.032)	(0.037)
Financial	1.789***	1.660***	5.001***	1.691***	2.049***	1.981***
	(0.015)	(0.016)	(0.093)	(0.021)	(0.030)	(0.062)
ABS	1.265***	0.842***	3.783***	0.230***	0.277***	0.198***
	(0.010)	(0.008)	(0.054)	(0.004)	(0.005)	(0.008)
CDO	1.915***	1.494***	3.162***	0.592***	0.600***	0.579***
	(0.016)	(0.016)	(0.049)	(0.011)	(0.014)	(0.017)
CMBS	1.081***	0.752***	1.817***	0.961**	1.523***	0.208***
	(0.012)	(0.011)	(0.033)	(0.016)	(0.029)	(0.009)
PF	1.144***	1.150***	3.283***	0.918***	1.169***	0.345***
	(0.011)	(0.012)	(0.300)	(0.014)	(0.020)	(0.115)
RMBS	1.091***	0.692***	3.360***	0.191***	0.228***	0.160***
	(0.008)	(0.006)	(0.048)	(0.003)	(0.004)	(0.006)
N	483,520	369,405	114,115	483,520	369,405	114,115

Table VI
Cox Proportional Hazard Regressions on First Credit Rating Adjustments

This table presents regression results from Cox proportional hazards regressions to estimate the relative downgrade and upgrade intensities of bonds by asset class. The asset classes include bonds issued by corporations (industrials and transportation companies), bonds issued by municipalities, bonds issued by sovereign nations, bonds issued by financial companies (U.S. banks, U.S. bank holding companies, securities companies, and insurance companies), and tranches of structured products. The types of structured products include Asset Backed Securities, Collateralized Debt Obligations, Commercial Mortgage Backed Securities, Public Finance, and Residential Mortgage Backed Securities. The coefficients represent the hazard rate of each asset class relative to the baseline hazard of the corporate asset class, and the unit of observation is the first rating change after issuance Standard errors appear below coefficient estimates in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. -- indicates insufficient observations to estimate a coefficient. The data come from Moody's Default and Recovery Database, and Moody's Structured Finance Default Risk Service Database.

	Downgrades			Upgrades		
	Full sample	Investment grade	Speculative grade	Full sample	Investment grade	Speculative grade
Corporate	1	1	1	1	1	1
Municipal	0.311***	0.294***	3.684***	1.816***	2.083***	1.104
	(0.013)	(0.012)	(0.646)	(0.054)	(0.065)	(0.321)
Sovereign	0.381***	0.295***	1.115*	1.499***	1.483***	1.308***
	(0.011)	(0.010)	(0.066)	(0.039)	(0.044)	(0.071)
Financial	1.290***	1.282***	1.912***	2.045***	2.353***	1.997***
	(0.019)	(0.020)	(0.291)	(0.042)	(0.053)	(0.276)
ABS	0.710***	0.666***	2.341***	0.182***	0.207***	0.098***
	(0.009)	(0.009)	(0.104)	(0.005)	(0.006)	(0.012)
CDO	1.399***	1.383***	1.553***	0.200***	0.232***	0.080***
	(0.020)	(0.020)	(0.073)	(0.008)	(0.010)	(0.010)
CMBS	0.639***	0.574***	0.972	0.985	1.094**	0.480***
	(0.019)	(0.020)	(0.065)	(0.037)	(0.047)	(0.040)
PF	0.846***	0.839***	--	0.828***	0.953	--
	(0.013)	(0.013)	(--)	(0.020)	(0.024)	(--)
RMBS	0.585***	0.571***	0.932	0.218***	0.227***	0.361***
	(0.007)	(0.007)	(0.046)	(0.005)	(0.006)	(0.023)
N	230,614	213,841	16,773	230,614	213,841	16,773

Table VII

Cox Proportional Hazard Regressions on Credit Rating Adjustments by Time Period

This table presents regression results from Cox proportional hazards regressions to estimate the relative downgrade and upgrade intensities of bonds by asset class over different time periods. The asset classes include bonds issued by corporations (industrials and transportation companies), bonds issued by municipalities, bonds issued by sovereign nations, bonds issued by financial companies (U.S. banks, U.S. bank holding companies, securities companies, and insurance companies), and tranches of structured products. The types of structured products include Asset Backed Securities, Collateralized Debt Obligations, Commercial Mortgage Backed Securities, Public Finance, and Residential Mortgage Backed Securities. The time periods represent the date of the rating change and exclude rating changes that don't lie in the specified interval. The coefficients represent the hazard rate of each asset class relative to the baseline hazard of the corporate asset class, and the unit of observation is a rating change. Standard errors appear below coefficient estimates in parentheses. *, **, 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.

	Downgrades			Upgrades		
	1980 – 1999	2000 – 2006	2007 – 2010	1980 – 1999	2000 – 2006	2007 – 2010
Corporate	1	1	1	1	1	1
Municipal	0.600***	0.102***	0.554***	0.915	2.267***	0.193***
	(0.030)	(0.007)	(0.026)	(0.053)	(0.055)	(0.025)
Sovereign	0.451***	0.638***	0.241***	1.104***	1.047*	2.772***
	(0.014)	(0.016)	(0.011)	(0.033)	(0.030)	(0.086)
Financial	0.837***	0.866***	3.073***	2.737***	1.196***	2.071***
	(0.019)	(0.013)	(0.046)	(0.059)	(0.025)	(0.055)
ABS	0.243***	0.298***	1.818***	0.246***	0.218***	0.301***
	(0.010)	(0.005)	(0.026)	(0.014)	(0.006)	(0.009)
CDO	1.190*	1.033	2.125***	0.737*	0.575***	0.775***
	(0.114)	(0.022)	(0.032)	(0.129)	(0.022)	(0.022)
CMBS	0.542***	0.287***	1.439***	1.329***	1.788***	0.751***
	(0.044)	(0.010)	(0.024)	(0.099)	(0.041)	(0.024)
PF	0.741***	0.236***	1.447***	2.158***	1.204***	1.068***
	(0.064)	(0.008)	(0.023)	(0.162)	(0.030)	(0.029)
RMBS	0.118***	0.014***	1.698***	0.443***	0.302***	0.076***
	(0.004)	(0.001)	(0.024)	(0.013)	(0.008)	(0.003)
N	57,305	138,103	288,112	57,305	138,103	288,112

Table VIII
Credit Rating Adjustment Regressions

This table displays results from measures of credit rating adjustment regressed on asset class dummy variables and results from tests of coefficients' equality. The asset classes include bonds issued by corporations (industrials and transportation companies), bonds issued by municipalities, bonds issued by sovereign nations, bonds issued by financial companies (U.S. banks, U.S. bank holding companies, securities companies, and insurance companies), and tranches of structured products. Panel A displays results from OLS regressions. The dependent variable in Panel A is *Rating change*, the difference between the numerical translation of an issue's credit rating when the issue matures, defaults, or the sample ends and the initial rating. The highest credit rating, Aaa, equals 21 and the lowest credit rating, C, equals 1. Panel B displays results from probit regressions. The dependent variable in Panel B is a dummy variable taking a value of one if the issue's first credit rating was investment grade but Moody's downgraded the issue to speculative grade by the earlier of the issue's maturity date, default date, or the end of the sample, and zero otherwise All of the issues in Panel B had initial credit ratings of investment grade. We cluster the standard errors at the issuer level. Standard errors appear below coefficient estimates in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. -- indicates insufficient observations to estimate a coefficient. The data come from Moody's Default and Recovery Database, and Moody's Structured Finance Default Risk Service Database.

Panel A. Dependent variable is *Rating change*

	Full sample	Issued 1980 – 1999	Issued 2000 – 2006	Issued 2007 – 2010
Corporate	-1.935***	-0.969***	-0.537***	-0.499***
	(0.419)	(0.062)	(0.078)	(0.076)
Municipal	1.484***	1.232***	1.299***	0.309***
	(0.280)	(0.163)	(0.169)	(0.098)
Sovereign	0.807***	0.976***	0.731***	0.832***
	(0.189)	(0.173)	(0.201)	(0.216)
Financial	0.327	0.856***	-0.773***	-1.432
	(0.611)	(0.288)	(0.635)	(0.874)
Structured	-1.173***	0.763***	-3.219***	-5.226**
	(0.306)	(0.071)	(0.780)	(2.271)
Issue year FE?	Yes	No	No	No
Adjusted R^2	0.281	0.022	0.057	0.116
N	260,031	65,957	144,159	49,915
Comparison of coefficient estimates:				
$\beta_{Corporate} - \beta_{Municipal} =$	-3.419***	-2.200***	-1.837***	-0.808***
	(0.637)	(0.195)	(0.216)	(0.164)
$\beta_{Corporate} - \beta_{Sovereign} =$	-2.742***	-1.945***	-1.268***	-1.331***
	(0.481)	(0.204)	(0.243)	(0.253)
$\beta_{Corporate} - \beta_{Financial} =$	-2.262***	-1.825***	0.236	0.933
	(0.868)	(0.308)	(0.649)	(0.884)
$\beta_{Corporate} - \beta_{Structured} =$	-0.762	-1.732***	2.682***	4.723**
	(0.463)	(0.129)	(0.791)	(2.275)

Panel B. Dependent variable is a dummy variable taking a value of one if Moody's downgrades the issue to speculative grade

	Full sample	Issued 1980 – 1999	Issued 2000 – 2006	Issued 2007 – 2010
Corporate	-1.496***	-1.273***	-1.655***	-2.208***
	(0.057)	(0.0479)	(0.091)	(0.116)
Municipal	-2.067***	-2.007***	--	--
	(0.273)	(0.295)	(--)	(--)
Sovereign	-0.480*	-0.775***	-0.065	--
	(0.273)	(0.219)	(0.424)	(--)
Financial	0.083	-0.467*	0.432	0.667
	(0.330)	(0.271)	(0.478)	(0.491)
Structured	0.826***	-0.642***	1.058***	1.934***
	(0.209)	(0.082)	(0.208)	(0.480)
Pseudo R^2	0.059	0.055	0.038	0.102
N	242,437	59,873	133,102	44,619
Comparison of coefficient estimates:				
$\beta_{Corporate} - \beta_{Municipal} =$	0.572**	0.733**		
	(0.290)	(0.307)		
$\beta_{Corporate} - \beta_{Sovereign} =$	-1.016***	-0.498**	-1.590***	
	(0.291)	(0.234)	(0.452)	
$\beta_{Corporate} - \beta_{Financial} =$	-1.579***	-0.806***	-2.087***	-2.875***
	(0.345)	(0.283)	(0.446)	(0.531)
$\beta_{Corporate} - \beta_{Structured} =$	-2.322***	-0.632***	-2.712***	-4.141***
	(0.232)	(0.117)	(0.261)	(0.521)

Table IX
Credit Rating Adjustment Regressions with Structured Issues by Product Type

This table displays results from OLS regressions with *Rating change* regressed on asset class dummy variables and results from tests of coefficients' equality. *Rating change* is the difference between the numerical translation of an issue's credit rating when the issue matures, defaults, or the sample ends and the initial rating. The highest credit rating, Aaa, equals 21 and the lowest credit rating, C, equals 1. The asset classes include bonds issued by corporations (industrials and transportation companies), bonds issued by municipalities, bonds issued by sovereign nations, bonds issued by financial companies (U.S. banks, U.S. bank holding companies, securities companies, and insurance companies), and tranches of structured products. The types of structured products include Asset Backed Securities, Collateralized Debt Obligations, Commercial Mortgage Backed Securities, Public Finance, and Residential Mortgage Backed Securities. We cluster the standard errors at the issuer level. Standard errors appear below coefficient estimates in parentheses. *, **, 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.

	Full sample	Issued 1980 – 1999	Issued 2000 – 2006	Issued 2007 – 2010
Corporate	-1.912***	-0.969***	-0.537***	-0.499***
	(0.433)	(0.062)	(0.078)	(0.076)
Municipal	1.525***	1.232***	1.299***	0.309***
	(0.294)	(0.163)	(0.169)	(0.098)
Sovereign	0.798***	0.976***	0.731***	0.832***
	(0.199)	(0.173)	(0.201)	(0.216)
Financial	0.400	0.856***	-0.773	-1.432
	(0.620)	(0.288)	(0.635)	(0.874)
ABS	-1.061***	0.262***	-2.944***	-4.790***
	(0.285)	(0.079)	(0.407)	(1.374)
CDO	-2.342***	-0.864**	-4.736***	-6.323***
	(0.409)	(0.396)	(0.462)	(1.261)
CMBS	1.316***	2.370***	-0.270*	-2.964***
	(0.465)	(0.139)	(0.160)	(0.905)
PF	1.261**	0.960***	-0.119	-0.648***
	(0.491)	(0.062)	(0.078)	(0.076)
RMBS	-2.530***	1.072***	-4.778***	-9.367***
	(0.396)	(0.063)	(0.685)	(2.041)
Issue year FE?	Yes	No	No	No
Adjusted R^2	0.333	0.055	0.139	0.309
N	260,031	65,957	144,159	49,915

Continued below

Continued from above

Comparison of coefficient estimates:				
$\beta_{Corporate} - \beta_{Municipal}$ =	-3.438***	-2.201***	-1.837***	-0.808***
	(0.672)	(0.195)	(0.216)	(0.164)
$\beta_{Corporate} - \beta_{Sovereign}$ =	-2.710***	-1.945***	-1.268***	-1.331***
	(0.500)	(0.204)	(0.243)	(0.253)
$\beta_{Corporate} - \beta_{Financial}$ =	-2.313***	-1.825***	0.236	0.932
	(0.898)	(0.308)	(0.649)	(0.884)
$\beta_{Corporate} - \beta_{ABS}$ =	-0.851	-1.231***	2.407***	4.290***
	(0.692)	(0.134)	(0.429)	(1.380)
$\beta_{Corporate} - \beta_{CDO}$ =	0.430	-0.105	4.200***	5.823***
	(0.814)	(0.411)	(0.481)	(1.268)
$\beta_{Corporate} - \beta_{CMBS}$ =	-3.228***	-3.340***	-0.267	2.464***
	(0.892)	(0.176)	(0.209)	(0.915)
$\beta_{Corporate} - \beta_{PF}$ =	-3.173***	-1.929***	-0.418***	0.149
	(0.922)	(0.125)	(0.156)	(0.152)
$\beta_{Corporate} - \beta_{RMBS}$ =	0.618	-2.041***	4.241***	8.868***
	(0.609)	(0.125)	(0.698)	(2.045)