

SECTOR IN-DEPTH

1 February 2019



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Corporates - Global

Annual default study: Defaults will rise modestly in 2019 amid higher volatility

Summary

We expect the annual default rate for speculative-grade companies that we rate to rise modestly to 3.0% in 2019 from 2.3% in 2018. More challenging market conditions will result in higher defaults in 2019 as economic growth decelerates, geopolitical tensions continue, credit conditions tighten and borrowing cost increases. On the other hand, low refinancing risk and healthy corporate profits will keep defaults low by historical standards.

- » **Including investment-grade companies, the annual default rate will rise to 1.5% in 2019 from 1.1% in 2018, according to our forecasts.** This annual rate implies roughly 98 defaults in 2019, which would be higher than the 77 defaults in 2018 but lower than the count of 104 in 2017.
- » **Defaults will decline in Retail as well as Oil & Gas, which had the most defaults in 2018.** We expect the Retail sector default rate to fall to 3.5% in 2019 from 7.3% in 2018, and the Oil & Gas sector default rate to decline to 1.9% from 3.1%.
- » **The dollar volume of defaults was \$75 billion in 2018, down from \$85 billion in 2017.** The largest defaulter in 2018 was iHeartCommunications Inc., which had about \$16 billion of debt outstanding when it filed for bankruptcy. By region, defaults remained concentrated in North America, with 57 defaults, followed by Europe (11) and Asia-Pacific (5).
- » **Rating upgrades outpaced downgrades in 2018 due to healthy market liquidity and positive macro environment.** Rating drift, measured by the average upgraded notches per issuer minus the average downgraded notches per issuer, rose to 2.3% of a rating notch in 2018 from 0.7% in 2017. Across sectors, Metals & Mining had the highest drift in 2018 while Nondurable Consumer Goods had the lowest.
- » **Measured by post-default trading prices, the issuer-weighted average recovery rate for senior unsecured bonds was high by historical standards.** The rate was 48.8% in 2018, up from the long-term average of 38.1%, reflecting higher recoveries in distressed exchanges and improved recoveries in commodity sectors.

THIS REPORT WAS REPUBLISHED ON 21 FEB 2019 TO UPDATE EXHIBITS 39-40 BY REMOVING DEFAULT RATES FOR Caa1 and Caa3 PRIOR TO 1997 AND DEFAULT RATES FOR Ca-C DURING 1983-1986. WE ALSO CORRECTED THE AVERAGE, MEDIAN, AND STDEV METRICS FOR THESE THREE RATING BUCKETS ACCORDINGLY. FURTHERMORE, WE CORRECTED THE 2018 CREDIT LOSS RATES IN EXHIBIT 30.

- » **Rating accuracy measures like Average Default Position (AP) show that our ratings have been successfully rank ordering credit risk.** Since 1983, the average one-year AP has measured 91.8%.

For inquiries on the underlying data, please contact ClientServices@moody.com.

About this report

This report is our 32nd annual default study, in which we provide statistics on defaults, losses and rating transitions for corporate bond, loan and deposit issuers in 2018, as well as for the historical period since 1920. This study covers financial institutions, nonfinancial companies and regulated utilities that have long-term debt ratings.

The first section of the study reviews major trends in defaults, recoveries and rating actions in 2018, including analyses by industry and geography. The second section discusses the default rate outlook and the drivers behind our forecasts. The final section examines the performance of our ratings since 1983.

The study results are based on a proprietary database of ratings and defaults for industrial and transportation companies, utilities and financial institutions. This database covers the credit experiences of more than 25,000 companies that had long-term rated bonds, loans and/or deposits between 1920 and 2018.

Introduction

Following a strong year in 2017, credit markets began with positive momentum in 2018. In the first quarter, investors continued to chase yield and the pace of corporate debt issuance was strong. As we moved into the summer, the US government applied higher tariffs on a broader array of goods than before, which led to some market volatility. Around the same time, defaults rose in onshore markets in China as a result of the country's deleveraging and de-risking campaign. Meanwhile, Argentina and Turkey experienced financial market sell-offs. Both countries are reliant on external and foreign currency financing, which made them vulnerable when investor sentiment turned amid tightening monetary policy by the US Federal Reserve. Nonetheless, the problems in both countries turned out to be idiosyncratic, and the US high-yield spread remained thin through the end of the third quarter.

In the fourth quarter, credit markets deteriorated amid heightened volatility as oil prices fell and investors worried about aggressive rate hikes by the Fed and a potential turning of the long credit cycle. US-China trade tensions continued to weigh on investor sentiment, as did the risk of a "no-deal" Brexit in Europe. The deterioration was most significant in December in the US when the high-yield bond spread widened more than 100 basis points (bps) and high-yield bond issuance reached the lowest level since the global financial crisis. Despite escalated volatility and lukewarm performance of high-yield bonds, corporate defaults remained low in 2018 as the global economy was strong, corporate earnings were healthy and financing conditions remained supportive.

Defaults fell for the second consecutive year

Strong liquidity and economic growth contained the default rate

The number of corporate defaults declined in 2018 as the global economy continued its momentum from 2017. Corporate earnings were generally positive and liquidity remained healthy. While the Fed continued to increase interest rates and the European Central Bank unwound its quantitative easing program, the benchmark interest rates in major economies were still low by historical standards. In addition, credit markets remained largely accommodative, allowing high-yield companies to access capital when needed.

Last year, 77 rated companies defaulted, down from 104 in 2017 and 144 in 2016.¹ Measured by volume, about \$75 billion of debt went into default in 2018, comprising nearly \$48 billion in bonds and \$28 billion in loans. In comparison, the default volume totaled \$85 billion in 2017 and \$136 billion in 2016. The largest defaulter in 2018 was [iHeartCommunications Inc.](#), a global media and entertainment company, which had \$16 billion of debt when it filed for bankruptcy in March. The company experienced negative free cash flow as increased competition for advertising dollars and listeners strained its terrestrial radio business.² Before its bankruptcy filing, iHeartCommunications had tried to improve its liquidity position by selling assets, but that move left the company with lower

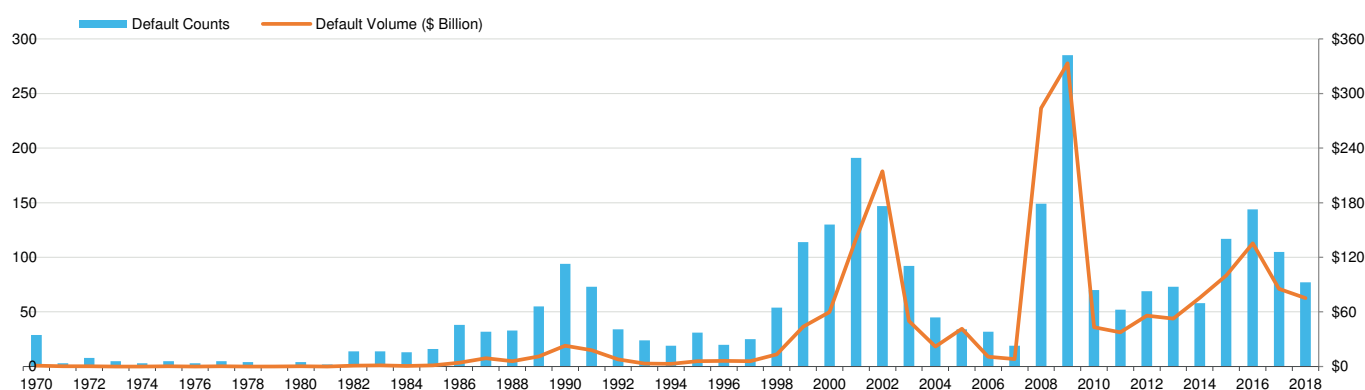
EBITDA. In addition, the company went through two distressed exchanges in 2009 and 2017, respectively. In the 2009 transaction, the company bought back approximately \$400 million of bonds at a discount, but it was not sufficient to reduce leverage.

Similarly to previous years, most corporate defaults occurred in North America, where most of the rated issuers are domiciled. Of the 77 defaults, 57, or almost three-quarters, were in North America. Europe had 11 (14%) while the rest were in Asia-Pacific (5), Latin America (3) and Africa (1). In terms of dollar volume, \$57 billion, or three-quarters of defaulted debt, was from North America, followed by Europe and Latin America, which each defaulted on approximately \$7 billion in debt.³

Distressed exchanges continued to be a prominent type of default. In 2018, more than 40% of defaults were distressed exchanges. The rest were split between bankruptcy (29%) and payment defaults (27%). Exhibit 1 presents the annual default counts and defaulted debt volumes for the period 1970-2018.

Exhibit 1

Defaults continued downward path in 2018



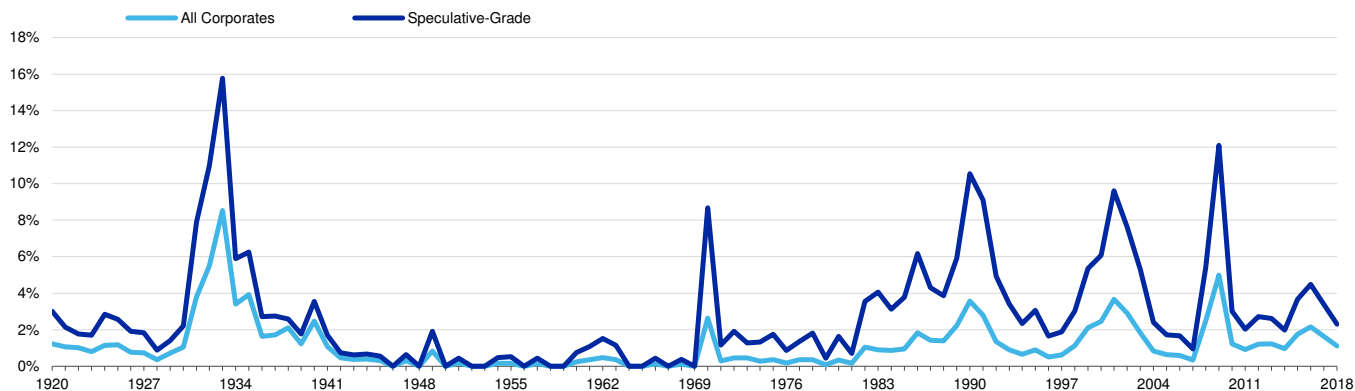
Source: Moody's Investors Service

Default rate fell to the lowest level since 2014

The issuer-weighted annual default rate finished at 1.1% in 2018, down from 1.6% in 2017 (see Exhibit 2). The lower default rate resulted from receding distress in commodity sectors. Among speculative-grade issuers, the default rate showed a similar trend, declining to 2.3% from 3.4%. The latest figures are below the average one-year default rate since 1983 of 1.6% for all rated issuers and 4.1% for all rated speculative-grade issuers. Measured on a dollar volume basis, the speculative-grade corporate bond default rate rose to 1.8% in 2018 from 1.6% in 2017 and the rate for all rated issuers held steady at 0.3% from 2017 to 2018.⁴

Exhibit 2

Default rate fell in 2018



Source: Moody's Investors Service

Retail had the most defaults

Similar to 2017, corporate defaults in 2018 remained concentrated in a few industries, led by Retail and Oil & Gas. There were 16 Retail defaults in 2018, the most of all sectors and up from 13 in 2017. The rise in Retail defaults reflected the fallout of structural shifts in consumer buying behavior and rising e-commerce penetration, which weighed on the operating earnings of department stores in particular. Oil & Gas had 15 defaults as some companies struggled with the lingering credit effects of the 2015-16 commodities downturn. Although Oil & Gas had the second-most defaults in 2018, the sector's defaults were down from 27 in 2017, which marked the biggest drop across sectors. In contrast, Construction & Building's contribution increased noticeably from one to eight defaults. Of the eight construction company defaults, three were in Latin America, where the operating environment was weak in 2018.

When measured by dollar volume, Oil & Gas topped the list by accounting for \$17 billion (or 23%) of the total. This amount includes debts from initial defaults in 2018 as well as follow-on events from prior-year defaults.⁵ The next highest sector by volume was Media: Broadcasting & Subscription, owing to the contribution of [iHeartCommunications Inc.](#), the largest default of the year. Other sizable defaults in 2018 included [Noble Group Limited](#), [Fieldwood Energy LLC](#) and [Community Health Systems Inc.](#), each having defaulted on more than \$3 billion of debt. Exhibit 3 shows the distribution of 2017-18 defaults by industry, as well as the changes between those two years.

Exhibit 3

Retail had the most defaults in 2018

MDY35 Industry Group*	Percent by count			Percent by volume		
	2018	2017	Change	2018	2017	Change
Aerospace & Defense	0%	2%	-2%	0%	0%	0%
Automotive	1%	0%	1%	3%	0%	3%
Banking	0%	7%	-7%	0%	6%	-6%
Beverage, Food, & Tobacco	3%	0%	3%	0%	0%	0%
Capital Equipment	0%	2%	-2%	0%	1%	-1%
Chemicals, Plastics, & Rubber	0%	2%	-2%	0%	0%	0%
Construction & Building	10%	1%	9%	3%	1%	3%
Consumer Goods: Durable	4%	0%	4%	3%	0%	3%
Consumer Goods: Non-durable	1%	0%	1%	2%	0%	2%
Energy: Electricity	5%	3%	2%	1%	3%	-2%
Energy: Oil & Gas	19%	26%	-6%	23%	46%	-24%
Environmental Industries	0%	3%	-3%	0%	1%	-1%
Finance	4%	4%	0%	2%	2%	0%
Real Estate Finance	0%	1%	-1%	0%	2%	-2%
Forest Products & Paper	1%	6%	-4%	0%	2%	-2%
Healthcare & Pharmaceuticals	3%	1%	2%	9%	2%	7%
High Tech Industries	1%	3%	-2%	0%	2%	-2%
Media: Advertising, Printing & Publishing	4%	0%	4%	2%	0%	2%
Media: Broadcasting & Subscription	1%	4%	-3%	21%	4%	17%
Media: Diversified & Production	0%	1%	-1%	0%	1%	-1%
Metals & Mining	4%	3%	1%	2%	1%	1%
Retail	21%	13%	8%	15%	11%	4%
Services: Business	8%	11%	-3%	9%	3%	5%
Services: Consumer	0%	1%	-1%	0%	0%	0%
Telecommunications	3%	4%	-1%	3%	9%	-6%
Transportation: Cargo	3%	3%	0%	2%	1%	1%
Utilities: Electric	1%	0%	1%	0%	0%	0%
Wholesale	3%	2%	1%	0%	0%	0%

*We omitted those industries which had no defaults in 2017 and 2018.

Source: Moody's Investors Service

With more than one-fifth of last year's defaults, Retail had a 7.3% default rate in 2018, the highest level across all sectors.⁶ Media: Advertising, Printing & Publishing followed with a rate of 7.1% (see Exhibit 4).

Exhibit 4

Retail led the one-year default rate in 2018

MDY35 Industry Group	Default Rate*	MDY35 Industry Group	Default Rate*
Retail	7.27%	High Tech Industries	0.39%
Media: Advertising, Printing & Publishing	7.05%	Utilities: Electric	0.24%
Energy: Electricity	6.88%	Aerospace & Defense	0.00%
Consumer Goods: Durable	5.88%	Banking	0.00%
Construction & Building	3.53%	Capital Equipment	0.00%
Wholesale	3.17%	Chemicals, Plastics, & Rubber	0.00%
Energy: Oil & Gas	3.12%	Containers, Packaging, & Glass	0.00%
Forest Products & Paper	2.70%	Environmental Industries	0.00%
Transportation: Cargo	1.92%	Insurance	0.00%
Metals & Mining	1.87%	Real Estate Finance	0.00%
Services: Business	1.86%	Hotel, Gaming, & Leisure	0.00%
Consumer Goods: Non-durable	1.43%	Media: Diversified & Production	0.00%
Finance	1.32%	Services: Consumer	0.00%
Healthcare & Pharmaceuticals	1.24%	Sovereign & Public Finance	0.00%
Beverage, Food, & Tobacco	1.13%	Transportation: Consumer	0.00%
Telecommunications	1.04%	Utilities: Oil & Gas	0.00%
Media: Broadcasting & Subscription	0.96%	Utilities: Water	0.00%
Automotive	0.85%		

*Issuer-weighted. Includes investment-grade and speculative-grade issuers.

Source: Moody's Investors Service

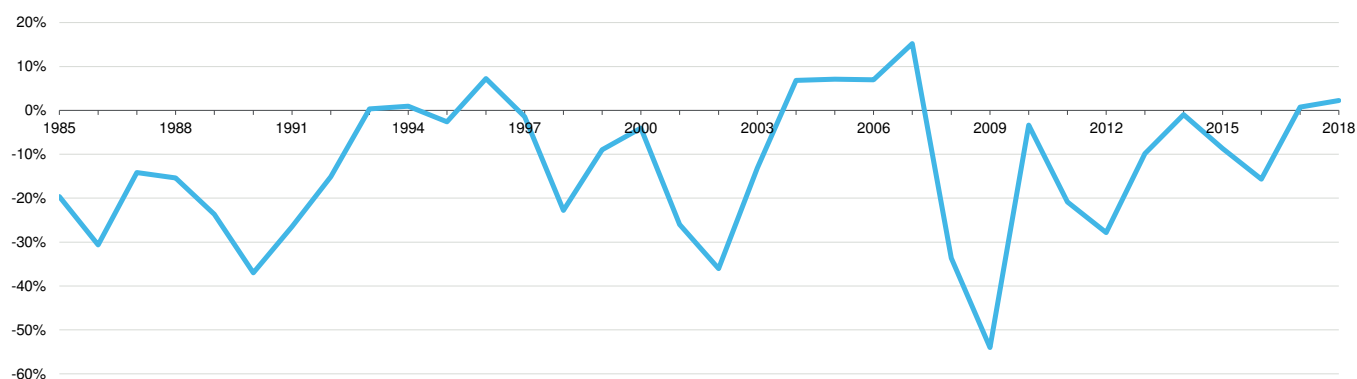
Rating upgrades outpaced downgrades in general, especially in Metals & Mining

For the second year in a row, rating upgrades beat downgrades in 2018 amid healthy market liquidity and a positive macro environment. Rating drift, which is calculated as the average upgraded notches per issuer minus the average downgraded notches per issuer, rose to 2.3% of a rating notch in 2018 from 0.7% in 2017 (see Exhibit 5). Of our 35 industry groups, 32 recorded higher drift relative to their historical averages.

Exhibit 5

Upgrades outpaced downgrades in 2018

Rating drift (% of rating notch)



Source: Moody's Investors Service

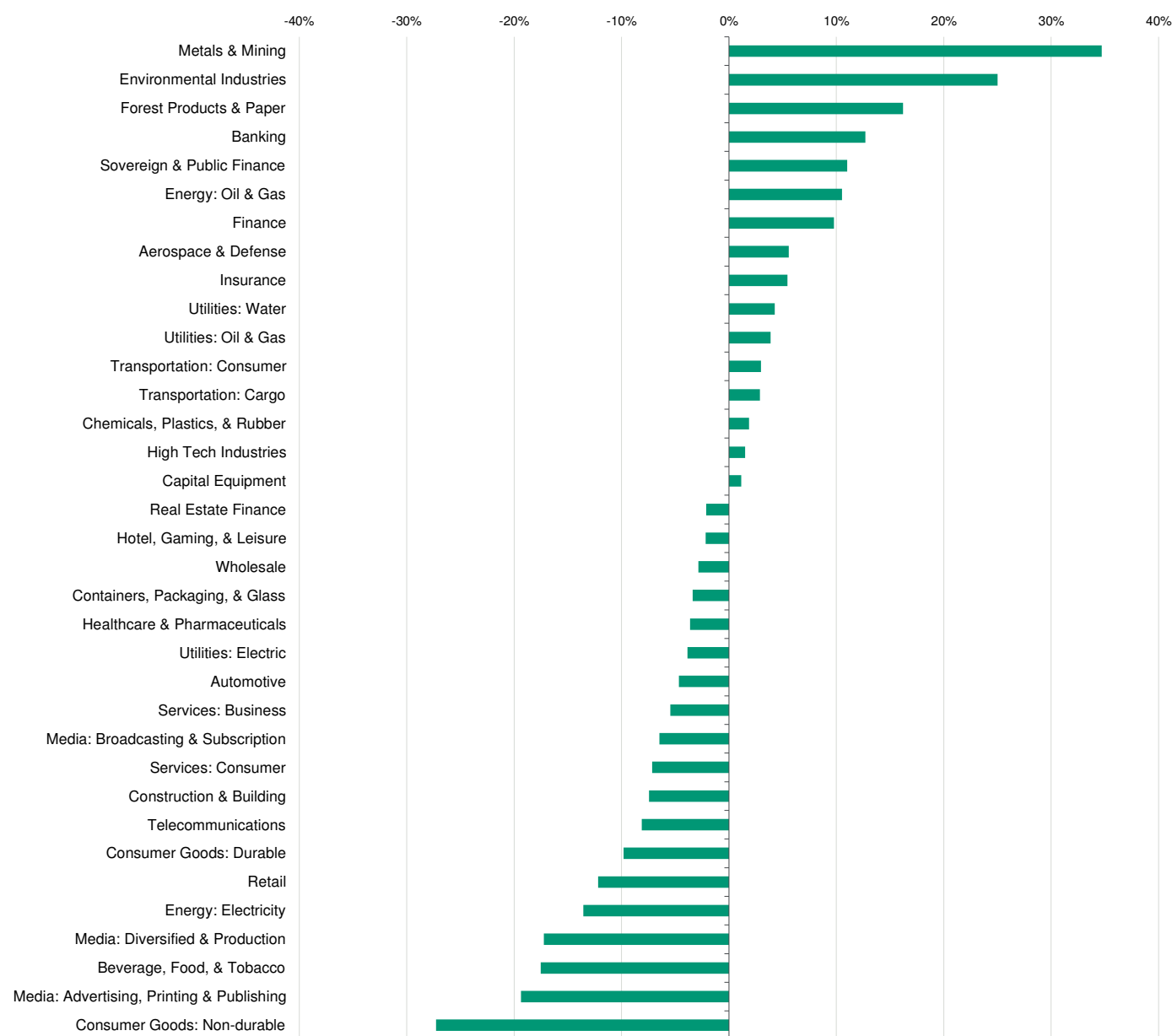
Across sectors, Metals & Mining experienced the most improvement as upgrades outpaced downgrades by 35% of a rating notch in 2018 (see Exhibit 6). The industry began to recover in late 2016 and continued to improve in 2017-18 as global economic growth increased at a healthy level. On the other hand, Nondurable Consumer Goods had the most significant deterioration in rating drift, closing at -27%. Some downgrades in this sector stemmed from pressure on household and personal care products as a whole, as

profit margins were hurt by severe competition and increased costs in raw materials, labor and transportation. Other downgrades of Nondurable Consumer Goods companies were more company specific. Over the course of 2018, upgrades outpaced downgrades in the first three quarters but the trend reversed in the fourth quarter. While some of the negative rating actions in the fourth quarter were associated with the downgrade of Italy's sovereign rating, others were driven by poor operating performance as a result of aggressive acquisitions, retail earnings pressure, rising cost of inputs and remaining commodity issues.⁷

Exhibit 6

Credit quality improved significantly in Metals & Mining in 2018

Rating drift (% of rating notch)



Source: Moody's Investors Service

Distressed exchanges push senior unsecured bond recovery rates higher than historical average

As indicated in Exhibit 7, recovery rates have been generally correlated with the priority of claim in the capital structure over the past three decades, with a higher priority of claim enjoying a higher average rate of recovery.⁸ For example, first-lien bank loans' recovery rates average 67% on an issuer-weighted basis and 64% on a dollar-volume basis; the highest recovery rates across security classes. This makes logical sense given their secured nature and seniority in the capital structure.

Exhibit 7

Average corporate debt recovery rates measured by trading prices*

Priority Position	Issuer-weighted recoveries			Volume-weighted recoveries		
	2018	2017	1983-2018	2018	2017	1983-2018
1st Lien Bank Loan	71.07%	69.19%	67.19%	77.67%	74.72%	64.07%
2nd Lien Bank Loan	54.96%	17.87%	32.27%	33.45%	30.29%	28.68%
Sr. Unsecured Bank Loan	41.93%	9.00%	45.75%	42.26%	9.00%	40.29%
1st Lien Bond	56.75%	65.91%	53.99%	68.75%	67.09%	55.23%
2nd Lien Bond	35.16%	52.75%	44.07%	43.62%	36.61%	43.74%
Sr. Unsecured Bond	48.75%	55.07%	38.15%	42.47%	41.03%	33.87%
Sr. Subordinated Bond	45.63%	38.00%	31.08%	25.60%	50.62%	26.33%
Subordinated Bond	n.a.	50.20%	31.98%	n.a.	68.34%	27.52%
Jr. Subordinated Bond	n.a.	27.17%	23.67%	n.a.	44.99%	26.78%

We use market prices (bids) to proxy recoveries in this exhibit.

Source: Moody's Investors Service

Exhibit 7 also shows that the average senior unsecured bond recovery rate was 49% in 2018, down from 55% in 2017. Some of the average recovery rates in 2017 and 2018 are based on small samples (see observation counts in Exhibit 8). Compared with the historical rate of 38%, the average senior unsecured bond recovery rate was noticeably higher in 2018 as the energy sector continued to recover. In addition, there were some strong recoveries from initial distressed exchanges in 2018, although they were partially offset by a handful of very low recoveries in re-defaults.⁹ Measured by dollar volume, the senior unsecured bond recovery rate averaged 42% in 2018, similar to the 41% rate in 2017. For first-lien bank loans, the volume-weighted average recovery rate was 78% in 2018, up slightly from 75% in 2017.

Exhibit 8

Recovery observation counts and dollar volume

Priority Position	Issuer counts			Dollar volume (in \$ billions of USD)		
	2018	2017	1983-2018	2018	2017	1983-2018
1st Lien Bank Loan	13	26	501	7.2	20.4	299.2
2nd Lien Bank Loan	6	5	78	2.6	1.2	155.1
Sr. Unsecured Bank Loan	2	1	69	1.4	0.0	35.2
1st Lien Bond	19	22	347	13.5	10.8	149.8
2nd Lien Bond	10	5	80	2.6	2.5	39.6
Sr. Unsecured Bond	28	40	1056	25.1	35.0	742.0
Sr. Subordinated Bond	2	2	512	1.2	0.9	115.7
Subordinated Bond	0	3	414	0.0	0.9	81.2
Jr. Subordinated Bond	0	3	27	0.0	2.6	6.5

Source: Moody's Investors Service

The recovery data in Exhibit 8 are based on trading prices at or post default.¹⁰ An alternative recovery measure is based on ultimate recoveries, or the value creditors realize at the resolution of a default event. For example, for issuers filing for bankruptcy, the ultimate recovery is the present value of the cash or securities that creditors actually receive when the issuer exits bankruptcy, typically one to two years following the initial default date.

Exhibit 9 shows data on ultimate recovery rates for nonfinancial companies in North America included in Moody's Ultimate Recovery Database.¹¹ In 2018, the average "firm-wide" recovery rate^{12,13} for the 10 default resolutions in 2018 was 60%,¹⁴ compared with 65% for the 23 companies that emerged from default in 2017. In both years, the overall firm-wide average recovery rates were above the

historical average of 55%. In 2017, a significant improvement in recoveries of bankrupt Oil & Gas companies helped lift the overall recovery rate as the market became more optimistic and commodity prices rebounded, leading to higher valuations for defaulted securities and for assets of companies in bankruptcy.

This positive sentiment in the energy sector continued through 2018. For example, among the 10 default resolutions during the year, the creditors to Pacific Drilling SA, a drilling company that emerged from bankruptcy protection, also realized sound recoveries on its debt investments, netting 69% on a company level. In 2018, 80% of all prepackaged bankruptcies and distressed exchanges, which normally realize higher-than-average recoveries, positively skewed the overall recovery average for the year and benefitted recoveries of all debt classes.

As Exhibit 9 shows, 21 loan tranches realized, on average, a slightly higher recovery in 2018 than the long-term average (85% vs. 80%), while senior unsecured and subordinated bonds fared worse than their respective historical averages. The latter could be explained by a rather small sample of analyzed default resolutions in 2018, but also by a shift to top-heavier structures among debt issuers, which have been structuring their balance sheets with a higher proportion of senior secured credit facilities and less junior, fixed-rated debt such as senior unsecured and subordinated bonds. As a result, there was only one subordinated bond among the 10 resolved defaults in 2018, and five among the 23 default resolutions in 2017.

Exhibit 9

Average corporate debt recovery rates measured by ultimate recoveries, 1987-2018

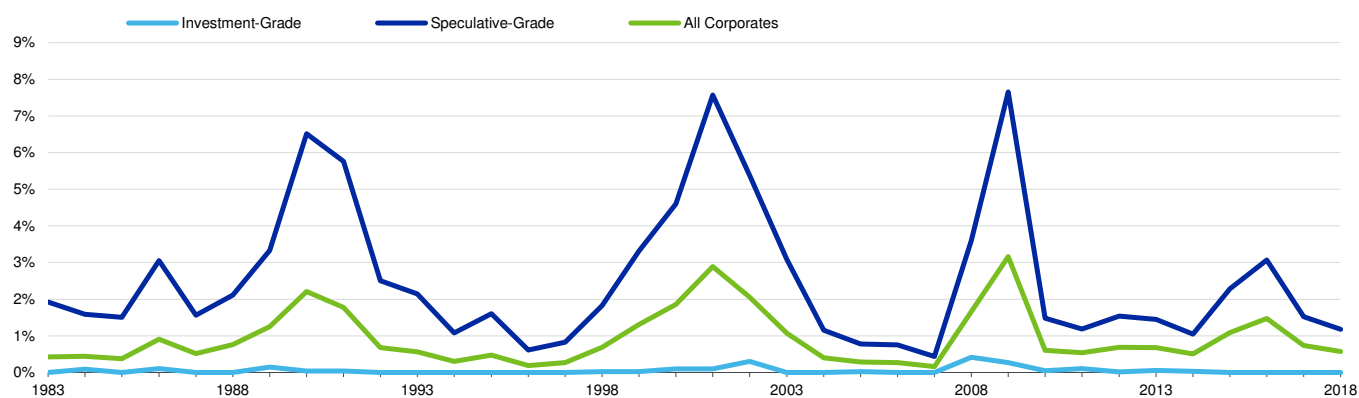
Priority Position	Emergence Year			Default Year		
	2018	2017	1987-2018	2018	2017	1987-2018
Loans	85.0%	83.3%	80.3%	85.0%	84.3%	80.3%
Senior Secured Bonds	53.8%	68.0%	62.1%	55.0%	65.7%	62.1%
Senior Unsecured Bonds	38.4%	56.4%	47.7%	35.4%	58.3%	47.7%
Subordinated Bonds	0.0%	51.2%	28.0%	n.a.	62.8%	28.0%

Source: Moody's Investors Service

Our credit ratings are opinions of relative probability of default and loss given default (LGD). Exhibit 10 shows annual average credit loss rates from 1983 through 2018 for rated corporate issuers. The chart indicates that the average credit loss rate among all rated issuers fell to 0.6% in 2018 from 0.7% in 2017. Historically, the average annual credit loss rate for rated issuers has been 0.9% since 1983.

Exhibit 10

Annual credit loss rates down in 2018



Source: Moody's Investors Service

Default rates to rise modestly in 2019

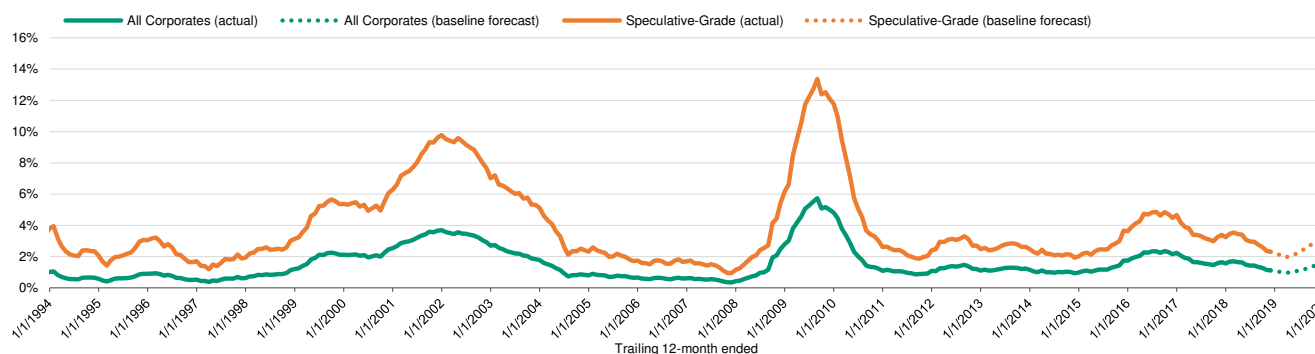
Default rate will climb but remain below historical average

Based on Moody's Credit Transition Model, the default rate for all rated corporate issuers will likely increase to 1.5% by the end of 2019, a lower rate than the average of 1.6% since 1983. For speculative-grade corporate issuers, the default rate is likely to rise to 3.0%, also below the historical average of 4.1% (see dotted lines in Exhibit 11). During 2019, we expect both rates to fall in the first quarter as the relatively high default count in the first quarter of 2018, that is, 10 per month on average, moves out of the trailing 12-month window. On the other hand, we expect both rates to rise in the second half of 2019 when the relatively low default count in the second half of 2018 (roughly five per month) transitions out.

Our forecasts are generated based on a few macro assumptions. We expect the global economy to grow at a slower pace in 2019 and oil prices to remain volatile but near their estimated long-run equilibrium level of around \$60 per barrel through the end of the decade. As for geopolitical issues, we assume a Brexit deal will be reached, although risks of a no-deal Brexit are rising. We also expect US-China trade tensions to continue and to extend beyond trade. Under this baseline scenario, we expect the average US high-yield spread will rise to 584 bps in the fourth quarter of 2019 from the latest quarter's average of 438 bps, whereas the US unemployment rate will ease to 3.3% from 3.7%.¹⁵

Exhibit 11

Default rates to trend up in the second half of 2019

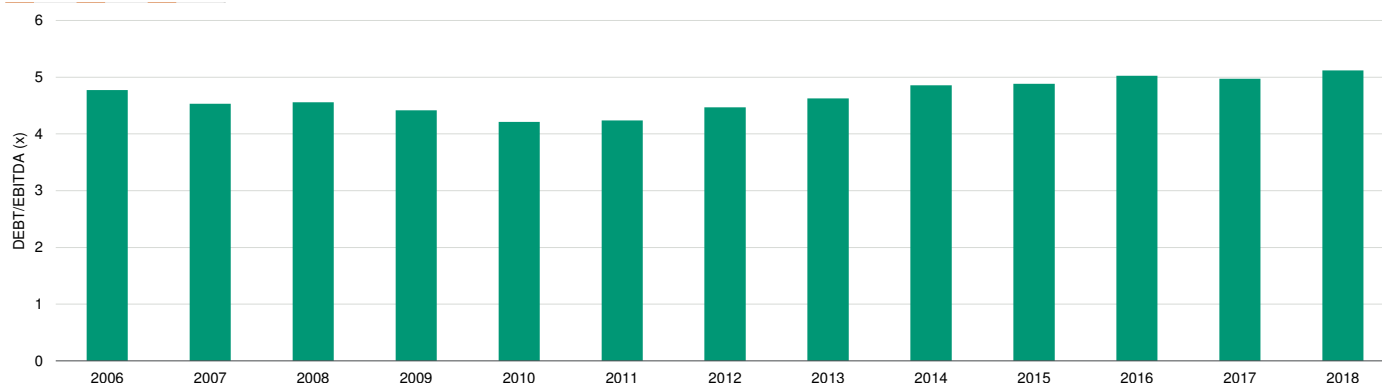


Source: Moody's Investors Service

The higher default rate forecast is underpinned by the risk factors associated with an increased level of debt and leverage as well as a weaker rating distribution, which have built up during a prolonged period during which speculative-grade issuers have had easy market access in a stable credit environment.¹⁶ For example, the median leverage ratio from nonfinancial global speculative-grade issuers rose to 5.1x in 2018, up from 4.2x in 2010 and 4.8x before the global financial crisis (see Exhibit 12).

Exhibit 12

Leverage is rising among nonfinancial global speculative-grade issuers



Source: Moody's Investors Service

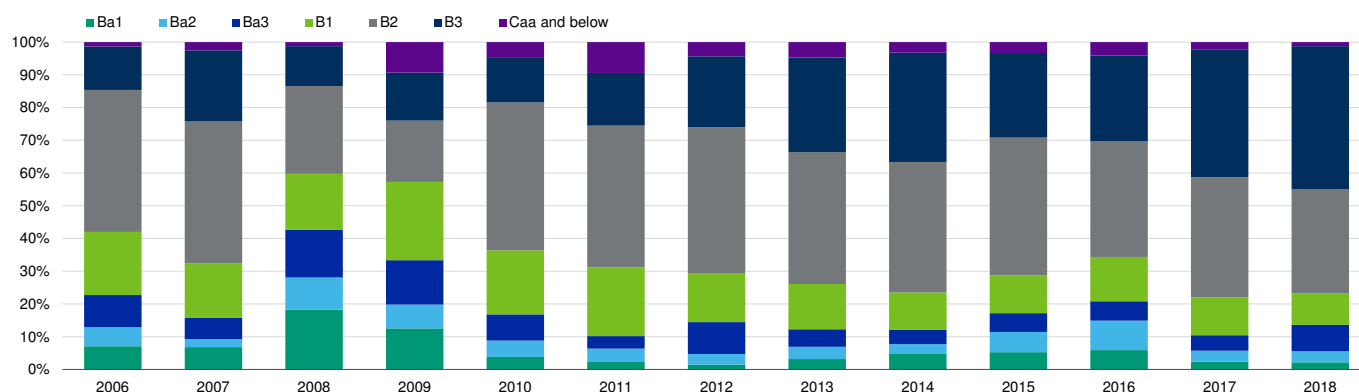
Additionally, accommodative credit conditions have allowed weaker corporate issuers to enter the market in recent years. Exhibit 13 illustrates this trend by showing the corporate family ratings for North American nonfinancial issuers when they first entered the high-yield market.¹⁷ The deterioration in the credit quality of new issuers, as shown by the surge in B3 issuers and the decline in higher-rated issuers, also supports the likelihood of rising defaults as companies with ratings of B3 and below typically have higher default risk in a vulnerable credit environment.

Finally, corporate issuers' borrowing costs will increase as central banks continue to normalize monetary policy. The rise in costs will increase the burden on companies' earnings and cash flow, adding upward pressure to the default rate.

Exhibit 13

New issuers have weaker credit qualities

Rating distribution of new issuers



Source: Moody's Investors Service

A sharp rise in defaults is unlikely in 2019

Although we expect the default rate to rise in 2019, default activities are not likely to pick up significantly for several key reasons. On the macro level, we expect the Fed to raise interest rates cautiously, as some FOMC members have recently communicated a preference for, so that financing conditions will tighten only slowly.¹⁸ Although the prolonged credit cycle is in its late stages, we do not believe a recession is imminent. Projected economic growth in the US and other developed markets, albeit slower than in 2018, will continue to support corporate fundamentals in our view.

On a micro level, a good number of corporate borrowers have taken advantage of favorable market conditions and refinanced their debt in recent years, leaving near-term refunding needs at manageable levels. For example, US speculative-grade borrowers currently have most of their debt maturing in 2022-23 and only \$43 billion of debt is due in 2019.¹⁹

Printing & Publishing to have the highest default rate as Retail rate falls

In Exhibit 14, we provide one-year default rate forecasts by industry.²⁰ The exhibit is based on the same economic assumption for all industries, so the only factors driving the different forecast default rates are rating factors including rating histories, current ratings and watch/outlook statuses of the companies in these industries.

Measured by default rate, the most troubled sector is Media: Advertising, Printing & Publishing, with a one-year default rate forecast of 3.8%. Although the forecast is based on a small portfolio of companies, it is underpinned by the sector's current ratings, more than half of which are in the single B and Caa rating buckets. We currently have a negative outlook on Publishing/Newspapers in the US, which reflects stress from persistent decline in print advertisement demands as reading habits shift away from print, and as competition from search engines, social media and digital video has increased. Although most media companies have responded by expanding digital platforms, we do not expect revenue from digital operations to replace lost print revenue.²¹

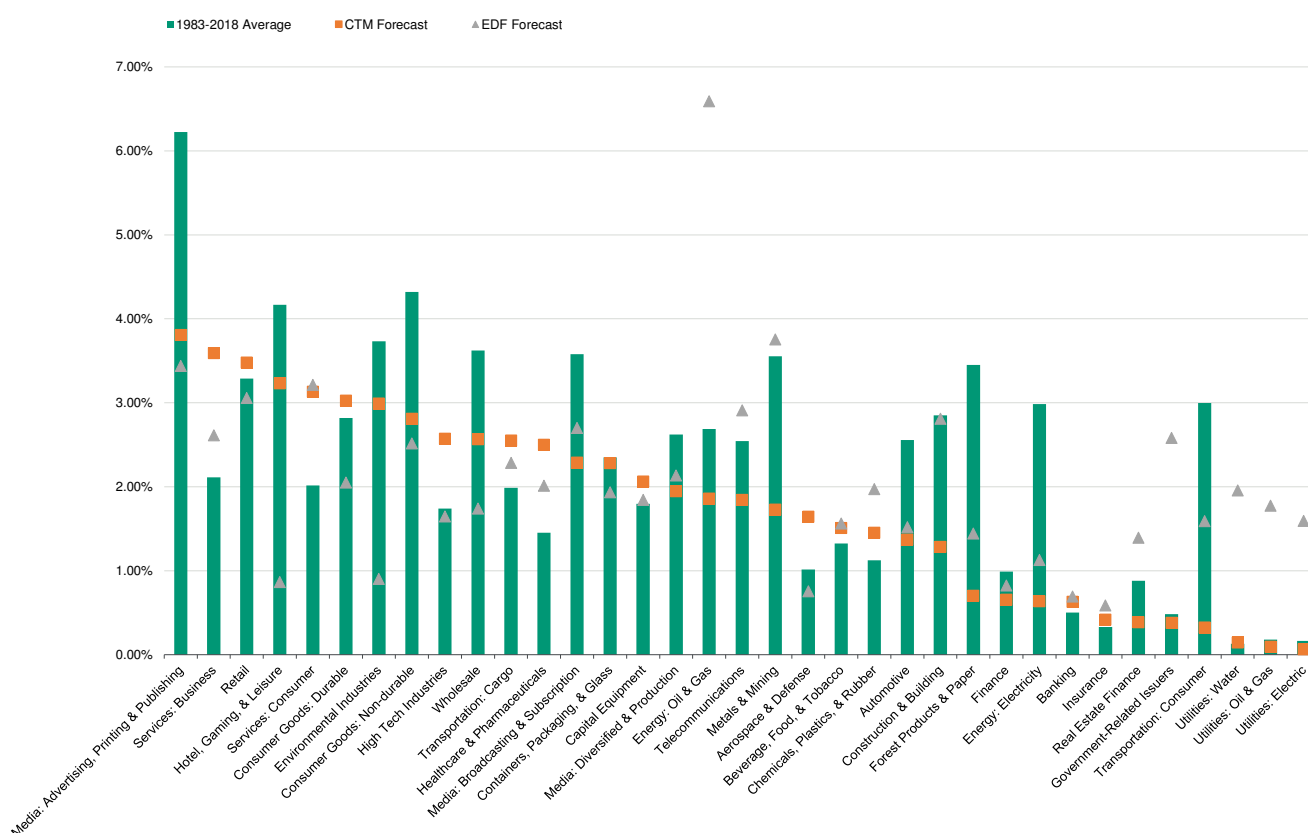
As for the most troubled sector from last year, we expect Retail's default rate to finish 2019 at 3.5%, down from 7.3% in 2018. The sector's outlook is positive in the US, which reflects higher operating income growth amid the robust US economy. In addition, the

sector is starting to reap the rewards of investments in e-commerce and operating efficiencies. In 2019, we expect US retailers' operating income growth to be in the 5%-6% range, led by online and off-price retailers, while department stores will be a drag.²²

Similarly to the default trend for Retail, our Credit Transition Model also predicts a decline in the default rate for Oil & Gas from 3.1% in 2018 to 1.9% in 2019 as the sector continues to recover. We expect oil and natural gas prices will be volatile but bound in a range of \$50-\$70 for oil and \$2.50-\$3.50 for natural gas. Within Oil & Gas, four of the five subsectors - Exploration & Production, Oilfield Services & Drilling, Midstream & MLPs, and Refining & Marketing - have positive outlooks, with 2019 EBITDA growth estimates ranging from the high single digits to the mid-teens in percentage terms. Integrated Oil and Gas is the only subsector that does not have a positive outlook. EBITDA for the Integrated Oil and Gas sector will likely decline modestly in 2019. Nonetheless, this subsector has a stable outlook.²³

Exhibit 14

One-year corporate default rate forecasts by industry



Source: Moody's Investors Service

Exhibit 14 also shows the default rate forecast implied by Expected Default Frequency (EDF).^{24,25} As the exhibit shows, EDF-implied ratings indicate a worse default rate outlook for Oil & Gas than the one suggested by the Credit Transition Model. This indication reflects the volatility in the equity market, which may not be fully captured in rating actions. In addition, the EDF-implied default rate may also be higher because that portfolio includes some unrated issuers that may have relatively weak credit quality. When compared with those EDF-implied forecasts from a year ago, the latest EDF forecasts that most sectors will likely have higher default rates in 2019 compared with 2018.

What could drive default rate higher than the baseline forecast?

While our baseline forecasts show the projections that will most likely happen, there are alternative scenarios that could drive default rates higher. In our view, the default rate forecast has more risk to the upside than the downside given the late stage in the credit cycle, the uncertainty on the pace of Fed rate hikes and US-China trade disputes. In addition, the outcome of Brexit, rising debt and complicated political issues in Italy, and fiscal woes in Turkey and Argentina will also be a factor, but to a smaller degree, in moving up the global default rate.

Central bank policy and US-China trade disputes could pose significant risks to corporate defaults in 2019. Faster-than-expected monetary policy normalization will drive borrowing costs higher and can cause sharper financial market adjustments, which in a worst-case scenario, may lead to an end of the current credit cycle. As for US-China trade issues, further escalation of the tensions could damage global growth, causing volatility in the financial markets and possibly triggering some disruption in liquidity.

In Exhibit 15, we present default rate forecasts under various scenarios. In this exhibit, we apply the same rating histories and current ratings (including watch/outlook assignments) in all scenarios so that the only factors driving different forecasts are economic assumptions.

Exhibit 15

Default rate forecasts under alternative scenarios

Scenario		Baseline	The downside 25% scenario	The downside 10% scenario	The downside 4% scenario
Scenario description		In this scenario, there is a 50% probability that economic conditions will be better, broadly speaking, and a 50% probability that conditions will be worse	In this scenario, there is a 75% probability that economic conditions will be better, broadly speaking, and a 25% probability that conditions will be worse.	In this recession scenario, there is a 90% probability that the economy will perform better, broadly speaking, and a 10% probability that it will perform worse.	In this recession scenario, there is a 96% probability that the economy will perform better, broadly speaking, and a 4% probability that it will perform worse.
Assumptions for 2019	US Unemployment*	3.3%	4.1%	7.2%	7.2%
	US HY Spread*	583 bps	711 bps	1187 bps	1249 bps
All corporates default rate	2018 Actual	1.12%	1.12%	1.12%	1.12%
	2019 Forecast	1.45%	1.99%	5.37%	6.29%
Speculative-grade default rate	2018 Actual	2.31%	2.31%	2.31%	2.31%
	2019 Forecast	3.01%	4.08%	10.90%	12.72%

* Average in Q4 2019.

Sources: Moody's Investors Service, MEDC, Bloomberg

Loan recoveries to face downward pressure

Recoveries will likely face downward pressure because of weaker and more loan-only structures. In recent years, the syndicated leveraged loan market has grown significantly and reached \$1 trillion in the US in 2018. Amid the growth of the leveraged loan market, demanding borrowers are undermining the strength of credit agreements and capital structures to the detriment of investors, resulting in aggressive financial policies, deteriorating debt cushions, and a greater number of smaller and less creditworthy firms accessing the institutional loan market.²⁶

Lower recoveries can occur through various means. Some of these pathways are highly visible, such as smaller debt cushions as a result of the inclusion of a higher proportion of first-lien debt in capital structures. But other recovery risks are more nuanced. For example, structuring credit agreements to allow borrowers to make collateral stripping asset transfers, issue dilutive incremental first-lien loans, and retain an increased portion of asset-sale proceeds, effectively reduces collateral support. All of these actions can weaken the position of current first-lien claims.

Loans can face additional challenges from the increase in loan-only structures, where loans no longer have bonds, as traditional buffer, below them. Based on our recent loss given default assessments (LGDAs), we expect first-lien senior secured term loans to recover in

the 61% range, on average, down from the historical average of 77%. For second-lien loans, the projected recovery is 14%, well below the long-term average of 43%.

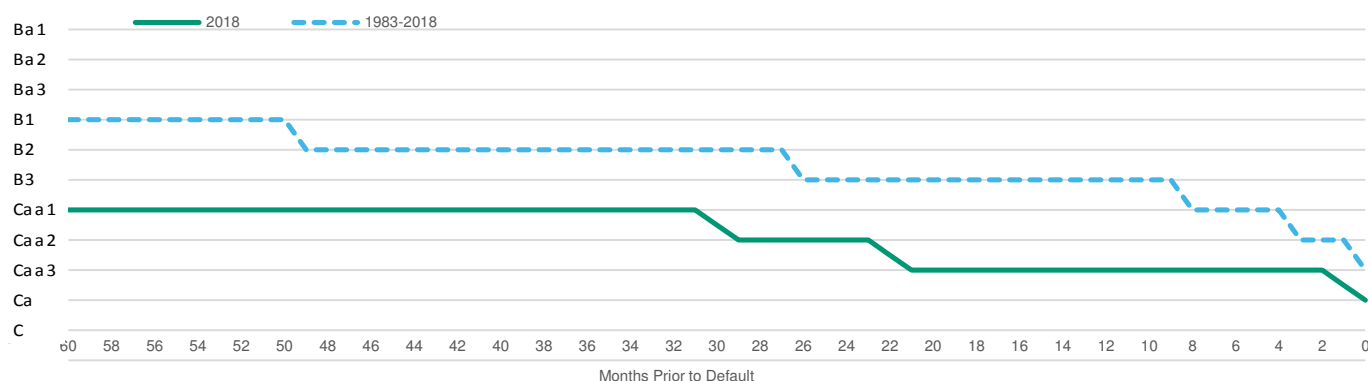
On the bond side, we expect their recoveries to be influenced by the frequent use of distressed exchanges (DEs). Historically, DEs were more focused on junior debt and had better recoveries on average. However, distressed exchanges do not always avert subsequent bankruptcies and bond recovery rates were often lower in subsequent defaults.

Rating Accuracy Metrics

Our ratings have historically proven to be effective predictors of default, as Exhibit 16 shows. The exhibit plots the median ratings of more than 2,000 corporate issuers that defaulted from 1983 to 2018. The exhibit demonstrates that, historically, rated issuers have been downgraded to B1 as early as five years before default. The comparable median rating was Caa1 among issuers that defaulted in 2018. The median rating one year before default was Caa3 among last year's defaulters, three notches below the rating measured over the entire 1983-2018 period.

Exhibit 16

Median ratings before default, 2018 vs. long-term average

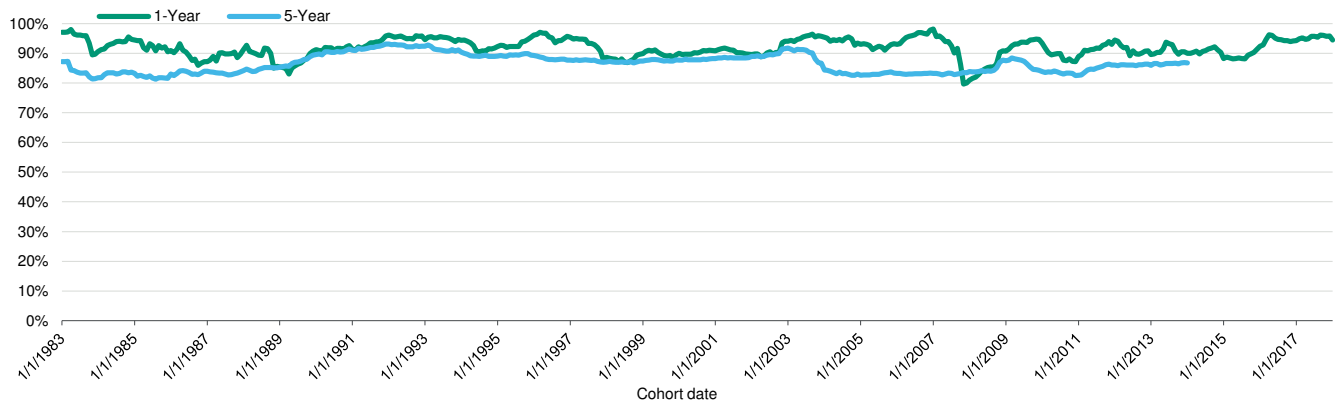


Source: Moody's Investors Service

The evolution of median ratings shown in Exhibit 16 demonstrate that our corporate ratings are correlated with subsequent default experience. To further demonstrate the ability of ratings to separate issuers with low credit risk from those with high credit risk, we use the Average Position (AP) of defaults to evaluate the accuracy of our ordinal rating systems (see Exhibit 17).²⁷ AP measures the average position for defaulters with position defined as the percentage of issuers with higher or equal ratings. A greater AP indicates a more discriminatory rating system because there are more issuers rated higher than the defaulters, or equivalently that defaulters are generally found in lower rating categories. Exhibit 17 shows that the AP of defaults was consistently high during the entire 1983-2018 period, with an average of 91.8% for the one-year horizon and 86.5% for the five-year horizon. These percentages indicate that our ratings have been effective in predicting defaults over both the short- and long-term periods.

Exhibit 17

One- and five-year average default position by cohort year, 1983-2018



Source: Moody's Investors Service

Methodology and Data Sources

Moody's Definition of Default

Moody's definition of default is applicable only to debt or debt-like obligations (e.g., swap agreements). For details, please refer to [Moody's Rating Symbols and Definitions](#).

Methodology

The methodology used in this study can be found in the [Glossary of Moody's Ratings Performance Metrics](#). The Glossary report is a technical paper that explains how Moody's calculates default rates, transition rates and rating performance metrics in detail.

Changes in this Year's Report

Moody's occasionally discovers historical defaults, leading to minor revisions of the historical data. As always, the data contained in the most recently published Moody's default study supersede the data published in previous reports.

Data Sources

Moody's bases the results of this study on its proprietary database of ratings and defaults for corporate bond and loan issuers. Municipal and sub-sovereign debt issuers, structured finance securities, private placements and issuers with only short-term debt ratings are excluded unless otherwise noted. In total, Moody's data covers the credit experiences of over 20,000 corporate issuers that sold long-term public debt at some time between 1920 and 2018. As of January 1, 2018, over 6,000 corporate issuers held a Moody's long-term bond, loan, deposit or corporate family rating.

Moody's database of corporate defaults covers more than 3,000 long-term bond and loan defaults by issuers both rated and nonrated by Moody's. Additional data sources, such as Barclay's Fixed Income Index data, supplemented Moody's proprietary data in the construction of the aggregate dollar volume-weighted default rates. Defaulted bond pricing data was derived from Bloomberg, Reuters, IDC and TRACE. The majority of these market quotes represent an actual bid on the debt instrument, although no trade may have occurred at that price. Over the 1982-2018 period, the dataset includes post-default prices for approximately 5,000 defaulted instruments issued by over 1,700 defaulting corporations. Moody's makes the 1970-2018 credit rating, default and recovery rate data used in this study available through its Default and Recovery Database (DRD).

Guide to Data Tables and Charts in Appendix

In this section, we briefly describe the interpretation of some of the exhibits contained in this report. Exhibit 16 was derived by mapping Moody's ratings to a linear scale, then taking the median values of the numerically mapped ratings. Exhibit 28 shows average senior unsecured recovery rates by letter rating and year prior to default. Each cell in the table indicates the average recovery rate on senior unsecured bonds with a specific rating within T years of default. For example, the 36.8% two-year B recovery rate reported in Exhibit 28 indicates the average recovery rate on B- rated issues that default at some time within a two-year period, not recovery rate for issuers rated B exactly two years before default. Together with issuer-weighted average cumulative default rates, these multi-period recovery estimates are used to calculate cumulative expected credit loss rates, as presented in Exhibit 29.

Exhibits 41 through 46 show issuer-weighted historical average default rates by rating category over various investment horizons. These data were generated by averaging the multi-year default rates of cohorts formed at monthly intervals. In addition to their being statements of historical fact, these data are also useful proxies for expected default rates. For example, over a five-year period a portfolio of B-rated issuers defaulted at a 20.7% average rate between 1983 and 2018 (see Exhibit 43). For an investor with a five-year exposure to a B-rated debt obligation or counterparty, this estimate also happens to be the best estimate of the expected risk of default for a B-rated exposure based on the available historical data, particularly over long investment horizons.

Exhibit 52 shows average cumulative volume-weighted default rates by rating category. Whereas issuer-based default rates weight each issuer equally, these data weight each issuer by the total volume of defaulted debt; larger defaults receive relatively more weight. Average default rates based on debt volume affected are less suitable estimates of expected default risk. One reason is that issuer default volumes vary considerably over time. On average, a leveraged corporate issuer defaults on approximately \$300 million of bonds. However, that total has been as high as \$30 billion (WorldCom). Issuer-based default rates receive particular emphasis in the rating process because the expected likelihood of default of a debt issuer holding a given rating is expected to be the same regardless of differences in the nominal sizes of the exposures.

Exhibit 53 shows the cumulative issuer-weighted historical default rates of cohorts formed between the years 1970 and 2018 (January 1 of each year). These data are a subset of the data used to calculate the issuer-weighted averages shown in Exhibits 32 through 34 (which, again, are based on cohorts formed at monthly time intervals). The default rates in Exhibit 41 may be useful for scenario analysis. For example, if one believed that future default rates for a given pool of issuers will behave as they did in, say, 1997, then one can use the January 1, 1997 cohort cumulative default rates as proxies for expected default rates.

Appendix

Exhibit 18

Moody's-rated 2018 corporate bond and loan defaults*

Company	Domicile	Default Date	Broad Default Type	Bond (US \$ mil)	Loan (US \$ mil)	In Jan 2018 Cohort?
American Tire Distributors, Inc.	United States	10/4/2018	Bankruptcy	\$1,050	\$1,391	1
Andrade Gutierrez Engenharia S.A.	Brazil	4/30/2018	Payment Default	\$345	\$0	1
Astaldi S.p.A.	Italy	12/31/2018	Payment Default	\$857	\$0	1
Avanti Communications Group plc	United Kingdom	2/21/2018	Bankruptcy	\$836	\$0	1
Bellatrix Exploration Ltd.	Canada	9/11/2018	Distressed Exchange	\$80	\$0	1
BI-LO Holding Finance, LLC	United States	3/27/2018	Bankruptcy	\$521	\$0	1
BI-LO, LLC	United States	3/27/2018	Bankruptcy	\$425	\$512	1
Bon-Ton Stores Inc., (The)	United States	1/15/2018	Payment Default	\$350	\$0	1
BrightHouse Group PLC	United Kingdom	2/2/2018	Distressed Exchange	\$308	\$0	1
Cenveo Corporation	United States	2/2/2018	Bankruptcy	\$935	\$126	1
Cenveo, Inc.	United States	2/2/2018	Bankruptcy	\$0	\$0	0
CEVA Group plc	United Kingdom	5/8/2018	Distressed Exchange	\$0	\$953	1
Charlotte Russe, Inc.	United States	2/2/2018	Distressed Exchange	\$0	\$214	0
Checkout Holding Corp.	United States	12/12/2018	Bankruptcy	\$0	\$1,540	1
Claire's Stores, Inc.	United States	3/19/2018	Bankruptcy	\$1,774	\$107	1
Community Choice Financial Inc.	United States	12/1/2018	Payment Default	\$250	\$0	1
Community Health Systems, Inc.	United States	6/20/2018	Distressed Exchange	\$3,217	\$0	1
Cooperativa Muratori e Cementisti C.M.C.	Italy	12/15/2018	Payment Default	\$367	\$0	1
Davids Bridal, Inc.	United States	11/14/2018	Payment Default	\$270	\$481	1
Del Monte Foods, Inc.	United States	6/28/2018	Distressed Exchange	\$0	\$223	1
DFC Finance Corp.	United States	12/11/2018	Distressed Exchange	\$953	\$0	1
Dixie Electric, LLC	United States	9/7/2018	Payment Default	\$0	\$267	1
Electroingenieria S.A.	Argentina	12/12/2018	Distressed Exchange	\$7	\$0	1
Eletson Holdings Inc.	Liberia	2/15/2018	Payment Default	\$300	\$0	1
Elli Investments Limited	United Kingdom	1/14/2018	Payment Default	\$240	\$0	1
EV Energy Partners, L.P.	United States	4/2/2018	Bankruptcy	\$343	\$0	1
Fairway Group Acquisition Company	United States	8/28/2018	Distressed Exchange	\$0	\$100	1
Fairway Group Holdings Corp.	United States	8/28/2018	Distressed Exchange	\$0	\$39	1
Fieldwood Energy LLC	United States	1/29/2018	Payment Default	\$0	\$3,413	1
FirstEnergy Generation, LLC	United States	3/31/2018	Bankruptcy	\$0	\$0	1
FirstEnergy Nuclear Generation, LLC	United States	3/31/2018	Bankruptcy	\$0	\$0	1
FirstEnergy Solutions Corp.	United States	3/31/2018	Bankruptcy	\$696	\$0	1
FULLBEAUTY Brands Holdings Corp.	United States	11/7/2018	Payment Default	\$0	\$345	1
Gibson Brands, Inc.	United States	5/1/2018	Bankruptcy	\$375	\$70	1
Guitar Center Inc.	United States	4/11/2018	Distressed Exchange	\$318	\$0	1
HGIM CORP.	United States	3/7/2018	Bankruptcy	\$0	\$1,100	1
House of Fraser (UK & Ireland) Limited	United Kingdom	7/27/2018	Distressed Exchange	\$217	\$263	1
Hovnanian Enterprises, Inc.	United States	1/30/2018	Distressed Exchange	\$0	\$0	1
Huachen Energy Co., Ltd.	China	9/20/2018	Payment Default	\$0	\$7	1
Ideal Standard International S.A.	Belgium	4/4/2018	Distressed Exchange	\$856	\$0	1
iHeartCommunications, Inc.	United States	3/3/2018	Payment Default	\$8,967	\$6,671	1
Imperial Metals Corporation	Canada	9/14/2018	Distressed Exchange	\$0	\$58	1

*This list only includes companies that have rated bonds, loans and/or deposits within one year prior to default. Only issuers included in the Jan 1st cohort are included in the annual default rates in this report. The list only includes 77 companies, which initially defaulted in 2018. Besides these 77 companies, there are seven issuers, which initially defaulted in prior years but experienced follow-on defaults on \$12.4 billion of debt in 2018 (\$8.8 billion in bonds and \$3.7 billion in loans). We include such \$12.4 billion in the 2018 default volume.

Source: Moody's Investors Service

Exhibit 19

Moody's-rated 2018 corporate bond and loan defaults* (continued)

Company	Domicile	Default Date	Broad Default Type	Bond (US \$ mil)	Loan (US \$ mil)	In Jan 2018 Cohort?
Johnston Press plc	United Kingdom	11/16/2018	Bankruptcy	\$282	\$0	1
Jupiter Resources Inc.	Canada	10/31/2018	Payment Default	\$1,100	\$0	1
K. Hovnanian Enterprises, Inc.	United States	1/30/2018	Distressed Exchange	\$185	\$0	1
Legacy Reserves LP	United States	1/5/2018	Distressed Exchange	\$187	\$0	1
Legacy Reserves LP	United States	9/20/2018	Distressed Exchange	\$130	\$0	0
MNC Investama Tbk. (P.T.)	Indonesia	5/11/2018	Distressed Exchange	\$186	\$0	1
Murray Energy Corporation	United States	6/15/2018	Distressed Exchange	\$744	\$0	1
NCSG Crane & Heavy Haul Corporation	Canada	3/17/2018	Payment Default	\$305	\$0	1
New Trident Holdcorp, Inc.	United States	4/30/2018	Distressed Exchange	\$0	\$495	1
Nine West Holdings, Inc.	United States	4/6/2018	Bankruptcy	\$705	\$885	1
Noble Group Limited	Hong Kong	3/20/2018	Payment Default	\$2,306	\$1,143	1
Northern Oil and Gas, Inc	United States	5/15/2018	Distressed Exchange	\$497	\$0	1
NRG REMA LLC	United States	7/9/2018	Payment Default	\$205	\$0	1
Odebrecht Engenharia e Construcao S.A. (OEC)	Brazil	11/24/2018	Payment Default	\$519	\$0	1
PaperWorks Industries, Inc.	United States	2/28/2018	Distressed Exchange	\$356	\$0	1
Parker Drilling Company	United States	12/12/2018	Bankruptcy	\$585	\$6	1
Philadelphia Energy Solutions R&M LLC	United States	1/21/2018	Bankruptcy	\$0	\$541	1
Proserv Operations Limited	United Kingdom	5/14/2018	Distressed Exchange	\$0	\$135	0
Proserv US LLC	United States	5/14/2018	Distressed Exchange	\$0	\$345	0
Remington Outdoor Company, Inc.	United States	3/25/2018	Bankruptcy	\$226	\$550	1
Reward Science and Tech. Industry Grp. Co Ltd	China	12/24/2018	Payment Default	\$44	\$0	1
RGL Reservoir Management Inc.	Canada	1/8/2018	Distressed Exchange	\$0	\$346	1
Sears Holdings Corp.	United States	3/20/2018	Distressed Exchange	\$481	\$0	1
Sears Holdings Corp.	United States	10/15/2018	Bankruptcy	\$898	\$1,006	0
Sterling Mid-Holdings Limited	United Kingdom	12/11/2018	Distressed Exchange	\$0	\$0	1
Tops Holding II Corporation	United States	2/21/2018	Bankruptcy	\$9	\$0	1
Tops Holding LLC	United States	2/21/2018	Bankruptcy	\$628	\$0	1
Transworld Systems, Inc.	United States	5/23/2018	Distressed Exchange	\$419	\$0	1
Triple Point Group Holdings, Inc	United States	4/15/2018	Distressed Exchange	\$0	\$32	1
Ultra Resources, Inc.	United States	12/26/2018	Distressed Exchange	\$780	\$0	1
United Central Industrial Supply, LLC	United States	8/15/2018	Distressed Exchange	\$0	\$190	1
United Distribution Group, Inc.	United States	8/15/2018	Distressed Exchange	\$0	\$0	1
Westmoreland Coal Company	United States	7/31/2018	Payment Default	\$350	\$317	1
Windstream Services, LLC	United States	7/31/2018	Distressed Exchange	\$1,444	\$0	1
Wuzhou International Holdings Limited	China	7/6/2018	Payment Default	\$330	\$0	1

*This list only includes companies that have rated bonds, loans and/or deposits within one year prior to default. Only issuers included in the Jan 1st cohort are included in the annual default rates in this report. The list only includes 77 companies, which initially defaulted in 2018. Besides these 77 companies, there are seven issuers, which initially defaulted in prior years but experienced follow-on defaults on \$12.4 billion of debt in 2018 (\$8.8 billion in bonds and \$3.7 billion in loans). We include such \$12.4 billion in the 2018 default volume.

Source: Moody's Investors Service

Exhibit 20

Annual Moody's-rated global corporate issuer default counts, 1920-2018*

Year	IG	SG	All
1920	8	25	33
1921	7	25	32
1922	10	23	33
1923	5	22	27
1924	3	37	40
1925	7	34	41
1926	4	18	22
1927	1	15	16
1928	0	8	8
1929	3	12	15
1930	2	21	23
1931	6	78	84
1932	10	108	118
1933	9	189	198
1934	5	60	65
1935	9	51	60
1936	3	19	22
1937	4	18	22
1938	9	17	26
1939	2	13	15
1940	2	22	24
1941	0	10	10
1942	0	4	4
1943	0	3	3
1944	0	3	3
1945	0	2	2
1946	0	0	0
1947	0	2	2
1948	0	0	0
1949	0	5	5
1950	0	0	0
1951	0	1	1
1952	0	0	0
1953	0	0	0
1954	0	1	1
1955	0	1	1
1956	0	0	0
1957	0	1	1
1958	0	0	0
1959	0	0	0
1960	0	2	2
1961	0	3	3
1962	0	4	4
1963	0	3	3
1964	0	0	0
1965	0	0	0
1966	0	1	1
1967	0	0	0
1968	0	1	1
1969	0	0	0
1970	2	25	27

* only include companies in Jan 1 cohort

Source: Moody's Investors Service

Exhibit 21

Annual Moody's-rated global corporate issuer default counts, 1920-2018*(Continued)

Year	IG	SG	All
1971	0	3	3
1972	0	5	5
1973	2	3	5
1974	0	3	3
1975	0	4	4
1976	0	2	2
1977	1	3	4
1978	0	4	4
1979	0	1	1
1980	0	4	4
1981	0	2	2
1982	2	11	13
1983	0	13	13
1984	2	11	13
1985	0	16	16
1986	3	33	36
1987	0	31	31
1988	0	33	33
1989	4	50	54
1990	1	89	90
1991	1	68	69
1992	0	33	33
1993	0	23	23
1994	0	19	19
1995	0	29	29
1996	0	18	18
1997	0	25	25
1998	1	51	52
1999	1	107	108
2000	4	124	128
2001	4	186	190
2002	14	133	147
2003	0	91	91
2004	0	41	41
2005	2	31	33
2006	0	31	31
2007	0	19	19
2008	21	118	139
2009	14	258	272
2010	3	61	64
2011	6	43	49
2012	1	66	67
2013	3	67	70
2014	2	55	57
2015	0	109	109
2016	0	137	137
2017	0	102	102
2018	0	71	71

* only include companies in Jan 1 cohort

Source: Moody's Investors Service

Exhibit 22

Annual rated global corporate bond and loan default volumes, 1970-2018*

In \$ millions

Year	IG			SG			All Ratings		
	Bond	Loan	Total	Bond	Loan	Total	Bond	Loan	Total
1970	\$154.04	\$0.00	\$154.04	\$756.43	\$0.00	\$756.43	\$910.47	\$0.00	\$910.47
1971	\$0.00	\$0.00	\$0.00	\$131.84	\$0.00	\$131.84	\$131.84	\$0.00	\$131.84
1972	\$0.00	\$0.00	\$0.00	\$215.08	\$0.00	\$215.08	\$215.08	\$0.00	\$215.08
1973	\$17.37	\$0.00	\$17.37	\$94.30	\$0.00	\$94.30	\$111.67	\$0.00	\$111.67
1974	\$0.00	\$0.00	\$0.00	\$69.36	\$0.00	\$69.36	\$69.36	\$0.00	\$69.36
1975	\$0.00	\$0.00	\$0.00	\$175.60	\$0.00	\$175.60	\$175.60	\$0.00	\$175.60
1976	\$0.00	\$0.00	\$0.00	\$33.97	\$0.00	\$33.97	\$33.97	\$0.00	\$33.97
1977	\$67.97	\$0.00	\$67.97	\$179.49	\$0.00	\$179.49	\$247.46	\$0.00	\$247.46
1978	\$0.00	\$0.00	\$0.00	\$111.88	\$0.00	\$111.88	\$111.88	\$0.00	\$111.88
1979	\$0.00	\$0.00	\$0.00	\$18.36	\$0.00	\$18.36	\$18.36	\$0.00	\$18.36
1980	\$0.00	\$0.00	\$0.00	\$302.17	\$0.00	\$302.17	\$302.17	\$0.00	\$302.17
1981	\$0.00	\$0.00	\$0.00	\$47.46	\$0.00	\$47.46	\$47.46	\$0.00	\$47.46
1982	\$243.10	\$0.00	\$243.10	\$515.12	\$0.00	\$515.12	\$758.22	\$0.00	\$758.22
1983	\$0.00	\$0.00	\$0.00	\$1,110.00	\$0.00	\$1,110.00	\$1,110.00	\$0.00	\$1,110.00
1984	\$215.29	\$0.00	\$215.29	\$366.81	\$0.00	\$366.81	\$582.10	\$0.00	\$582.10
1985	\$0.00	\$0.00	\$0.00	\$1,354.39	\$0.00	\$1,354.39	\$1,354.39	\$0.00	\$1,354.39
1986	\$138.24	\$0.00	\$138.24	\$3,212.83	\$0.00	\$3,212.83	\$3,351.07	\$0.00	\$3,351.07
1987	\$0.00	\$0.00	\$0.00	\$8,940.66	\$241.50	\$9,182.16	\$8,940.66	\$241.50	\$9,182.16
1988	\$0.00	\$0.00	\$0.00	\$5,641.96	\$361.00	\$6,002.96	\$5,641.96	\$361.00	\$6,002.96
1989	\$1,505.93	\$0.00	\$1,505.93	\$9,656.50	\$0.00	\$9,656.50	\$11,162.43	\$0.00	\$11,162.43
1990	\$0.00	\$0.00	\$0.00	\$20,429.13	\$1,830.80	\$22,259.93	\$20,429.13	\$1,830.80	\$22,259.93
1991	\$1,348.00	\$0.00	\$1,348.00	\$15,545.95	\$678.02	\$16,223.96	\$16,893.95	\$678.02	\$17,571.96
1992	\$0.00	\$0.00	\$0.00	\$6,666.73	\$956.12	\$7,622.85	\$6,666.73	\$956.12	\$7,622.85
1993	\$0.00	\$0.00	\$0.00	\$2,616.51	\$486.73	\$3,103.24	\$2,616.51	\$486.73	\$3,103.24
1994	\$0.00	\$0.00	\$0.00	\$2,713.41	\$299.36	\$3,012.77	\$2,713.41	\$299.36	\$3,012.77
1995	\$0.00	\$0.00	\$0.00	\$5,400.60	\$372.30	\$5,772.90	\$5,400.60	\$372.30	\$5,772.90
1996	\$0.00	\$0.00	\$0.00	\$4,106.13	\$1,435.00	\$5,541.13	\$4,106.13	\$1,435.00	\$5,541.13
1997	\$0.00	\$0.00	\$0.00	\$5,024.25	\$948.00	\$5,972.25	\$5,024.25	\$948.00	\$5,972.25
1998	\$399.00	\$0.00	\$399.00	\$9,469.31	\$3,299.09	\$12,768.40	\$9,868.31	\$3,299.09	\$13,167.40
1999	\$460.92	\$1,225.00	\$1,685.92	\$26,216.76	\$14,053.62	\$40,270.38	\$26,677.68	\$15,278.62	\$41,956.30
2000	\$4,115.47	\$3,950.00	\$8,065.47	\$25,360.01	\$26,205.69	\$51,565.70	\$29,475.48	\$30,155.69	\$59,631.16
2001	\$21,195.04	\$5,363.00	\$26,558.04	\$78,863.52	\$34,103.46	\$112,966.98	\$100,058.56	\$39,466.46	\$139,525.02
2002	\$44,214.01	\$13,657.86	\$57,871.87	\$115,778.89	\$40,470.83	\$156,249.73	\$159,992.90	\$54,128.70	\$214,121.60
2003	\$0.00	\$869.50	\$869.50	\$38,667.20	\$10,308.30	\$48,975.50	\$38,667.20	\$11,177.80	\$49,845.00
2004	\$0.00	\$0.00	\$0.00	\$16,409.17	\$4,712.41	\$21,121.59	\$16,409.17	\$4,712.41	\$21,121.59
2005	\$2,155.00	\$2,825.00	\$4,980.00	\$27,629.41	\$8,744.57	\$36,373.98	\$29,784.41	\$11,569.57	\$41,353.98
2006	\$0.00	\$0.00	\$0.00	\$7,758.48	\$2,629.60	\$10,388.08	\$7,758.48	\$2,629.60	\$10,388.08
2007	\$0.00	\$0.00	\$0.00	\$6,213.67	\$1,983.00	\$8,196.67	\$6,213.67	\$1,983.00	\$8,196.67
2008	\$182,072.71	\$10,379.55	\$192,452.26	\$51,362.38	\$32,321.53	\$83,683.91	\$233,435.09	\$42,701.08	\$276,136.17
2009	\$35,703.75	\$21,930.72	\$57,634.47	\$148,230.59	\$122,349.58	\$270,580.17	\$183,934.35	\$144,280.30	\$328,214.65
2010	\$4,046.86	\$0.00	\$4,046.86	\$21,323.09	\$14,041.55	\$35,364.64	\$25,369.95	\$14,041.55	\$39,411.49
2011	\$6,561.44	\$1,410.88	\$7,972.32	\$22,658.17	\$4,906.15	\$27,564.33	\$29,219.61	\$6,317.03	\$35,536.65
2012	\$323.07	\$0.00	\$323.07	\$34,835.44	\$18,289.37	\$53,124.81	\$35,158.51	\$18,289.37	\$53,447.88
2013	\$2,408.45	\$0.00	\$2,408.45	\$28,781.05	\$13,825.59	\$42,606.65	\$31,189.50	\$13,825.59	\$45,015.09
2014	\$939.11	\$0.00	\$939.11	\$40,360.69	\$30,331.30	\$70,691.99	\$41,299.80	\$30,331.30	\$71,631.10
2015	\$0.00	\$0.00	\$0.00	\$75,662.44	\$19,793.76	\$95,456.20	\$75,662.44	\$19,793.76	\$95,456.20
2016	\$0.00	\$0.00	\$0.00	\$90,573.35	\$42,508.40	\$133,081.74	\$90,573.35	\$42,508.40	\$133,081.74
2017	\$0.00	\$0.00	\$0.00	\$57,837.77	\$26,528.21	\$84,365.98	\$57,837.77	\$26,528.21	\$84,365.98
2018	\$0.00	\$0.00	\$0.00	\$46,500.72	\$25,829.09	\$72,329.82	\$46,500.72	\$25,829.09	\$72,329.82

* only include companies in Jan 1 cohort

Source: Moody's Investors Service

Exhibit 23

Annual issuer default counts and volume by geographical region, 1986-2018*

Count						Volume (in \$ Mil)					
Year	Africa & Middle East	Asia Pacific	Europe	Latin America	North America	Africa & Middle East	Asia Pacific	Europe	Latin America	North America	
1986	0	0	0	0	38	\$0.00	\$0.00	\$0.00	\$0.00	\$4,142.20	
1987	0	0	0	0	32	\$0.00	\$0.00	\$0.00	\$0.00	\$9,262.16	
1988	0	0	0	0	33	\$0.00	\$0.00	\$0.00	\$0.00	\$6,002.96	
1989	0	4	0	0	51	\$0.00	\$969.11	\$0.00	\$0.00	\$10,253.32	
1990	0	1	1	0	92	\$0.00	\$200.00	\$516.40	\$0.00	\$22,096.73	
1991	0	0	2	0	71	\$0.00	\$0.00	\$1,228.00	\$0.00	\$16,752.76	
1992	0	0	0	0	34	\$0.00	\$0.00	\$0.00	\$0.00	\$7,672.85	
1993	0	0	0	0	24	\$0.00	\$0.00	\$0.00	\$0.00	\$3,103.52	
1994	0	0	1	0	18	\$0.00	\$0.00	\$774.36	\$0.00	\$2,238.41	
1995	0	0	0	1	30	\$0.00	\$0.00	\$0.00	\$100.00	\$5,773.70	
1996	0	0	0	1	19	\$0.00	\$0.00	\$0.00	\$207.40	\$5,930.23	
1997	0	2	0	2	21	\$0.00	\$613.78	\$0.00	\$310.00	\$5,048.47	
1998	0	5	5	0	44	\$0.00	\$1,444.00	\$707.00	\$0.00	\$11,241.40	
1999	0	9	9	8	88	\$0.00	\$4,458.44	\$3,950.14	\$2,017.73	\$33,299.49	
2000	0	4	4	3	119	\$0.00	\$4,452.88	\$865.77	\$305.19	\$54,074.39	
2001	4	15	15	7	150	\$2,757.58	\$7,832.37	\$10,540.24	\$2,034.17	\$116,674.56	
2002	0	2	26	17	102	\$0.00	\$1,841.81	\$45,418.40	\$10,724.43	\$156,436.95	
2003	0	3	8	11	70	\$0.00	\$624.74	\$3,708.41	\$4,152.26	\$41,484.59	
2004	1	0	5	1	38	\$183.00	\$0.00	\$2,311.15	\$1,093.39	\$18,304.21	
2005	0	0	1	1	32	\$0.00	\$0.00	\$207.48	\$100.00	\$41,151.50	
2006	0	0	7	2	23	\$0.00	\$0.00	\$1,601.38	\$167.03	\$9,112.66	
2007	0	0	4	0	15	\$0.00	\$0.00	\$2,229.54	\$0.00	\$5,967.13	
2008	0	3	51	2	93	\$0.00	\$625.02	\$54,356.46	\$555.47	\$228,445.89	
2009	1	16	31	11	226	\$650.00	\$6,988.78	\$28,013.48	\$3,030.82	\$294,547.33	
2010	0	3	11	3	53	\$0.00	\$6,913.22	\$10,490.21	\$487.00	\$25,269.80	
2011	0	0	15	1	36	\$0.00	\$0.00	\$10,064.08	\$358.00	\$27,149.25	
2012	1	1	11	5	51	\$47.94	\$1,804.52	\$17,275.30	\$3,076.67	\$33,780.19	
2013	0	2	25	10	36	\$0.00	\$546.19	\$24,094.64	\$4,880.06	\$23,111.56	
2014	1	5	15	5	32	\$350.00	\$3,999.99	\$13,635.45	\$4,539.24	\$53,091.62	
2015	1	9	29	9	69	\$456.40	\$4,114.26	\$16,149.24	\$4,313.72	\$75,136.42	
2016	2	2	20	12	108	\$944.93	\$1,805.90	\$17,333.17	\$26,134.98	\$89,310.10	
2017	1	7	27	3	66	\$552.50	\$2,336.36	\$19,635.68	\$20,834.98	\$41,477.11	
2018	1	5	11	3	57	\$300.00	\$4,015.68	\$7,284.96	\$6,871.04	\$56,585.85	

* include defaults outside of Jan 1 cohort.

Source: Moody's Investors Service

Exhibit 24

2018 defaulted corporate bond and loan recoveries*

In percent

Company Name	Default Type	Loans			Bond			
		1st Lien	2nd Lien	Sr. Unsec	1st Lien	2nd Lien	Sr. Unsec	Sr Sub
Agrokor D.D.	Bankruptcy						27.07	
American Tire Distributors, Inc.	Bankruptcy	88.84						18.00
Andrade Gutierrez Engenharia S.A.	Payment Default						94.50	
Avanti Communications Group plc	Bankruptcy					80.00		
Bellatrix Exploration Ltd.	Distressed Exchange						61.25	
BI-LO Holding Finance, LLC	Bankruptcy						59.50	
BI-LO, LLC	Bankruptcy				100.13			
Bon-Ton Stores Inc., (The)	Payment Default					18.50		
BrightHouse Group PLC	Distressed Exchange				79.00			
Cenveo Corporation	Bankruptcy				47.75	9.00	5.50	
Charlotte Russe, Inc.	Distressed Exchange	40.44						
CHS/Community Health Systems, Inc.	Distressed Exchange						79.08	
Claire's Stores, Inc.	Bankruptcy	93.00			57.63	12.00	12.00	
Community Choice Financial Inc.	Payment Default				31.50			
Concordia International Corp.	Payment Default						9.5	
Consolidated Infrastructure Group Limited	Distressed Exchange						99.935	
David's Bridal, Inc.	Payment Default	57.50					38.00	
Del Monte Foods, Inc.	Distressed Exchange		70.75					
Denbury Resources Inc.	Distressed Exchange							73.25
DFC Finance Corp.	Distressed Exchange				82.00			
Dixie Electric, LLC	Payment Default	32.00						
Eletson Holdings Inc.	Payment Default				53.25			
EV Energy Partners, L.P.	Bankruptcy						46.00	
EXCO Resources, Inc.	Bankruptcy						8	
Fieldwood Energy LLC	Bankruptcy	97.61	20.50					
FirstEnergy Solutions Corp.	Bankruptcy						47.47	
Gibson Brands, Inc.	Bankruptcy				84.00			
Guitar Center Inc.	Distressed Exchange						92.75	
HGIM CORP.	Bankruptcy	41.67						
House of Fraser (UK & Ireland) Limited	Distressed Exchange				69.43			
Ideal Standard International S.A.	Distressed Exchange				27.50	6.00		
iHeartCommunications, Inc.	Payment Default				79.48		15.88	
Johnston Press plc	Bankruptcy				54.00			
Jupiter Resources Inc.	Payment Default						34.00	

* Based on trading prices, data in percent.

Source: Moody's Investors Service

Exhibit 25

2018 defaulted corporate bond and loan recoveries* (continued)

In percent

Company Name	Default Type	Loans			Bond			
		1st Lien	2nd Lien	Sr. Unsec	1st Lien	2nd Lien	Sr. Unsec	Sr Sub
K. Hovnanian Enterprises, Inc.	Distressed Exchange						112.00	
LBH Media, Inc.	Bankruptcy					13		
Legacy Reserves LP	Distressed Exchange						82.50	
MNC Investama Tbk. (P.T.)	Distressed Exchange				94.63			
Murray Energy Corporation	Distressed Exchange					59.63		
NCSG Crane & Heavy Haul Corporation	Payment Default					54.00		
New Trident Holdcorp, Inc.	Distressed Exchange	76.20	51.81					
Nine West Holdings, Inc.	Bankruptcy	96.39		41.36			16.08	
Noble Group Limited	Payment Default			42.50			45.44	
Northern Oil and Gas, Inc	Distressed Exchange						104.50	
Odebrecht Engenharia e Construção S.A. (OEC)	Payment Default						13.00	
PaperWorks Industries, Inc.	Distressed Exchange				50.00			
Petroleos de Venezuela, S.A.	Payment Default						26	
Philadelphia Energy Solutions R&M LLC	Bankruptcy	81.70						
Proserv Operations Limited	Distressed Exchange	59.00						
Proserv US LLC	Distressed Exchange	59.00						
Sears Holdings Corp.	Distressed Exchange					74.5	41	
Sears Holdings Corp.	Bankruptcy	100.50			25.00	25.00	8.75	
Tops Holding II Corporation	Bankruptcy						73.00	
Tops Holding LLC	Bankruptcy				45.00			
Transworld Systems, Inc.	Distressed Exchange				26.00			
Triple Point Group Holdings, Inc	Distressed Exchange		77.00					
Ultra Resources, Inc.	Distressed Exchange						41.50	
United Central Industrial Supply, LLC	Distressed Exchange		70.00					
Westmoreland Coal Company	Payment Default		39.70		27.00			
Windstream Services, LLC	Distressed Exchange						70.92	
Wuzhou International Holdings Limited	Payment Default				44.95			

* Measured by trading prices.

Source: Moody's Investors Service

Exhibit 26

Annual defaulted corporate bond and loan recoveries*

In percent

Year	Loan	Bond					All Bonds
	1st Lien	1st Lien	Sr. Unsec.	Sr. Sub.	Sub.	Jr. Sub.	
1983	n.a.	40.00	52.72	43.50	41.14	n.a.	44.53
1984	n.a.	n.a.	49.41	67.88	44.26	n.a.	45.49
1985	n.a.	83.63	60.16	29.63	39.68	48.50	43.60
1986	n.a.	59.22	50.42	46.76	40.36	n.a.	46.75
1987	n.a.	71.00	63.75	46.50	46.89	n.a.	51.30
1988	n.a.	55.40	45.24	31.41	33.77	36.50	38.54
1989	n.a.	46.54	43.57	35.72	26.81	16.85	32.54
1990	72.00	33.81	38.16	25.53	19.50	10.70	25.80
1991	67.88	48.39	36.66	41.82	24.42	7.79	35.51
1992	60.58	62.05	49.19	49.40	38.04	13.50	45.89
1993	53.40	n.a.	37.13	51.91	44.15	n.a.	43.08
1994	67.59	69.25	53.73	29.61	38.01	40.00	45.57
1995	75.44	62.02	47.60	34.30	41.54	n.a.	43.28
1996	85.48	47.58	62.75	43.75	22.60	n.a.	41.54
1997	81.31	72.00	56.10	44.73	33.10	30.58	47.56
1998	56.67	46.82	39.54	44.99	18.19	62.00	38.30
1999	73.55	39.14	38.02	26.91	35.64	n.a.	34.31
2000	68.82	39.21	24.16	20.75	31.86	15.50	25.24
2001	64.87	31.74	21.24	19.82	15.94	47.00	21.58
2002	58.40	50.62	29.53	21.39	23.40	n.a.	29.49
2003	73.43	69.20	41.87	37.82	12.31	n.a.	41.38
2004	87.74	73.25	52.09	42.33	94.00	n.a.	58.50
2005	83.78	69.21	54.88	32.77	51.25	n.a.	56.52
2006	83.60	74.63	55.02	41.41	56.11	n.a.	55.02
2007	68.63	82.31	53.65	56.15	n.a.	n.a.	55.06
2008	61.69	52.46	33.53	23.32	29.47	n.a.	34.12
2009	53.63	37.30	36.72	23.10	45.31	n.a.	33.92
2010	70.87	57.63	50.69	37.50	33.66	n.a.	51.46
2011	70.95	70.45	41.31	36.66	31.89	n.a.	45.70
2012	66.44	57.60	43.28	33.75	37.35	n.a.	44.51
2013	76.17	68.81	44.98	20.71	26.36	n.a.	46.13
2014	78.36	73.56	46.97	39.08	38.78	n.a.	48.52
2015	64.06	54.75	37.56	36.60	58.55	14.00	40.62
2016	75.05	47.57	31.45	36.72	24.50	0.63	36.07
2017	69.19	65.91	55.07	38.00	50.20	27.17	56.75
2018	71.07	56.75	48.75	45.63	n.a.	n.a.	51.65

*Measured by trading prices

Source: Moody's Investors Service

Exhibit 27

Defaulted corporate bond and loan recoveries by industry

Mdy35 industry groups	Recoveries					Observation Counts				
	1Lien Loan	1Lien Bond	Sr Unsec Bond	Sr. Sub Bond	Sub Bond	1Lien Loan	1Lien Bond	Sr Unsec Bond	Sr. Sub Bond	Sub Bond
Aerospace & Defense	69.39	n.a.	45.66	23.85	44.25	3	0	11	9	4
Automotive	67.83	57.94	42.48	23.16	49.46	35	4	36	28	5
Banking	n.a.	7	40.69	25.08	30.96	0	1	57	8	62
Beverage, Food, & Tobacco	83.15	51.71	42.62	26.2	37.08	14	13	25	16	8
Capital Equipment	63.58	57.19	39.24	37.98	38.36	27	8	23	34	19
Chemicals, Plastics, & Rubber	71.19	46.38	31.14	21.83	61.04	14	16	25	18	3
Construction & Building	58.04	76.63	44.67	22.27	27.25	25	5	48	30	21
Consumer Goods: Durable	75.52	34.55	27.4	34	29.11	8	5	14	11	9
Consumer Goods: Non-durable	66.34	45.63	32.3	31.89	39.5	27	6	30	35	9
Containers, Packaging, & Glass	72.7	58.83	48.49	41.15	42.04	6	8	10	8	3
Energy: Electricity	62.01	97.8	59.52	56.67	27.42	3	8	20	5	2
Energy: Oil & Gas	72.28	59.31	39.97	40.91	40.77	44	36	124	23	33
Environmental Industries	49.84	13	28.7	27.08	5.44	6	1	5	6	2
Finance	66.89	41.55	48.75	38.14	25.26	7	5	20	8	12
Insurance	86.17	96.25	37.89	59.28	43.19	2	1	10	3	6
Real Estate Finance	68.47	43.67	37.9	26.64	31.22	6	3	26	8	12
Forest Products & Paper	72.07	51.43	37.16	20.54	1.47	6	15	37	9	3
Healthcare & Pharmaceuticals	62.89	63.81	39.44	32.01	34.83	22	4	20	30	32
High Tech Industries	60.16	53.51	33.07	24.89	24.19	17	14	30	27	45
Hotel, Gaming, & Leisure	73.73	57.42	40.1	36.36	29.78	29	37	39	33	16
Media: Advertising, Printing &	56.62	46.13	29.81	22	50.88	33	15	19	23	4
Media: Broadcasting & Subscription	68.65	48.71	42.54	39.45	30.69	16	9	44	23	8
Media: Diversified & Production	66.95	10.35	37.99	27.11	28.74	8	3	8	11	7
Metals & Mining	74.16	39.42	36.7	24.96	44.82	12	37	68	9	12
Retail	66.11	62.27	36.6	35.09	21.67	47	22	66	44	30
Services: Business	81.08	68.08	57.83	36.79	n.a.	20	12	15	7	0
Services: Consumer	67.27	55	79.06	57.5	n.a.	6	1	4	2	0
Sovereign & Public Finance	n.a.	63.38	49.69	n.a.	n.a.	0	2	5	0	0
Telecommunications	52.85	50.18	26.12	28.06	33.25	27	15	131	20	18
Transportation: Cargo	65.94	51.38	42.28	35.57	36.11	14	12	27	13	3
Transportation: Consumer	86.54	55.43	34.03	43.58	29.03	5	11	27	3	14
Utilities: Electric	88.39	67.4	42.89	n.a.	19.58	4	12	18	0	5
Utilities: Oil & Gas	n.a.	n.a.	64.56	n.a.	57.5	0	0	2	0	1
Utilities: Water	n.a.	n.a.	92	n.a.	n.a.	0	0	1	0	0
Wholesale	70.47	47.15	26.84	12.14	48.5	8	6	11	6	4

*Measured by trading prices

Source: Moody's Investors Service

Exhibit 28

Average senior unsecured bond recovery rates by year prior to default, 1983-2018*

	Year 1	Year 2	Year 3	Year 4	Year 5
Aaa**		3.3%	3.3%	61.9%	69.6%
Aa	37.2%	39.0%	38.1%	44.0%	43.2%
A	30.4%	42.6%	45.0%	44.5%	44.2%
Baa	42.9%	44.2%	44.0%	43.9%	43.6%
Ba	44.6%	43.3%	42.2%	41.8%	41.9%
B	37.7%	36.9%	37.4%	37.9%	38.5%
Caa_C	38.6%	39.0%	39.1%	39.5%	39.7%
IG	40.0%	43.3%	44.0%	44.1%	43.9%
SG	38.7%	38.6%	38.7%	39.1%	39.5%
All Ratings	38.7%	38.8%	39.1%	39.5%	39.9%

*Issuer-weighted, based on post default trading prices.

**The Aaa recovery rates are based on five observations, three of which are Icelandic banks that have an average recovery rate of 3.33%.

Source: Moody's Investors Service

Exhibit 29

Average cumulative credit loss rates by letter rating, 1983-2018*

	Year 1	Year 2	Year 3	Year 4	Year 5
Aaa	0.00%	0.01%	0.01%	0.01%	0.02%
Aa	0.01%	0.04%	0.07%	0.11%	0.17%
A	0.04%	0.10%	0.19%	0.30%	0.43%
Baa	0.10%	0.25%	0.42%	0.63%	0.85%
Ba	0.48%	1.40%	2.53%	3.72%	4.75%
B	2.06%	4.97%	7.87%	10.45%	12.72%
Caa_C	5.95%	10.57%	14.51%	17.74%	20.46%
IG	0.05%	0.14%	0.24%	0.37%	0.51%
SG	2.52%	5.14%	7.61%	9.76%	11.57%
All Ratings	1.00%	1.99%	2.90%	3.66%	4.28%

* Based on average default rates and senior unsecured bond recoveries measured on issuer-weighted basis.

Source: Moody's Investors Service

Exhibit 30

Annual Credit Loss Rates By Letter Rating, 1983-2018*

Year	Aaa	Aa	A	Baa	Ba	B	Caa_C	IG	SG	All Ratings
1983	0.00%	0.00%	0.00%	0.00%	0.55%	1.09%	20.01%	0.00%	1.92%	0.43%
1984	0.00%	0.00%	0.00%	0.32%	0.26%	2.70%	9.20%	0.09%	1.58%	0.44%
1985	0.00%	0.00%	0.00%	0.00%	0.35%	2.91%	2.66%	0.00%	1.50%	0.38%
1986	0.00%	0.00%	0.00%	0.43%	1.17%	5.22%	8.48%	0.10%	3.06%	0.91%
1987	0.00%	0.00%	0.00%	0.00%	1.10%	1.97%	3.56%	0.00%	1.56%	0.52%
1988	0.00%	0.00%	0.00%	0.00%	0.74%	3.25%	6.85%	0.00%	2.11%	0.76%
1989	0.00%	0.28%	0.00%	0.30%	1.67%	4.26%	11.47%	0.14%	3.33%	1.26%
1990	0.00%	0.00%	0.00%	0.16%	2.33%	8.50%	27.15%	0.04%	6.52%	2.21%
1991	0.00%	0.00%	0.00%	0.16%	2.43%	8.38%	9.72%	0.04%	5.76%	1.77%
1992	0.00%	0.00%	0.00%	0.00%	0.17%	3.75%	8.38%	0.00%	2.51%	0.68%
1993	0.00%	0.00%	0.00%	0.00%	0.39%	2.75%	8.51%	0.00%	2.14%	0.56%
1994	0.00%	0.00%	0.00%	0.00%	0.00%	1.94%	2.49%	0.00%	1.08%	0.30%
1995	0.00%	0.00%	0.00%	0.00%	0.14%	2.11%	5.46%	0.00%	1.61%	0.47%
1996	0.00%	0.00%	0.00%	0.00%	0.00%	0.56%	3.72%	0.00%	0.61%	0.19%
1997	0.00%	0.00%	0.00%	0.00%	0.08%	0.88%	4.02%	0.00%	0.83%	0.27%
1998	0.00%	0.00%	0.00%	0.07%	0.55%	2.28%	5.00%	0.02%	1.83%	0.68%
1999	0.00%	0.00%	0.00%	0.06%	0.85%	3.11%	9.40%	0.02%	3.32%	1.31%
2000	0.00%	0.00%	0.00%	0.26%	1.09%	4.18%	13.38%	0.10%	4.60%	1.86%
2001	0.00%	0.00%	0.12%	0.14%	0.92%	7.24%	22.71%	0.10%	7.57%	2.89%
2002	0.00%	0.00%	0.11%	0.71%	0.99%	3.21%	18.72%	0.30%	5.38%	2.05%
2003	0.00%	0.00%	0.00%	0.00%	0.52%	1.56%	11.69%	0.00%	3.09%	1.07%
2004	0.00%	0.00%	0.00%	0.00%	0.18%	0.38%	5.42%	0.00%	1.15%	0.40%
2005	0.00%	0.00%	0.00%	0.07%	0.00%	0.37%	3.20%	0.03%	0.78%	0.29%
2006	0.00%	0.00%	0.00%	0.00%	0.09%	0.48%	2.60%	0.00%	0.75%	0.27%
2007	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.26%	0.00%	0.44%	0.16%
2008	0.00%	0.34%	0.27%	0.68%	1.56%	2.59%	7.12%	0.41%	3.60%	1.66%
2009	0.00%	0.00%	0.15%	0.59%	1.12%	4.51%	16.43%	0.27%	7.65%	3.16%
2010	0.00%	0.00%	0.08%	0.04%	0.00%	0.19%	4.17%	0.05%	1.48%	0.61%
2011	0.00%	0.11%	0.00%	0.21%	0.09%	0.20%	3.50%	0.11%	1.19%	0.54%
2012	0.00%	0.00%	0.00%	0.04%	0.08%	0.31%	4.33%	0.02%	1.54%	0.69%
2013	0.00%	0.00%	0.05%	0.07%	0.32%	0.50%	3.42%	0.05%	1.44%	0.68%
2014	0.00%	0.00%	0.05%	0.03%	0.08%	0.26%	2.47%	0.03%	1.05%	0.51%
2015	0.00%	0.00%	0.00%	0.00%	0.18%	1.49%	4.12%	0.00%	2.28%	1.09%
2016	0.00%	0.00%	0.00%	0.00%	0.09%	1.07%	6.12%	0.00%	3.07%	1.48%
2017	0.00%	0.00%	0.00%	0.00%	0.11%	0.20%	3.30%	0.00%	1.52%	0.74%
2018	0.00%	0.00%	0.00%	0.00%	0.00%	0.29%	2.55%	0.00%	1.18%	0.57%

* Based on issuer-weighted annual default rates and senior unsecured bond recoveries measured on issuer-weighted basis.

Source: Moody's Investors Service

Exhibit 31

2018 one-year letter rating migration rates

	Aaa	Aa	A	Baa	Ba	B	Caa	Ca-C	WR	Def
Aaa	92.45%	3.77%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.77%	0.00%
Aa	0.00%	93.80%	3.49%	0.00%	0.00%	0.00%	0.00%	0.00%	2.71%	0.00%
A	0.00%	3.34%	89.43%	3.65%	0.08%	0.00%	0.00%	0.00%	3.50%	0.00%
Baa	0.00%	0.00%	3.38%	90.90%	1.32%	0.00%	0.06%	0.00%	4.35%	0.00%
Ba	0.00%	0.00%	0.00%	6.64%	79.04%	5.15%	0.34%	0.00%	8.82%	0.00%
B	0.00%	0.00%	0.00%	0.00%	5.27%	77.71%	4.26%	0.10%	12.16%	0.51%
Caa	0.00%	0.00%	0.00%	0.00%	0.15%	4.80%	74.30%	1.55%	16.17%	3.03%
Ca-C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	15.29%	41.18%	14.12%	29.41%

Source: Moody's Investors Service

Exhibit 32

Average one-year letter rating migration rates, 1920-2018

	Aaa	Aa	A	Baa	Ba	B	Caa	Ca-C	WR	Def
Aaa	86.90%	7.73%	0.79%	0.19%	0.03%	0.00%	0.00%	0.00%	4.36%	0.00%
Aa	1.03%	84.18%	7.74%	0.71%	0.16%	0.05%	0.01%	0.00%	6.06%	0.06%
A	0.07%	2.70%	85.17%	5.47%	0.63%	0.11%	0.03%	0.01%	5.73%	0.08%
Baa	0.03%	0.23%	4.16%	83.11%	4.46%	0.71%	0.12%	0.02%	6.92%	0.24%
Ba	0.01%	0.07%	0.48%	6.19%	74.20%	6.78%	0.67%	0.09%	10.39%	1.12%
B	0.00%	0.04%	0.15%	0.60%	5.55%	71.87%	6.14%	0.46%	12.06%	3.12%
Caa	0.00%	0.01%	0.02%	0.11%	0.49%	6.70%	67.98%	2.85%	14.16%	7.69%
Ca-C	0.00%	0.01%	0.09%	0.03%	0.58%	2.75%	8.94%	46.67%	18.26%	22.66%

Source: Moody's Investors Service

Exhibit 33

Average one-year letter rating migration rates, 1970-2018

	Aaa	Aa	A	Baa	Ba	B	Caa	Ca-C	WR	Def
Aaa	87.76%	7.88%	0.58%	0.07%	0.02%	0.00%	0.00%	0.00%	3.68%	0.00%
Aa	0.80%	85.24%	8.52%	0.42%	0.06%	0.03%	0.02%	0.00%	4.90%	0.02%
A	0.05%	2.47%	86.87%	5.25%	0.48%	0.10%	0.04%	0.00%	4.69%	0.05%
Baa	0.03%	0.14%	4.07%	85.89%	3.70%	0.67%	0.15%	0.02%	5.18%	0.16%
Ba	0.01%	0.04%	0.41%	6.19%	76.50%	7.04%	0.71%	0.11%	8.14%	0.85%
B	0.01%	0.03%	0.13%	0.44%	4.79%	73.59%	6.52%	0.51%	10.84%	3.14%
Caa	0.00%	0.01%	0.02%	0.08%	0.33%	6.52%	68.17%	2.75%	14.60%	7.53%
Ca-C	0.00%	0.00%	0.04%	0.00%	0.57%	2.24%	9.90%	38.79%	21.51%	26.94%

Source: Moody's Investors Service

Exhibit 34

Average five-year letter rating migration rates, 1970-2018

	Aaa	Aa	A	Baa	Ba	B	Caa	Ca-C	WR	Def
Aaa	53.66%	23.29%	4.89%	0.63%	0.31%	0.03%	0.04%	0.00%	17.08%	0.07%
Aa	2.15%	46.05%	23.66%	3.92%	0.79%	0.26%	0.12%	0.03%	22.78%	0.25%
A	0.18%	7.22%	51.66%	14.51%	2.45%	0.74%	0.16%	0.02%	22.40%	0.65%
Baa	0.14%	1.00%	12.16%	49.72%	8.01%	2.52%	0.57%	0.09%	24.38%	1.40%
Ba	0.03%	0.19%	2.54%	14.36%	28.02%	11.48%	2.06%	0.13%	34.53%	6.66%
B	0.02%	0.07%	0.44%	2.38%	7.39%	22.68%	6.34%	0.61%	43.94%	16.13%
Caa	0.00%	0.00%	0.11%	0.62%	1.67%	8.14%	13.71%	1.00%	49.81%	24.94%
Ca-C	0.00%	0.00%	0.03%	0.85%	1.79%	4.69%	3.14%	3.06%	50.74%	35.70%

Source: Moody's Investors Service

Exhibit 35

2018 one-year alphanumeric rating migration rates

	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa1	Caa2	Caa3	Ca-C	WR	Def
Aaa	92.45%	3.77%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.77%	0.00%
Aa1	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Aa2	0.00%	5.56%	84.44%	6.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.33%	0.00%
Aa3	0.00%	0.75%	7.46%	82.09%	6.72%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.99%	0.00%
A1	0.00%	0.00%	4.01%	5.76%	82.21%	3.51%	0.50%	0.00%	0.25%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.76%	0.00%
A2	0.00%	0.00%	0.50%	0.50%	11.41%	80.40%	2.73%	1.24%	0.25%	0.00%	0.25%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.73%	0.00%
A3	0.00%	0.00%	0.00%	0.00%	0.62%	6.80%	80.41%	7.01%	0.82%	0.41%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.92%	0.00%
Baa1	0.00%	0.00%	0.00%	0.00%	0.00%	0.50%	8.04%	83.08%	4.86%	0.50%	0.17%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.85%	0.00%
Baa2	0.00%	0.00%	0.00%	0.00%	0.00%	0.65%	0.49%	8.65%	79.45%	5.38%	0.16%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	5.22%	0.00%
Baa3	0.00%	0.00%	0.00%	0.00%	0.00%	0.19%	0.00%	0.37%	15.27%	75.05%	2.42%	1.30%	0.19%	0.00%	0.00%	0.00%	0.19%	0.00%	0.00%	0.00%	5.03%	0.00%
Ba1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.81%	15.16%	63.54%	6.14%	1.44%	2.53%	1.81%	0.36%	0.00%	0.00%	0.00%	0.00%	7.22%	0.00%
Ba2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.44%	10.69%	70.99%	2.29%	1.91%	2.29%	0.00%	0.00%	0.00%	0.00%	0.00%	8.40%	0.00%
Ba3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.60%	2.69%	10.18%	68.86%	2.10%	1.50%	2.69%	0.60%	0.00%	0.30%	0.00%	10.48%	0.00%
B1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.66%	2.32%	9.93%	64.24%	7.28%	4.30%	0.33%	0.33%	0.00%	0.00%	10.60%	0.00%
B2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.34%	3.06%	11.90%	65.65%	5.44%	1.70%	0.68%	0.00%	0.00%	10.20%	1.02%
B3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.77%	3.58%	7.42%	64.19%	6.14%	2.05%	0.26%	0.26%	14.83%	0.51%
Caa1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.32%	0.64%	0.96%	6.72%	62.72%	10.40%	1.92%	0.48%	14.56%	1.28%
Caa2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.19%	0.19%	1.90%	5.52%	66.48%	6.67%	1.14%	16.38%	1.52%
Caa3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.49%	3.43%	14.22%	43.14%	5.88%	20.59%	12.25%
Ca-C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.18%	3.53%	10.59%	41.18%	14.12%	29.41%

Source: Moody's Investors Service

Exhibit 36

Average one-year alphanumeric rating migration rates, 1983-2018

	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa1	Caa2	Caa3	Ca-C	WR	Def
Aaa	86.92%	5.39%	2.32%	0.55%	0.29%	0.15%	0.02%	0.06%	0.00%	0.02%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.25%	0.00%
Aa1	1.70%	76.66%	8.04%	5.90%	1.43%	0.91%	0.18%	0.12%	0.08%	0.01%	0.04%	0.00%	0.01%	0.04%	0.03%	0.01%	0.02%	0.02%	0.00%	0.00%	4.82%	0.00%
Aa2	1.04%	4.33%	73.29%	10.31%	3.52%	1.65%	0.41%	0.09%	0.16%	0.07%	0.03%	0.02%	0.00%	0.03%	0.01%	0.02%	0.00%	0.02%	0.00%	0.00%	5.01%	0.00%
Aa3	0.15%	1.07%	4.18%	75.15%	8.79%	3.60%	0.84%	0.24%	0.25%	0.12%	0.03%	0.03%	0.01%	0.01%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	5.48%	0.04%
A1	0.05%	0.10%	1.06%	5.12%	75.75%	7.73%	2.84%	0.62%	0.45%	0.20%	0.18%	0.13%	0.05%	0.06%	0.01%	0.01%	0.02%	0.01%	0.01%	0.00%	5.55%	0.07%
A2	0.06%	0.03%	0.21%	1.05%	5.83%	76.17%	7.37%	2.60%	1.02%	0.38%	0.18%	0.14%	0.17%	0.05%	0.03%	0.01%	0.02%	0.02%	0.01%	0.00%	4.61%	0.04%
A3	0.04%	0.04%	0.10%	0.30%	1.52%	6.39%	75.07%	6.84%	2.74%	0.89%	0.36%	0.16%	0.13%	0.11%	0.03%	0.02%	0.03%	0.01%	0.00%	0.02%	5.14%	0.05%
Baa1	0.02%	0.02%	0.08%	0.12%	0.21%	1.63%	6.75%	75.05%	6.98%	2.34%	0.65%	0.34%	0.22%	0.27%	0.06%	0.03%	0.05%	0.03%	0.01%	0.02%	5.01%	0.12%
Baa2	0.04%	0.04%	0.02%	0.06%	0.17%	0.58%	1.97%	6.63%	75.27%	6.49%	1.37%	0.64%	0.45%	0.34%	0.20%	0.09%	0.11%	0.01%	0.02%	0.01%	5.34%	0.16%
Baa3	0.03%	0.01%	0.02%	0.04%	0.07%	0.18%	0.48%	1.90%	8.85%	72.74%	4.81%	2.10%	0.99%	0.72%	0.29%	0.25%	0.15%	0.07%	0.06%	0.04%	6.00%	0.23%
Ba1	0.02%	0.00%	0.02%	0.02%	0.15%	0.13%	0.21%	0.72%	2.50%	10.25%	65.29%	5.18%	4.12%	1.63%	0.64%	0.52%	0.13%	0.23%	0.05%	0.12%	7.66%	0.42%
Ba2	0.00%	0.00%	0.02%	0.03%	0.09%	0.12%	0.16%	0.37%	0.69%	3.83%	8.01%	63.92%	6.58%	3.72%	1.40%	0.96%	0.31%	0.21%	0.09%	0.14%	8.64%	0.71%
Ba3	0.00%	0.01%	0.01%	0.01%	0.06%	0.17%	0.17%	0.09%	0.46%	0.78%	2.88%	6.80%	64.34%	7.08%	3.27%	1.88%	0.63%	0.42%	0.10%	0.13%	9.40%	1.30%
B1	0.01%	0.01%	0.02%	0.01%	0.05%	0.03%	0.08%	0.09%	0.21%	0.34%	0.72%	2.88%	6.65%	63.68%	6.09%	4.43%	1.29%	0.72%	0.21%	0.25%	10.35%	1.88%
B2	0.00%	0.01%	0.00%	0.01%	0.02%	0.02%	0.09%	0.11%	0.13%	0.26%	0.22%	0.70%	2.05%	7.44%	61.95%	7.87%	3.60%	1.78%	0.43%	0.48%	9.97%	2.83%
B3	0.01%	0.00%	0.02%	0.00%	0.03%	0.03%	0.06%	0.04%	0.04%	0.10%	0.14%	0.23%	0.60%	2.37%	6.33%	60.40%	7.27%	3.29%	1.13%	0.83%	12.46%	4.62%
Caa1	0.00%	0.01%	0.00%	0.00%	0.00%	0.01%	0.00%	0.02%	0.01%	0.03%	0.06%	0.12%	0.24%	0.42%	1.39%	7.74%	59.35%	8.41%	2.63%	1.30%	14.09%	4.16%
Caa2	0.00%	0.00%	0.02%	0.00%	0.02%	0.01%	0.00%	0.00%	0.05%	0.09%	0.04%	0.05%	0.15%	0.42%	0.81%	2.34%	7.86%	54.87%	5.98%	2.97%	15.48%	8.82%
Caa3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.06%	0.03%	0.04%	0.18%	0.17%	1.04%	3.17%	8.61%	44.82%	8.76%	14.75%	18.37%
Ca-C	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.03%	0.00%	0.00%	0.00%	0.23%	0.14%	0.21%	0.10%	0.28%	1.82%	2.11%	3.43%	4.51%	38.16%	21.84%	27.12%

Source: Moody's Investors Service

Exhibit 37

Annual issuer-weighted corporate default rates by letter rating, 1920-2018

Year	Aaa	Aa	A	Baa	Ba	B	Caa-C	IG	SG	All
1920	0.00%	0.00%	0.32%	0.94%	2.15%	4.38%	0.00%	0.43%	3.01%	1.23%
1921	0.00%	0.19%	0.35%	0.65%	0.44%	2.68%	13.33%	0.39%	2.15%	1.07%
1922	0.00%	0.18%	0.17%	1.10%	1.08%	1.71%	7.63%	0.51%	1.76%	1.01%
1923	0.00%	0.00%	0.00%	0.62%	0.93%	2.27%	5.93%	0.24%	1.70%	0.80%
1924	0.00%	0.37%	0.00%	0.13%	2.06%	2.70%	12.84%	0.14%	2.85%	1.15%
1925	0.00%	0.00%	0.14%	0.71%	1.74%	2.59%	14.40%	0.32%	2.56%	1.17%
1926	0.00%	0.40%	0.15%	0.11%	1.39%	2.90%	3.70%	0.19%	1.91%	0.77%
1927	0.00%	0.00%	0.21%	0.00%	1.30%	1.98%	12.84%	0.07%	1.83%	0.74%
1928	0.00%	0.00%	0.00%	0.00%	0.16%	1.32%	10.48%	0.00%	0.88%	0.36%
1929	0.00%	0.29%	0.00%	0.44%	0.82%	0.92%	9.73%	0.24%	1.40%	0.71%
1930	0.00%	0.00%	0.00%	0.40%	0.92%	3.16%	7.72%	0.15%	2.20%	1.04%
1931	0.00%	0.00%	0.27%	1.08%	3.00%	9.52%	31.67%	0.50%	7.90%	3.80%
1932	0.00%	0.67%	1.10%	0.92%	6.10%	13.98%	24.06%	0.86%	10.99%	5.50%
1933	0.00%	0.00%	0.26%	1.77%	11.71%	16.15%	25.92%	0.79%	15.77%	8.53%
1934	0.00%	0.62%	0.31%	0.86%	2.52%	4.22%	16.50%	0.59%	5.89%	3.40%
1935	0.00%	0.00%	1.43%	1.92%	5.12%	4.27%	13.02%	1.29%	6.25%	3.93%
1936	0.00%	0.85%	0.54%	0.33%	1.23%	2.38%	7.80%	0.48%	2.71%	1.63%
1937	0.00%	0.00%	0.51%	1.04%	0.99%	2.67%	9.07%	0.62%	2.74%	1.72%
1938	0.00%	0.85%	1.64%	1.99%	0.98%	1.47%	12.81%	1.55%	2.59%	2.11%
1939	0.00%	0.00%	0.00%	0.99%	0.62%	1.74%	6.07%	0.41%	1.77%	1.22%
1940	0.00%	0.00%	0.00%	1.37%	0.43%	3.29%	11.83%	0.59%	3.55%	2.47%
1941	0.00%	0.00%	0.00%	0.00%	0.97%	0.81%	5.07%	0.00%	1.71%	1.08%
1942	0.00%	0.00%	0.00%	0.00%	0.00%	0.78%	2.00%	0.00%	0.73%	0.45%
1943	0.00%	0.00%	0.00%	0.00%	0.00%	1.35%	0.00%	0.00%	0.61%	0.37%
1944	0.00%	0.00%	0.00%	0.00%	0.00%	0.49%	2.55%	0.00%	0.66%	0.39%
1945	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.57%	0.00%	0.56%	0.31%
1946	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1947	0.00%	0.00%	0.00%	0.00%	0.00%	0.71%	2.78%	0.00%	0.63%	0.31%
1948	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1949	0.00%	0.00%	0.00%	0.00%	1.36%	1.02%	8.57%	0.00%	1.92%	0.84%
1950	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1951	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.76%	0.00%	0.43%	0.18%
1952	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1953	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1954	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	7.14%	0.00%	0.47%	0.17%
1955	0.00%	0.00%	0.00%	0.00%	0.00%	1.61%	0.00%	0.00%	0.52%	0.17%
1956	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1957	0.00%	0.00%	0.00%	0.00%	0.00%	1.27%	0.00%	0.00%	0.45%	0.14%
1958	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1959	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1960	0.00%	0.00%	0.00%	0.00%	1.25%	0.00%	0.00%	0.00%	0.75%	0.25%
1961	0.00%	0.00%	0.00%	0.00%	0.60%	0.00%	8.70%	0.00%	1.07%	0.35%
1962	0.00%	0.00%	0.00%	0.00%	1.75%	1.47%	0.00%	0.00%	1.52%	0.47%
1963	0.00%	0.00%	0.00%	0.00%	1.16%	1.47%	0.00%	0.00%	1.15%	0.35%
1964	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1965	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1966	0.00%	0.00%	0.00%	0.00%	0.00%	2.44%	0.00%	0.00%	0.44%	0.12%
1967	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1968	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	5.00%	0.00%	0.37%	0.11%
1969	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1970	0.00%	0.00%	0.00%	0.54%	4.24%	19.44%	50.00%	0.27%	8.68%	2.63%
1971	0.00%	0.00%	0.00%	0.00%	0.89%	0.00%	12.50%	0.00%	1.16%	0.29%
1972	0.00%	0.00%	0.00%	0.00%	0.00%	6.90%	37.50%	0.00%	1.92%	0.45%
1973	0.00%	0.00%	0.00%	0.46%	0.00%	3.85%	37.50%	0.23%	1.28%	0.46%
1974	0.00%	0.00%	0.00%	0.00%	0.51%	7.16%	0.00%	0.00%	1.33%	0.28%

Exhibit 38

Annual issuer-weighted corporate default rates by letter rating, 1920-2018 (continued)

Year	Aaa	Aa	A	Baa	Ba	B	Caa-C	IG	SG	All
1975	0.00%	0.00%	0.00%	0.00%	1.03%	6.16%	0.00%	0.00%	1.74%	0.36%
1976	0.00%	0.00%	0.00%	0.00%	1.00%	0.00%	0.00%	0.00%	0.87%	0.18%
1977	0.00%	0.00%	0.00%	0.29%	0.54%	3.23%	33.33%	0.11%	1.36%	0.35%
1978	0.00%	0.00%	0.00%	0.00%	1.12%	5.41%	0.00%	0.00%	1.82%	0.35%
1979	0.00%	0.00%	0.00%	0.00%	0.51%	0.00%	0.00%	0.00%	0.43%	0.09%
1980	0.00%	0.00%	0.00%	0.00%	0.00%	5.00%	33.33%	0.00%	1.63%	0.34%
1981	0.00%	0.00%	0.00%	0.00%	0.00%	4.40%	0.00%	0.00%	0.70%	0.16%
1982	0.00%	0.00%	0.26%	0.33%	2.79%	2.22%	23.08%	0.21%	3.55%	1.04%
1983	0.00%	0.00%	0.00%	0.00%	1.16%	2.30%	42.31%	0.00%	4.06%	0.90%
1984	0.00%	0.00%	0.00%	0.62%	0.52%	5.34%	18.18%	0.18%	3.13%	0.87%
1985	0.00%	0.00%	0.00%	0.00%	0.87%	7.31%	6.67%	0.00%	3.77%	0.95%
1986	0.00%	0.00%	0.00%	0.87%	2.36%	10.54%	17.11%	0.21%	6.16%	1.83%
1987	0.00%	0.00%	0.00%	0.00%	3.03%	5.44%	9.82%	0.00%	4.31%	1.42%
1988	0.00%	0.00%	0.00%	0.00%	1.36%	5.93%	12.50%	0.00%	3.85%	1.39%
1989	0.00%	0.50%	0.00%	0.53%	2.96%	7.55%	20.33%	0.25%	5.91%	2.22%
1990	0.00%	0.00%	0.00%	0.26%	3.77%	13.74%	43.91%	0.06%	10.54%	3.57%
1991	0.00%	0.00%	0.00%	0.25%	3.84%	13.24%	15.35%	0.06%	9.10%	2.80%
1992	0.00%	0.00%	0.00%	0.00%	0.34%	7.37%	16.49%	0.00%	4.93%	1.34%
1993	0.00%	0.00%	0.00%	0.00%	0.62%	4.38%	13.53%	0.00%	3.40%	0.90%
1994	0.00%	0.00%	0.00%	0.00%	0.00%	4.19%	5.39%	0.00%	2.34%	0.65%
1995	0.00%	0.00%	0.00%	0.00%	0.27%	4.02%	10.42%	0.00%	3.06%	0.90%
1996	0.00%	0.00%	0.00%	0.00%	0.00%	1.50%	10.00%	0.00%	1.65%	0.51%
1997	0.00%	0.00%	0.00%	0.00%	0.18%	2.00%	9.16%	0.00%	1.89%	0.62%
1998	0.00%	0.00%	0.00%	0.11%	0.90%	3.77%	8.26%	0.03%	3.02%	1.13%
1999	0.00%	0.00%	0.00%	0.09%	1.38%	5.02%	15.17%	0.03%	5.35%	2.12%
2000	0.00%	0.00%	0.00%	0.35%	1.44%	5.51%	17.64%	0.13%	6.07%	2.45%
2001	0.00%	0.00%	0.16%	0.18%	1.17%	9.19%	28.84%	0.12%	9.61%	3.67%
2002	0.00%	0.00%	0.16%	1.01%	1.41%	4.55%	26.57%	0.43%	7.63%	2.91%
2003	0.00%	0.00%	0.00%	0.00%	0.89%	2.68%	20.12%	0.00%	5.31%	1.84%
2004	0.00%	0.00%	0.00%	0.00%	0.38%	0.80%	11.30%	0.00%	2.41%	0.83%
2005	0.00%	0.00%	0.00%	0.16%	0.00%	0.82%	7.09%	0.06%	1.72%	0.64%
2006	0.00%	0.00%	0.00%	0.00%	0.20%	1.07%	5.79%	0.00%	1.67%	0.59%
2007	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.87%	0.00%	0.94%	0.35%
2008	0.00%	0.50%	0.40%	1.02%	2.35%	3.90%	10.70%	0.62%	5.42%	2.49%
2009	0.00%	0.00%	0.24%	0.93%	1.77%	7.12%	25.96%	0.43%	12.10%	4.99%
2010	0.00%	0.00%	0.17%	0.08%	0.00%	0.39%	8.46%	0.10%	3.01%	1.23%
2011	0.00%	0.19%	0.00%	0.36%	0.16%	0.35%	5.97%	0.19%	2.03%	0.92%
2012	0.00%	0.00%	0.00%	0.07%	0.14%	0.54%	7.64%	0.03%	2.71%	1.21%
2013	0.00%	0.00%	0.09%	0.12%	0.58%	0.91%	6.21%	0.10%	2.63%	1.23%
2014	0.00%	0.00%	0.09%	0.06%	0.14%	0.50%	4.66%	0.06%	1.98%	0.96%
2015	0.00%	0.00%	0.00%	0.00%	0.29%	2.38%	6.61%	0.00%	3.66%	1.75%
2016	0.00%	0.00%	0.00%	0.00%	0.14%	1.56%	8.93%	0.00%	4.48%	2.15%
2017	0.00%	0.00%	0.00%	0.00%	0.25%	0.44%	7.36%	0.00%	3.39%	1.64%
2018	0.00%	0.00%	0.00%	0.00%	0.00%	0.57%	4.97%	0.00%	2.31%	1.12%
Mean	0.00%	0.06%	0.09%	0.26%	1.01%	3.14%	10.39%	0.14%	2.81%	1.16%
Media	0.00%	0.00%	0.00%	0.00%	0.52%	1.98%	7.64%	0.00%	1.91%	0.83%
St Dev	0.00%	0.17%	0.26%	0.45%	1.61%	3.79%	11.14%	0.27%	2.95%	1.35%
Min	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Max	0.00%	0.85%	1.64%	1.99%	11.71%	19.44%	50.00%	1.55%	15.77%	8.53%

Source: Moody's Investors Service

Exhibit 39

Annual issuer-weighted corporate default rates by alphanumeric rating, 1983-2018

In percent

	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa1	Caa2	Caa3	Ca-C	IG	SG	All
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.08	1.01	0.00	8.52		42.31			0.00	4.06	0.90
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.83	0.00	1.67	0.00	6.49	0.00	3.33		18.18			0.18	3.13	0.87
1985	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.64	1.15	4.53	5.56	14.21		6.67			0.00	3.77	0.95
1986	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.81	1.94	1.23	1.10	4.00	8.66	7.14	15.80		17.11			0.21	6.16	1.83
1987	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.05	0.93	3.13	4.17	5.66	8.20		10.16		0.00	0.00	4.31	1.42
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.77	4.24	4.46	11.27		10.53		50.00	0.00	3.85	1.39
1989	0.00	0.00	0.00	1.08	0.00	0.00	0.00	0.00	0.74	0.80	1.00	1.82	4.60	6.70	5.30	13.45		21.43		0.00	0.25	5.91	2.22
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96	1.08	5.84	3.96	6.86	16.72	25.21		45.16		33.33	0.06	10.54	3.57
1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.00	0.00	1.05	0.00	7.22	7.46	7.16	30.14		15.30		16.67	0.06	9.10	2.80
1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.76	1.44	1.41	23.32		18.41		7.69	0.00	4.93	1.34
1993	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.03	0.00	0.79	2.81	1.35	12.00		14.43		9.09	0.00	3.40	0.90
1994	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.51	2.71	9.50		5.10		7.14	0.00	2.34	0.65
1995	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.68	3.73	5.71	1.95		6.14		23.07	0.00	3.06	0.90
1996	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	1.25	3.93		10.73		5.88	0.00	1.65	0.51
1997	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.33	0.50	7.07		7.99		15.19	0.00	1.89	0.62
1998	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	1.18	1.57	2.82	4.08	4.96	4.08	8.76	37.50	5.00	0.03	3.02	1.13
1999	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.47	0.92	2.67	3.31	4.06	8.32	9.82	24.08	14.43	18.96	0.03	5.35	2.12
2000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.87	0.48	1.37	2.53	1.55	4.00	11.36	13.40	25.31	18.74	17.19	0.13	6.07	2.45
2001	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.27	0.25	0.00	0.00	0.99	2.61	3.53	9.56	14.42	25.56	27.23	38.52	33.69	0.12	9.61	3.67

Source: Moody's Investors Service

Exhibit 40

Annual issuer-weighted corporate default rates by alphanumeric rating, 1983-2018 (continued)

In percent

	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa1	Caa2	Caa3	Ca-C	IG	SG	All
2002	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.98	0.90	1.17	2.08	1.13	1.00	1.92	4.76	6.97	18.34	21.68	31.35	37.96	0.43	7.63	2.91
2003	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	0.63	1.41	0.71	2.66	4.98	9.47	23.45	27.17	27.89	0.00	5.31	1.84
2004	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.57	2.17	7.46	8.68	11.91	27.26	0.00	2.41	0.83
2005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.29	0.00	0.00	0.00	0.00	0.51	1.96	5.05	4.85	21.37	13.44	0.06	1.72	0.64
2006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.66	0.65	0.31	2.06	2.33	7.49	13.17	14.06	0.00	1.67	0.59
2007	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.81	10.38	7.02	41.04	0.00	0.94	0.35
2008	0.00	0.00	0.00	1.49	1.02	0.23	0.00	0.97	1.38	0.61	0.90	2.86	3.50	3.06	3.64	4.61	5.88	17.41	35.32	42.40	0.62	5.42	2.49
2009	0.00	0.00	0.00	0.00	0.00	0.00	0.69	1.02	0.87	0.91	1.42	1.74	2.18	3.39	6.96	9.71	11.46	33.56	55.43	63.81	0.43	12.10	4.99
2010	0.00	0.00	0.00	0.00	0.31	0.00	0.22	0.00	0.00	0.25	0.00	0.00	0.00	0.86	0.00	0.28	1.75	7.23	22.90	26.14	0.10	3.01	1.23
2011	0.00	0.00	0.00	0.42	0.00	0.00	0.00	0.00	0.20	0.88	0.00	0.56	0.00	0.00	0.47	0.52	1.95	7.56	15.97	21.90	0.19	2.03	0.92
2012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.41	0.00	0.76	0.76	2.13	10.06	17.26	43.76	0.03	2.71	1.21
2013	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.16	0.19	0.00	0.00	1.57	0.71	1.22	0.85	2.26	6.52	10.36	57.97	0.10	2.63	1.23
2014	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.36	0.35	1.06	0.23	2.18	4.11	11.15	26.23	0.06	1.98	0.96
2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.00	0.00	0.70	3.29	2.88	4.06	5.15	14.34	36.60	0.00	3.66	1.75
2016	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	1.03	1.02	2.38	3.77	5.05	19.26	48.38	0.00	4.48	2.15
2017	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.36	0.00	0.40	0.85	1.44	4.85	16.30	32.69	0.00	3.39	1.64
2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.58	1.41	1.65	14.15	30.66	0.00	2.31	1.12
Mean	0.00	0.00	0.00	0.08	0.05	0.02	0.04	0.12	0.16	0.31	0.48	0.69	1.52	2.39	3.20	7.47		14.30		26.10	0.09	4.32	1.59
Median	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	1.49	2.03	4.97		10.27		26.18	0.02	3.53	1.23
St Dev	0.00	0.00	0.00	0.31	0.19	0.08	0.14	0.30	0.34	0.52	0.95	1.15	1.68	2.45	3.45	7.45		10.60		16.67	0.14	2.67	1.03
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.41	1.65	7.02	0.00	0.00	0.94	0.35
Max	0.00	0.00	0.00	1.49	1.02	0.41	0.69	1.02	1.38	1.94	5.05	5.84	7.22	8.66	16.72	30.14	25.56	45.16	55.43	63.81	0.62	12.10	4.99

Source: Moody's Investors Service

Exhibit 41

Average cumulative issuer-weighted global default rates by letter rating, 1920-2018

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	0.00%	0.01%	0.03%	0.07%	0.14%	0.21%	0.30%	0.42%	0.55%	0.70%	0.83%	0.93%	1.04%	1.07%	1.10%	1.16%	1.22%	1.27%	1.32%	1.36%
Aa	0.06%	0.18%	0.28%	0.43%	0.65%	0.91%	1.18%	1.43%	1.66%	1.92%	2.22%	2.54%	2.86%	3.16%	3.39%	3.57%	3.74%	3.93%	4.16%	4.36%
A	0.08%	0.25%	0.50%	0.78%	1.09%	1.43%	1.78%	2.14%	2.53%	2.92%	3.33%	3.73%	4.10%	4.48%	4.90%	5.28%	5.59%	5.90%	6.20%	6.49%
Baa	0.25%	0.70%	1.24%	1.82%	2.44%	3.05%	3.64%	4.25%	4.88%	5.50%	6.13%	6.76%	7.40%	7.97%	8.50%	9.05%	9.60%	10.09%	10.56%	11.03%
Ba	1.18%	2.82%	4.62%	6.51%	8.34%	10.08%	11.67%	13.21%	14.71%	16.30%	17.67%	19.04%	20.35%	21.51%	22.61%	23.67%	24.71%	25.71%	26.60%	27.42%
B	3.33%	7.57%	11.85%	15.77%	19.24%	22.27%	25.00%	27.33%	29.43%	31.26%	32.91%	34.41%	35.85%	37.34%	38.77%	40.19%	41.44%	42.47%	43.27%	43.86%
Caa-C	9.74%	17.23%	23.34%	28.36%	32.50%	35.83%	38.67%	41.21%	43.59%	45.54%	47.45%	49.21%	50.74%	52.27%	53.88%	55.45%	56.88%	58.23%	59.55%	60.94%
IG	0.14%	0.40%	0.71%	1.07%	1.45%	1.86%	2.26%	2.66%	3.08%	3.51%	3.95%	4.38%	4.81%	5.21%	5.59%	5.95%	6.28%	6.60%	6.91%	7.22%
SG	3.68%	7.38%	10.85%	13.96%	16.70%	19.08%	21.19%	23.07%	24.82%	26.48%	27.95%	29.34%	30.67%	31.92%	33.12%	34.29%	35.38%	36.38%	37.25%	38.03%
All	1.49%	3.00%	4.41%	5.66%	6.77%	7.75%	8.61%	9.40%	10.15%	10.87%	11.54%	12.19%	12.80%	13.37%	13.91%	14.43%	14.90%	15.35%	15.75%	16.14%

Source: Moody's Investors Service

Exhibit 42

Average cumulative issuer-weighted global default rates by letter rating, 1970-2018

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	0.00%	0.01%	0.01%	0.03%	0.08%	0.13%	0.19%	0.24%	0.31%	0.37%	0.44%	0.51%	0.58%	0.62%	0.67%	0.71%	0.76%	0.78%	0.78%	0.78%
Aa	0.02%	0.06%	0.11%	0.19%	0.29%	0.39%	0.51%	0.61%	0.69%	0.78%	0.88%	1.01%	1.15%	1.26%	1.36%	1.45%	1.57%	1.72%	1.95%	2.17%
A	0.05%	0.15%	0.32%	0.50%	0.71%	0.96%	1.22%	1.50%	1.80%	2.10%	2.39%	2.68%	2.98%	3.30%	3.66%	4.02%	4.38%	4.76%	5.11%	5.48%
Baa	0.16%	0.42%	0.75%	1.13%	1.52%	1.93%	2.32%	2.74%	3.20%	3.70%	4.23%	4.79%	5.36%	5.92%	6.47%	7.08%	7.69%	8.29%	8.81%	9.29%
Ba	0.88%	2.43%	4.22%	6.14%	7.94%	9.59%	11.05%	12.48%	13.96%	15.50%	16.94%	18.40%	19.75%	21.04%	22.36%	23.67%	24.83%	25.86%	26.94%	27.77%
B	3.32%	7.86%	12.53%	16.79%	20.65%	24.09%	27.19%	29.83%	32.23%	34.28%	36.01%	37.52%	38.93%	40.48%	41.98%	43.41%	44.63%	45.73%	46.64%	47.55%
Caa-C	9.77%	17.42%	23.93%	29.39%	33.99%	37.60%	40.75%	43.68%	46.31%	48.20%	49.68%	50.40%	50.85%	50.93%	51.11%	51.46%	51.55%	51.55%	51.55%	51.55%
IG	0.08%	0.23%	0.42%	0.64%	0.89%	1.15%	1.41%	1.69%	1.98%	2.28%	2.59%	2.91%	3.24%	3.56%	3.89%	4.24%	4.59%	4.94%	5.28%	5.61%
SG	4.00%	8.10%	11.98%	15.44%	18.45%	21.03%	23.27%	25.26%	27.12%	28.80%	30.28%	31.64%	32.89%	34.12%	35.35%	36.56%	37.59%	38.51%	39.40%	40.16%
All	1.52%	3.04%	4.43%	5.63%	6.65%	7.52%	8.27%	8.94%	9.57%	10.15%	10.69%	11.20%	11.69%	12.16%	12.64%	13.11%	13.55%	13.98%	14.38%	14.75%

Source: Moody's Investors Service

Exhibit 43

Average cumulative issuer-weighted global default rates by letter rating, 1983-2018

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	0.00%	0.01%	0.01%	0.04%	0.06%	0.10%	0.13%	0.13%	0.13%	0.13%	0.13%	0.13%	0.13%	0.13%	0.13%	0.13%	0.13%	0.13%	0.13%	0.13%
Aa	0.02%	0.06%	0.12%	0.20%	0.30%	0.39%	0.48%	0.57%	0.65%	0.74%	0.84%	0.97%	1.11%	1.20%	1.29%	1.38%	1.49%	1.66%	1.89%	2.09%
A	0.05%	0.17%	0.35%	0.54%	0.77%	1.03%	1.30%	1.58%	1.87%	2.14%	2.41%	2.67%	2.96%	3.30%	3.68%	4.07%	4.46%	4.87%	5.22%	5.57%
Baa	0.17%	0.44%	0.75%	1.12%	1.50%	1.90%	2.27%	2.64%	3.02%	3.42%	3.87%	4.34%	4.85%	5.33%	5.80%	6.35%	6.92%	7.45%	7.93%	8.26%
Ba	0.87%	2.47%	4.38%	6.39%	8.17%	9.77%	11.21%	12.57%	13.91%	15.26%	16.42%	17.60%	18.67%	19.73%	20.86%	21.91%	22.81%	23.68%	24.65%	25.28%
B	3.31%	7.88%	12.57%	16.84%	20.71%	24.19%	27.29%	29.93%	32.26%	34.22%	35.87%	37.32%	38.71%	40.24%	41.67%	43.03%	44.29%	45.49%	46.50%	47.52%
Caa-C	9.70%	17.32%	23.84%	29.34%	33.93%	37.51%	40.63%	43.53%	46.19%	48.19%	49.75%	50.52%	51.00%	51.09%	51.29%	51.66%	51.77%	51.77%	51.77%	51.77%
IG	0.09%	0.24%	0.43%	0.66%	0.90%	1.16%	1.41%	1.66%	1.91%	2.16%	2.43%	2.70%	3.00%	3.29%	3.60%	3.93%	4.26%	4.61%	4.93%	5.20%
SG	4.12%	8.37%	12.41%	16.02%	19.12%	21.76%	24.07%	26.09%	27.91%	29.51%	30.85%	32.05%	33.16%	34.29%	35.41%	36.46%	37.37%	38.24%	39.10%	39.79%
All	1.63%	3.26%	4.76%	6.04%	7.12%	8.03%	8.80%	9.47%	10.07%	10.61%	11.10%	11.55%	11.99%	12.43%	12.87%	13.31%	13.72%	14.14%	14.52%	14.84%

Source: Moody's Investors Service

Exhibit 44

Average cumulative issuer-weighted global default rates by alphanumeric rating, 1983-2018

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	0.00%	0.01%	0.01%	0.04%	0.06%	0.10%	0.13%	0.13%	0.13%	0.13%	0.13%	0.13%	0.13%	0.13%	0.13%	0.13%	0.13%	0.13%	0.13%	0.13%
Aa1	0.00%	0.00%	0.00%	0.05%	0.09%	0.14%	0.14%	0.14%	0.16%	0.22%	0.27%	0.34%	0.48%	0.65%	0.82%	0.95%	1.06%	1.18%	1.31%	1.31%
Aa2	0.00%	0.01%	0.11%	0.23%	0.35%	0.43%	0.51%	0.61%	0.73%	0.87%	0.99%	1.13%	1.25%	1.31%	1.37%	1.49%	1.71%	1.95%	2.19%	2.43%
Aa3	0.04%	0.12%	0.17%	0.24%	0.37%	0.48%	0.62%	0.74%	0.82%	0.90%	1.01%	1.16%	1.30%	1.39%	1.46%	1.52%	1.56%	1.70%	1.96%	2.22%
A1	0.07%	0.20%	0.41%	0.61%	0.81%	1.02%	1.22%	1.41%	1.55%	1.72%	1.92%	2.13%	2.36%	2.65%	2.94%	3.22%	3.51%	3.78%	3.95%	4.12%
A2	0.05%	0.14%	0.29%	0.49%	0.72%	1.05%	1.40%	1.76%	2.13%	2.50%	2.86%	3.18%	3.50%	3.87%	4.29%	4.76%	5.32%	5.86%	6.29%	6.70%
A3	0.05%	0.16%	0.36%	0.54%	0.80%	1.01%	1.27%	1.56%	1.88%	2.15%	2.38%	2.63%	2.94%	3.28%	3.72%	4.12%	4.41%	4.83%	5.29%	5.76%
Baa1	0.12%	0.33%	0.58%	0.84%	1.07%	1.31%	1.53%	1.69%	1.86%	2.09%	2.39%	2.79%	3.21%	3.58%	4.03%	4.58%	5.10%	5.49%	5.68%	5.81%
Baa2	0.16%	0.41%	0.68%	1.04%	1.36%	1.71%	2.08%	2.47%	2.88%	3.34%	3.89%	4.42%	4.97%	5.46%	5.94%	6.35%	6.71%	7.15%	7.68%	8.09%
Baa3	0.24%	0.60%	1.03%	1.54%	2.17%	2.81%	3.37%	3.98%	4.57%	5.13%	5.66%	6.14%	6.71%	7.34%	7.82%	8.55%	9.47%	10.35%	11.16%	11.67%
Ba1	0.43%	1.42%	2.63%	3.83%	5.09%	6.26%	7.17%	7.91%	8.66%	9.52%	10.38%	11.30%	12.10%	12.70%	13.56%	14.39%	14.98%	15.78%	17.07%	18.15%
Ba2	0.74%	1.92%	3.30%	4.69%	5.97%	7.00%	8.01%	9.16%	10.47%	11.84%	12.85%	13.82%	14.47%	15.25%	16.24%	16.86%	17.49%	17.97%	18.57%	18.66%
Ba3	1.36%	3.82%	6.78%	10.05%	12.74%	15.25%	17.60%	19.79%	21.79%	23.69%	25.36%	27.06%	28.92%	30.86%	32.52%	34.34%	35.99%	37.44%	38.42%	38.94%
B1	1.99%	5.30%	8.93%	12.44%	16.01%	19.28%	22.48%	25.26%	27.73%	29.72%	31.51%	33.00%	34.65%	36.57%	38.07%	39.40%	40.68%	42.04%	43.43%	44.82%
B2	3.00%	7.69%	12.37%	16.67%	20.27%	23.56%	26.40%	28.71%	30.88%	32.88%	34.50%	36.20%	37.52%	38.88%	40.57%	42.17%	43.52%	44.66%	45.18%	45.92%
B3	4.90%	10.69%	16.55%	21.68%	26.25%	30.29%	33.69%	36.66%	39.09%	41.05%	42.59%	43.61%	44.66%	45.76%	46.65%	47.78%	48.97%	49.96%	50.89%	51.19%
Caa	7.90%	15.33%	21.85%	27.42%	32.17%	35.96%	39.12%	42.13%	45.00%	47.28%	48.99%	49.69%	50.12%	50.24%	50.51%	51.03%	51.18%	51.18%	51.18%	51.18%
Ca-C	30.67%	40.87%	47.70%	52.41%	55.14%	56.37%	58.85%	60.60%	61.52%	61.52%	62.08%	62.95%	63.48%	63.48%	63.48%	63.48%	63.48%	63.48%	63.48%	63.48%
IG	0.09%	0.24%	0.43%	0.66%	0.90%	1.16%	1.41%	1.66%	1.91%	2.16%	2.43%	2.70%	3.00%	3.29%	3.60%	3.93%	4.26%	4.61%	4.93%	5.20%
SG	4.12%	8.37%	12.41%	16.02%	19.12%	21.76%	24.07%	26.09%	27.91%	29.51%	30.85%	32.05%	33.16%	34.29%	35.41%	36.46%	37.37%	38.24%	39.10%	39.79%
All	1.63%	3.26%	4.76%	6.04%	7.12%	8.03%	8.80%	9.47%	10.07%	10.61%	11.10%	11.55%	11.99%	12.43%	12.87%	13.31%	13.72%	14.14%	14.52%	14.84%

Source: Moody's Investors Service

Exhibit 45

Average cumulative issuer-weighted global default rates by alphanumeric rating, 1998-2018

	1	2	3	4	5	6	7	8	9	10
Aaa	0.00%	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%
Aa1	0.00%	0.00%	0.00%	0.00%	0.03%	0.08%	0.09%	0.09%	0.13%	0.21%
Aa2	0.00%	0.01%	0.14%	0.28%	0.37%	0.47%	0.57%	0.69%	0.85%	0.99%
Aa3	0.05%	0.13%	0.18%	0.24%	0.37%	0.52%	0.76%	0.96%	1.08%	1.22%
A1	0.10%	0.23%	0.40%	0.60%	0.84%	1.11%	1.39%	1.66%	1.87%	2.11%
A2	0.07%	0.19%	0.36%	0.54%	0.79%	1.18%	1.57%	2.00%	2.52%	3.12%
A3	0.07%	0.18%	0.39%	0.59%	0.89%	1.07%	1.32%	1.63%	2.03%	2.42%
Baa1	0.14%	0.36%	0.60%	0.84%	1.02%	1.23%	1.42%	1.59%	1.76%	2.03%
Baa2	0.18%	0.41%	0.65%	0.91%	1.12%	1.37%	1.61%	1.86%	2.19%	2.52%
Baa3	0.24%	0.57%	0.97%	1.40%	1.91%	2.37%	2.81%	3.37%	3.88%	4.50%
Ba1	0.29%	1.12%	2.02%	2.84%	3.93%	4.85%	5.65%	6.32%	7.16%	8.14%
Ba2	0.67%	1.63%	2.78%	3.93%	5.02%	5.82%	6.57%	7.77%	9.12%	10.65%
Ba3	0.87%	2.46%	4.32%	6.47%	7.98%	9.51%	11.18%	13.06%	14.84%	16.38%
B1	1.20%	3.65%	6.43%	9.29%	11.91%	14.25%	16.58%	18.68%	20.74%	22.64%
B2	2.68%	7.06%	11.62%	15.95%	19.26%	22.21%	24.73%	26.94%	29.08%	30.99%
B3	3.63%	8.87%	14.58%	19.46%	23.63%	27.20%	30.13%	32.80%	35.41%	37.50%
Caa1	4.44%	10.49%	16.39%	21.57%	26.16%	29.71%	32.60%	35.06%	37.91%	40.55%
Caa2	8.57%	16.36%	23.49%	29.86%	34.94%	39.52%	43.77%	48.02%	51.21%	51.88%
Caa3	19.52%	32.55%	41.00%	46.30%	51.04%	54.96%	58.10%	60.51%	61.04%	61.04%
Ca-C	32.94%	44.16%	51.67%	56.44%	59.35%	60.69%	63.34%	65.18%	66.14%	66.14%
IG	0.11%	0.27%	0.47%	0.68%	0.91%	1.15%	1.40%	1.67%	1.97%	2.29%
SG	4.07%	8.24%	12.18%	15.60%	18.39%	20.68%	22.69%	24.53%	26.32%	27.88%
All	1.73%	3.44%	5.00%	6.29%	7.33%	8.18%	8.91%	9.59%	10.24%	10.86%

Source: Moody's Investors Service

Exhibit 46

Average cumulative issuer-weighted global default rates by broad industry group, 1970-2018

Moody's 35 Industry Groups	1	2	3	4	5	6	7	8	9	10
Aerospace & Defense	0.84%	1.75%	2.56%	3.18%	3.71%	4.06%	4.30%	4.49%	4.59%	4.61%
Automotive	2.37%	4.82%	7.16%	9.37%	11.45%	13.37%	15.15%	16.89%	18.46%	19.58%
Banking	0.50%	0.99%	1.46%	1.92%	2.35%	2.74%	3.08%	3.41%	3.75%	4.09%
Beverage, Food, & Tobacco	1.17%	2.31%	3.43%	4.37%	5.09%	5.74%	6.26%	6.68%	7.11%	7.42%
Capital Equipment	1.56%	3.23%	4.87%	6.33%	7.56%	8.50%	9.34%	10.09%	10.81%	11.49%
Chemicals, Plastics, & Rubber	1.02%	2.13%	3.19%	4.18%	5.09%	5.79%	6.31%	6.72%	7.14%	7.62%
Construction & Building	2.65%	5.50%	8.23%	10.82%	13.13%	15.20%	16.93%	18.62%	20.18%	21.51%
Consumer Goods: Durable	2.52%	5.52%	8.71%	11.71%	14.74%	17.32%	19.17%	20.97%	23.00%	24.90%
Consumer Goods: Non-durable	3.72%	7.77%	11.57%	14.63%	17.04%	19.12%	21.05%	22.68%	23.90%	24.81%
Containers, Packaging, & Glass	2.21%	4.67%	6.87%	8.90%	10.72%	12.29%	13.62%	14.97%	16.13%	17.19%
Energy: Electricity	2.83%	5.78%	8.52%	10.77%	13.02%	15.19%	17.37%	19.43%	21.49%	23.72%
Energy: Oil & Gas	2.44%	4.65%	6.57%	8.15%	9.47%	10.51%	11.39%	12.17%	12.92%	13.59%
Environmental Industries	3.71%	7.11%	9.71%	11.76%	13.27%	14.53%	15.62%	16.84%	18.20%	19.72%
Finance	0.94%	1.86%	2.68%	3.26%	3.77%	4.25%	4.74%	5.23%	5.75%	6.33%
Insurance	0.33%	0.71%	1.09%	1.51%	1.93%	2.35%	2.76%	3.17%	3.60%	4.02%
Real Estate Finance	0.88%	1.82%	2.69%	3.50%	4.07%	4.54%	4.93%	5.21%	5.49%	5.81%
Forest Products & Paper	3.04%	5.91%	8.64%	11.00%	12.94%	14.68%	16.22%	17.53%	18.45%	19.21%
Healthcare & Pharmaceuticals	1.37%	2.81%	4.12%	5.35%	6.42%	7.43%	8.38%	9.11%	9.87%	10.42%
High Tech Industries	1.69%	3.51%	5.16%	6.67%	7.91%	9.00%	10.14%	11.33%	12.52%	13.67%
Hotel, Gaming, & Leisure	4.03%	8.03%	11.54%	14.67%	17.34%	19.54%	21.40%	23.20%	25.01%	26.89%
Media: Advertising, Printing & Publishing	6.01%	11.94%	17.18%	21.71%	26.00%	29.70%	32.45%	34.37%	36.16%	38.15%
Media: Broadcasting & Subscription	3.45%	7.10%	10.85%	14.10%	17.13%	19.85%	22.11%	24.08%	25.81%	27.43%
Media: Diversified & Production	2.34%	4.65%	6.65%	7.96%	8.90%	9.72%	10.09%	10.34%	10.62%	10.92%
Metals & Mining	3.07%	6.14%	8.98%	11.47%	13.48%	15.31%	17.03%	18.54%	19.96%	21.36%
Retail	3.02%	6.08%	9.14%	11.92%	14.31%	16.36%	18.10%	19.64%	21.09%	22.41%
Services: Business	2.02%	4.11%	6.12%	7.88%	9.44%	10.84%	12.11%	13.15%	14.11%	15.00%
Services: Consumer	2.00%	3.95%	5.49%	6.97%	8.34%	9.72%	11.17%	12.67%	14.06%	15.37%
Sovereign & Public Finance	0.48%	0.95%	1.36%	1.67%	1.85%	1.96%	2.00%	2.00%	2.00%	2.00%
Telecommunications	2.21%	4.31%	6.18%	7.64%	8.73%	9.49%	10.07%	10.44%	10.70%	10.89%
Transportation: Cargo	1.97%	3.61%	4.98%	6.09%	6.93%	7.65%	8.26%	8.78%	9.24%	9.73%
Transportation: Consumer	2.81%	5.44%	8.06%	10.62%	12.85%	14.69%	16.46%	18.30%	20.20%	22.04%
Utilities: Electric	0.13%	0.25%	0.36%	0.46%	0.55%	0.65%	0.73%	0.82%	0.92%	1.02%
Utilities: Oil & Gas	0.14%	0.26%	0.38%	0.52%	0.63%	0.75%	0.85%	0.90%	0.95%	1.00%
Utilities: Water	0.12%	0.24%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%
Wholesale	3.31%	7.14%	10.45%	12.77%	14.50%	16.07%	16.97%	17.70%	18.44%	19.27%

Source: Moody's Investors Service

Exhibit 47

Annual default rates by broad industry group, 1970-2018

In percent

Year	Aerospace & Defense	Automotive	Banking	Beverage, Food, & Tobacco	Capital Equipment	Chemicals, Plastics, & Rubber	Construction & Building	Consumer Goods: Durable	Consumer Goods: Non-durable	Containers, Packaging, & Glass	Energy: Electricity	Energy: Oil & Gas	Environmental Industries	Finance	Insurance	Real Estate Finance	Forest Products & Paper
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	25.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	1.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	1.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	3.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	1.03	0.00	0.00	0.00	2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.70	0.00	0.00	1.32	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	3.23	0.00	0.00	0.00	0.00	0.00	33.33	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	1.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	2.86	0.00	0.00	0.00	0.00	3.33	0.00	0.00	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00
1983	0.00	8.11	0.00	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.44	0.00	0.00	0.00	0.00	0.00
1984	0.00	2.94	0.00	1.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.01	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	1.83	2.04	0.00	0.00	1.82	0.00	0.00	3.43	0.00	0.00	3.45	0.00	0.00
1986	2.94	0.00	0.00	1.20	0.00	1.85	1.79	5.88	0.00	0.00	0.00	8.37	0.00	0.00	0.00	0.00	0.00
1987	0.00	1.82	0.28	0.00	2.47	0.00	4.64	0.00	0.00	0.00	0.00	5.54	0.00	0.00	0.00	0.00	0.00
1988	2.38	0.00	1.45	0.00	0.00	1.64	2.82	4.35	3.73	0.00	4.55	2.13	0.00	0.00	1.52	0.00	0.00
1989	0.00	7.69	1.49	2.25	0.00	0.00	8.85	0.00	3.85	5.56	0.00	0.00	0.00	3.67	1.35	8.33	0.00
1990	0.00	3.97	1.84	5.61	2.61	0.00	16.93	4.76	10.03	0.00	8.00	1.45	0.00	0.00	0.00	0.00	0.00
1991	2.22	4.28	1.40	0.00	4.54	0.00	7.55	5.88	6.09	5.56	4.17	3.06	0.00	0.00	1.22	0.00	3.33

Source: Moody's Investors Service

Exhibit 48

Annual default rates by broad industry group, 1970-2018 (continued)

In percent

Year	Aerospace & Defense	Automotive	Banking	Beverage, Food, & Tobacco	Capital Equipment	Chemicals, Plastics, & Rubber	Construction & Building	Consumer Goods: Durable	Consumer Goods: Non-durable	Containers, Packaging, & Glass	Energy: Electricity	Energy: Oil & Gas	Environmental Industries	Finance	Insurance	Real Estate Finance	Forest Products & Paper
1992	0.00	0.00	0.32	1.22	2.99	0.00	0.00	0.00	5.98	5.26	0.00	0.79	0.00	0.00	0.00	4.76	0.00
1993	2.27	0.00	0.30	1.14	4.88	0.00	1.69	0.00	2.00	0.00	0.00	2.25	0.00	0.00	0.00	0.00	0.00
1994	0.00	0.00	0.00	1.06	0.84	0.00	0.00	0.00	0.00	0.00	3.57	0.00	0.00	0.00	0.00	0.00	2.78
1995	0.00	0.00	0.00	1.94	0.83	0.00	5.07	0.00	7.51	0.00	0.00	0.64	0.00	0.00	0.81	5.71	2.22
1996	0.00	0.00	0.00	0.83	0.72	0.00	1.06	0.00	4.31	3.23	0.00	0.57	5.26	0.00	0.00	0.00	0.00
1997	0.00	1.35	0.00	0.78	0.00	0.00	1.12	0.00	6.43	2.56	0.00	0.00	0.00	0.00	0.62	0.00	0.00
1998	0.00	1.08	0.30	0.69	0.00	2.38	0.00	0.00	4.42	0.00	0.00	1.29	5.88	0.68	0.00	2.63	1.33
1999	0.00	0.89	0.14	1.84	1.40	1.49	6.44	10.60	4.33	0.00	0.00	6.20	4.55	1.85	0.00	0.71	2.44
2000	1.61	4.75	0.00	2.87	4.21	1.45	1.98	3.45	14.34	8.28	0.00	0.40	16.67	0.62	1.48	0.00	4.46
2001	4.74	4.96	0.07	2.26	5.18	5.72	3.84	3.45	15.50	8.42	1.67	1.19	11.76	1.79	0.00	2.24	16.84
2002	0.00	2.40	0.40	1.63	2.05	0.00	5.04	3.13	6.01	5.26	9.77	2.33	14.29	0.00	0.44	0.83	2.76
2003	0.00	2.43	0.08	1.67	2.50	4.45	2.41	0.00	2.74	0.00	11.27	0.00	0.00	0.62	0.79	0.00	1.33
2004	0.00	2.35	0.00	1.66	0.96	0.00	2.27	2.70	4.49	1.56	0.00	0.35	0.00	0.00	0.37	0.00	1.43
2005	0.00	4.86	0.07	0.00	0.95	0.00	0.00	4.08	1.59	3.23	3.64	0.36	0.00	0.65	0.00	0.00	1.61
2006	0.00	5.21	0.00	1.13	1.51	0.00	2.05	1.89	3.04	1.67	0.00	0.00	0.00	0.00	0.68	0.00	0.00
2007	0.00	1.56	0.00	1.06	0.50	0.00	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.30
2008	1.56	4.03	3.03	1.58	2.75	1.94	5.27	2.00	6.28	8.71	0.00	1.65	5.56	4.10	0.00	2.31	7.12
2009	4.59	18.64	0.93	4.31	10.09	7.57	14.72	23.45	6.73	9.33	1.92	2.00	0.00	4.94	0.32	6.36	17.37
2010	0.00	1.03	0.41	0.56	3.60	0.00	1.77	0.00	3.81	1.64	6.00	0.98	10.53	1.95	0.37	0.85	2.04
2011	0.00	0.91	0.54	0.00	1.94	0.00	2.29	0.00	0.00	3.51	3.92	0.99	0.00	0.58	0.37	0.78	1.85
2012	1.28	0.00	0.49	1.61	2.29	1.42	0.00	0.00	0.00	1.56	5.45	0.91	4.55	1.72	0.36	0.00	4.01
2013	1.25	0.85	1.21	1.59	0.58	0.65	2.48	0.00	2.08	1.56	1.82	1.62	4.76	0.00	0.38	0.67	0.00
2014	1.30	0.00	0.67	0.00	0.00	0.57	0.52	2.17	0.00	0.00	7.14	0.50	0.00	0.52	0.00	0.00	2.00
2015	2.69	0.00	1.55	1.93	0.00	0.00	2.26	2.00	4.64	0.00	0.00	7.13	4.35	0.50	0.72	0.53	4.17
2016	1.32	1.49	0.15	0.50	0.84	1.62	1.35	2.33	1.45	0.00	1.89	14.34	8.17	2.26	0.00	1.01	4.17
2017	2.74	0.00	0.53	0.00	0.85	0.98	0.45	0.00	0.00	0.00	5.36	6.89	11.11	1.93	0.00	0.49	13.56
2018	0.00	0.85	0.00	1.13	0.00	0.00	3.53	5.88	1.43	0.00	6.88	3.11	0.00	1.32	0.00	0.00	2.70

Source: Moody's Investors Service

Exhibit 49

Annual default rates by broad industry group, 1970-2018 (continued)

In percent

Year	Healthcare & Pharmaceuticals	High Tech Industries	Hotel, Gaming, & Leisure	Media: Advertising, Printing & Publishing	Media: Broadcasting & Subscription	Media: Diversified & Production	Metals & Mining	Retail	Services: Business	Services: Consumer	Sovereign & Public Finance	Telecommunications	Transportation: Cargo	Transportation: Consumer	Utilities: Electric	Utilities: Oil & Gas	Utilities: Water	Wholesale
1970	0.00	3.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.05	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.85	4.76	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.64	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.45	0.00	0.00	0.00	0.00	1.94	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	4.76	0.00	0.00	11.11	0.00	0.00	0.00	1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	14.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.20	0.00	0.00	0.00	0.00	0.00
1978	0.00	3.13	0.00	0.00	0.00	0.00	0.00	1.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	2.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	2.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.11	0.00	0.00	0.00	0.00	0.00
1982	0.00	3.92	0.00	14.29	0.00	0.00	2.38	5.89	0.00	0.00	0.00	1.22	1.18	5.56	0.00	0.00	0.00	0.00
1983	0.00	1.72	0.00	0.00	0.00	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00	19.05	0.00	0.00	0.00	0.00
1984	2.22	4.84	0.00	0.00	0.00	0.00	0.00	0.00	5.26	0.00	0.00	0.00	1.20	0.00	0.00	0.00	0.00	0.00
1985	0.00	1.52	5.26	0.00	0.00	0.00	3.51	0.00	0.00	0.00	0.00	0.00	1.19	0.00	0.00	0.00	0.00	0.00
1986	1.43	0.00	2.38	0.00	3.85	5.26	19.78	0.00	0.00	0.00	0.00	0.00	1.16	8.17	0.00	0.00	0.00	4.76
1987	3.74	1.11	6.49	5.88	0.00	0.00	0.00	1.05	8.33	12.50	0.00	0.00	1.09	0.00	0.00	1.59	0.00	4.35
1988	4.73	1.68	2.04	0.00	4.26	3.70	0.00	1.90	3.70	0.00	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.00
1989	2.53	1.76	13.81	0.00	4.35	11.71	0.00	2.52	3.70	0.00	10.53	0.98	1.14	3.57	0.00	0.00	0.00	0.00
1990	1.15	5.68	26.10	12.50	6.43	5.00	3.96	6.34	13.79	11.11	0.00	0.00	0.00	24.14	0.00	0.00	0.00	0.00
1991	4.88	2.22	2.70	0.00	4.94	4.76	2.04	11.48	0.00	0.00	0.00	0.90	2.58	30.00	0.54	1.82	0.00	0.00

Source: Moody's Investors Service

Exhibit 50

Annual default rates by broad industry group, 1970-2018 (continued)

In percent

Year	Healthcare & Pharmaceuticals	High Tech Industries	Hotel, Gaming, & Leisure	Media: Advertising, Printing & Publishing	Media: Broadcasting & Subscription	Media: Diversified & Production	Metals & Mining	Retail	Services: Business	Services: Consumer	Sovereign & Public Finance	Telecommunications	Transportation: Cargo	Transportation: Consumer	Utilities: Electric	Utilities: Oil & Gas	Utilities: Water	Wholesale
1992	1.45	3.35	5.27	0.00	10.81	10.84	6.17	2.86	0.00	0.00	0.00	0.00	0.00	0.00	1.58	0.00	0.00	0.00
1993	0.00	0.00	2.33	0.00	9.01	0.00	1.75	2.86	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1994	1.03	3.00	5.36	0.00	2.44	0.00	0.00	2.49	3.13	0.00	0.00	0.00	1.25	2.94	0.00	0.00	0.00	3.70
1995	1.00	1.85	2.65	0.00	0.00	0.00	0.00	1.45	3.23	0.00	0.00	0.00	0.00	5.64	0.00	0.00	0.00	3.57
1996	0.00	1.02	2.29	0.00	0.00	18.75	0.00	0.75	2.56	0.00	0.00	0.68	0.00	0.00	0.00	0.00	0.00	0.00
1997	0.88	1.77	2.06	0.00	2.30	0.00	0.00	3.59	0.00	0.00	0.00	0.54	1.19	0.00	0.00	0.00	0.00	2.70
1998	3.12	0.72	2.90	2.38	2.51	5.56	2.91	5.45	0.00	0.00	0.00	0.94	1.04	0.00	0.00	0.00	0.00	7.14
1999	5.43	2.65	6.51	3.85	3.63	0.00	4.18	1.93	3.81	6.90	4.76	1.99	7.47	0.00	0.00	1.45	0.00	5.78
2000	4.85	3.13	6.15	1.56	1.54	3.45	6.87	4.86	2.35	8.82	4.55	2.70	3.96	5.45	0.00	0.00	0.00	10.60
2001	1.53	4.45	8.76	3.28	3.79	3.57	13.75	6.58	4.99	3.13	2.44	10.27	4.82	1.79	0.74	0.00	0.00	13.26
2002	0.73	2.68	1.85	3.55	13.83	8.52	7.24	2.82	2.55	3.03	0.00	14.50	4.53	8.96	0.00	1.20	3.70	6.99
2003	3.00	3.42	2.97	1.72	5.33	0.00	4.38	2.91	1.28	0.00	0.00	8.37	3.70	3.60	0.33	1.23	0.00	9.79
2004	0.77	0.00	4.14	0.00	4.68	0.00	1.94	0.72	2.48	0.00	0.00	1.54	0.00	5.17	0.30	0.00	0.00	2.94
2005	0.00	0.00	0.97	0.00	1.01	0.00	0.88	1.61	0.00	0.00	0.00	0.43	0.00	8.20	0.30	0.00	0.00	3.13
2006	0.00	2.56	0.84	0.00	3.03	0.00	0.00	0.75	0.00	0.00	0.00	0.00	3.52	0.00	0.00	0.00	0.00	0.00
2007	0.79	0.00	0.00	3.26	0.00	0.00	0.00	2.25	0.78	2.33	0.00	0.93	1.12	0.00	0.00	0.00	0.00	0.00
2008	0.83	0.00	10.07	7.60	1.93	7.41	0.78	2.87	0.65	0.00	0.00	2.45	4.80	0.00	0.00	0.00	0.00	0.00
2009	0.78	6.85	17.93	36.35	22.30	0.00	9.97	3.74	3.83	6.21	0.00	6.00	6.95	3.20	0.30	0.00	0.00	9.09
2010	1.50	1.53	4.50	15.35	2.05	0.00	0.00	4.09	1.86	0.00	0.00	1.57	1.37	0.00	0.00	0.99	0.00	3.03
2011	0.00	0.00	3.52	8.94	0.00	0.00	0.00	3.26	1.32	1.61	0.00	0.00	5.67	5.66	0.00	0.00	0.00	0.00
2012	0.71	1.15	3.92	16.29	1.00	0.00	2.15	2.16	1.67	6.10	0.00	1.71	1.11	1.96	0.54	0.00	0.00	0.00
2013	1.94	0.58	2.40	20.25	0.88	0.00	1.90	1.36	1.93	0.00	0.00	1.66	2.14	0.00	0.00	0.00	0.00	0.00
2014	0.00	2.70	1.56	8.70	0.00	0.00	5.16	2.36	2.46	3.00	1.10	1.64	0.96	0.00	0.00	0.00	0.00	0.00
2015	0.00	0.47	2.32	2.38	0.96	4.17	6.64	2.12	2.16	4.14	0.00	0.56	0.00	0.00	0.25	0.00	0.00	1.82
2016	0.67	0.81	0.73	16.57	0.00	0.00	9.04	3.71	1.10	0.00	0.00	1.61	1.99	1.59	0.25	0.00	0.00	4.97
2017	0.68	1.27	0.00	0.00	3.77	3.57	1.94	7.08	3.75	1.18	0.00	1.61	2.93	0.00	0.00	0.00	0.00	3.42
2018	1.24	0.39	0.00	7.05	0.96	0.00	1.87	7.27	1.86	0.00	0.00	1.04	1.92	0.00	0.24	0.00	0.00	3.17

Source: Moody's Investors Service

Exhibit 51

Annual volume-weighted corporate bond default rates by letter rating, 1994-2018 In percent

Year	Aaa	Aa	A	Baa	Ba	B	Caa-C	Inv-Grade	Spec-Grade	All- Rated
1994	0.000	0.000	0.000	0.000	0.000	2.294	22.755	0.000	2.125	0.433
1995	0.000	0.000	0.000	0.000	0.000	4.793	9.108	0.000	3.081	0.714
1996	0.000	0.000	0.000	0.000	0.000	2.288	18.461	0.000	2.341	0.668
1997	0.000	0.000	0.000	0.000	0.051	3.065	6.415	0.000	1.909	0.494
1998	0.000	0.000	0.000	0.000	0.654	3.285	11.306	0.000	2.872	0.853
1999	0.000	0.000	0.000	0.140	1.154	5.499	21.194	0.031	5.875	1.131
2000	0.000	0.000	0.000	0.623	1.948	5.296	19.985	0.137	5.630	1.302
2001	0.000	0.000	0.720	0.957	1.276	14.339	54.455	0.545	15.801	3.042
2002	0.000	0.000	2.718	1.979	5.250	16.148	77.821	1.758	21.556	4.819
2003	0.000	0.000	0.000	0.000	3.622	3.745	17.012	0.000	6.122	1.070
2004	0.000	0.000	0.000	0.000	0.000	0.258	9.190	0.000	1.879	0.328
2005	0.000	0.000	0.000	0.201	0.000	0.899	18.181	0.073	3.787	0.754
2006	0.000	0.000	0.000	0.000	0.033	1.065	3.999	0.000	1.050	0.212
2007	0.000	0.000	0.000	0.000	0.000	0.000	4.834	0.000	0.796	0.155
2008	0.000	0.816	2.370	1.108	8.274	1.051	11.158	1.466	5.802	2.220
2009	0.000	0.000	0.014	0.751	3.601	6.466	37.815	0.217	16.255	2.754
2010	0.000	0.000	0.147	0.021	0.000	0.130	6.021	0.077	1.643	0.339
2011	0.000	0.114	0.000	0.403	0.000	0.173	7.145	0.149	1.461	0.397
2012	0.000	0.000	0.000	0.018	0.000	0.218	11.103	0.007	2.036	0.396
2013	0.000	0.000	0.060	0.024	0.000	0.841	4.365	0.039	1.073	0.254
2014	0.000	0.000	0.023	0.000	0.108	0.324	9.244	0.010	1.737	0.388
2015	0.000	0.000	0.000	0.000	0.813	1.376	17.030	0.000	3.468	0.789
2016	0.000	0.000	0.000	0.000	0.134	0.938	19.308	0.000	3.488	0.738
2017	0.000	0.000	0.000	0.000	0.096	0.058	9.700	0.000	1.611	0.317
2018	0.000	0.000	0.000	0.000	0.000	0.553	11.302	0.000	1.837	0.338
Mean	0.000	0.037	0.242	0.249	1.081	3.004	17.556	0.180	4.609	0.996
Media	0.000	0.000	0.000	0.000	0.051	1.065	11.302	0.000	2.341	0.668
StDev	0.000	0.164	0.710	0.487	2.049	4.162	16.799	0.448	5.319	1.103
Min	0.000	0.000	0.000	0.000	0.000	0.000	3.999	0.000	0.796	0.155
Max	0.000	0.816	2.718	1.979	8.274	16.148	77.821	1.758	21.556	4.819

Source: Moody's Investors Service

Exhibit 52

Average volume-weighted corporate bond default rates by letter rating, 1994-2018

In percent

Rating \ Year	1	2	3	4	5
Aaa	0.000	0.043	0.043	0.043	0.043
Aa	0.029	0.076	0.105	0.143	0.198
A	0.223	0.424	0.593	0.718	0.869
Baa	0.128	0.275	0.392	0.600	0.888
Ba	0.632	1.611	2.492	3.382	4.012
B	2.452	5.688	8.812	11.577	13.444
Caa-C	14.570	24.041	30.888	34.402	36.643
Inv-Grade	0.150	0.301	0.423	0.556	0.728
Spec-Grade	3.723	7.061	9.882	12.000	13.432
All Rated	0.849	1.624	2.273	2.788	3.198

Source: Moody's Investors Service

Exhibit 53

Cumulative issuer-weighted default rates by annual cohort, 1970-2018

1/1/70																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	39	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.027	0.027	0.027
Aa	77	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.014	0.014	0.029	0.029	0.029	0.029
A	254	0.000	0.000	0.000	0.004	0.004	0.008	0.008	0.008	0.008	0.008	0.013	0.013	0.013	0.013	0.013	0.013	0.018	0.018	0.028	0.028
Baa	372	0.005	0.005	0.005	0.011	0.014	0.014	0.017	0.024	0.030	0.030	0.034	0.034	0.046	0.050	0.054	0.059	0.072	0.083	0.093	0.099
Ba	238	0.042	0.051	0.056	0.060	0.070	0.081	0.086	0.092	0.105	0.105	0.105	0.120	0.146	0.155	0.155	0.176	0.211	0.236	0.236	0.251
B	36	0.194	0.194	0.223	0.223	0.223	0.223	0.223	0.223	0.223	0.223	0.223	0.223	0.305	0.305	0.305	0.305	0.363	0.363	0.363	0.363
Caa-C	16	0.500	0.563	0.750	0.813	0.813	0.813	0.813	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906
IG	742	0.003	0.003	0.003	0.007	0.008	0.010	0.011	0.014	0.018	0.018	0.021	0.021	0.026	0.030	0.032	0.033	0.043	0.049	0.057	0.059
SG	290	0.087	0.098	0.116	0.124	0.132	0.140	0.145	0.154	0.165	0.165	0.165	0.177	0.210	0.217	0.217	0.233	0.270	0.289	0.289	0.301
All	1032	0.026	0.029	0.034	0.040	0.043	0.046	0.048	0.053	0.058	0.058	0.060	0.063	0.074	0.078	0.079	0.084	0.098	0.106	0.113	0.116
1/1/71																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.027	0.027	0.027	0.027
Aa	74	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.018
A	282	0.000	0.000	0.004	0.004	0.007	0.007	0.007	0.007	0.007	0.011	0.011	0.015	0.020	0.020	0.020	0.024	0.024	0.033	0.033	0.033
Baa	398	0.000	0.000	0.005	0.008	0.011	0.014	0.020	0.026	0.026	0.029	0.029	0.041	0.045	0.049	0.053	0.066	0.076	0.085	0.091	0.102
Ba	228	0.009	0.013	0.018	0.028	0.038	0.044	0.050	0.062	0.062	0.062	0.078	0.103	0.112	0.112	0.133	0.179	0.205	0.205	0.220	0.220
B	27	0.000	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.159	0.159	0.159	0.159	0.235	0.235	0.235	0.235	0.235
Caa-C	8	0.125	0.500	0.625	0.625	0.625	0.625	0.813	0.813	0.813	0.813	0.813	0.813	0.813	0.813	0.813	0.813	0.813	0.813	0.813	0.813
IG	794	0.000	0.000	0.004	0.005	0.008	0.009	0.012	0.015	0.015	0.018	0.018	0.025	0.028	0.030	0.031	0.039	0.044	0.052	0.054	0.060
SG	263	0.012	0.031	0.039	0.048	0.057	0.062	0.072	0.083	0.083	0.083	0.096	0.132	0.139	0.139	0.157	0.205	0.226	0.226	0.238	0.238
All	1057	0.003	0.008	0.013	0.016	0.020	0.022	0.026	0.031	0.031	0.034	0.036	0.048	0.052	0.053	0.058	0.071	0.079	0.086	0.089	0.094
1/1/72																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	41	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.026	0.026	0.026	0.026	0.026
Aa	78	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.017	0.017
A	303	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.007	0.011	0.011	0.011	0.015	0.015	0.023	0.023	0.028	0.033
Baa	431	0.000	0.005	0.007	0.012	0.015	0.021	0.026	0.026	0.033	0.033	0.040	0.043	0.051	0.055	0.067	0.076	0.085	0.095	0.111	0.138
Ba	224	0.000	0.005	0.015	0.025	0.030	0.036	0.048	0.048	0.048	0.063	0.095	0.103	0.103	0.132	0.175	0.199	0.199	0.212	0.226	0.287
B	29	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.178	0.178	0.178	0.178	0.253	0.253	0.253	0.253	0.253	0.253
Caa-C	8	0.375	0.500	0.500	0.500	0.500	0.667	0.667	0.667	0.667	0.667	0.667	0.667	0.667	0.667	0.667	0.667	0.667	0.667	0.667	0.667
IG	853	0.000	0.004	0.005	0.007	0.009	0.011	0.014	0.014	0.017	0.017	0.021	0.024	0.028	0.029	0.036	0.041	0.048	0.052	0.062	0.074
SG	261	0.019	0.027	0.036	0.045	0.049	0.059	0.070	0.070	0.070	0.082	0.122	0.130	0.130	0.154	0.199	0.219	0.219	0.230	0.243	0.297
All	1114	0.005	0.009	0.012	0.016	0.018	0.022	0.026	0.026	0.029	0.031	0.042	0.046	0.049	0.054	0.067	0.074	0.080	0.085	0.095	0.112
1/1/73																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	41	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.026	0.026	0.026	0.026	0.026	0.026
Aa	81	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0.016	0.016
A	309	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.007	0.007	0.007	0.011	0.011	0.020	0.020	0.024	0.029	0.033
Baa	441	0.005	0.007	0.012	0.014	0.019	0.025	0.025	0.031	0.031	0.037	0.044	0.051	0.059	0.070	0.078	0.087	0.097	0.117	0.138	0.138
Ba	205	0.000	0.010	0.021	0.026	0.032	0.045	0.045	0.045	0.060	0.100	0.109	0.109	0.128	0.170	0.205	0.205	0.218	0.232	0.305	0.320
B	27	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.152	0.152	0.152	0.152	0.229	0.229	0.229	0.229	0.229	0.229	0.229
Caa-C	6	0.375	0.375	0.375	0.375	0.583	0.583	0.583	0.583	0.583	0.583	0.583	0.583	0.583	0.583	0.583	0.583	0.583	0.583	0.583	0.583
IG	872	0.002	0.003	0.006	0.007	0.010	0.012	0.012	0.015	0.015	0.019	0.024	0.027	0.030	0.036	0.041	0.048	0.052	0.063	0.073	0.075
SG	238	0.013	0.022	0.031	0.036	0.046	0.057	0.057	0.057	0.070	0.117	0.125	0.125	0.141	0.186	0.216	0.216	0.227	0.240	0.305	0.318
All	1110	0.005	0.007	0.011	0.013	0.017	0.021	0.021	0.024	0.026	0.038	0.043	0.045	0.050	0.063	0.071	0.077	0.082	0.093	0.110	0.113
1/1/74																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	44	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Aa	89	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.027	0.027	0.027	0.027
A	307	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.007	0.007	0.007	0.011	0.011	0.019	0.019	0.024	0.028	0.033	0.033
Baa	431	0.000	0.005	0.007	0.012	0.018	0.018	0.024	0.024	0.030	0.037	0.044	0.052	0.056	0.064	0.073	0.082	0.097	0.118	0.118	0.118
Ba	197	0.005	0.016	0.022	0.028	0.041	0.041	0.041	0.049	0.089	0.098	0.098	0.117	0.179	0.214	0.214	0.227	0.255	0.328	0.343	0.362
B	29	0.072	0.072	0.072	0.072	0.072	0.072	0.118	0.222	0.222	0.222	0.222	0.222	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
Caa-C	3	0.000	0.000	0.000	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333
IG	871	0.000	0.002	0.004	0.006	0.009	0.009	0.011	0.011	0.017	0.021	0.024	0.027	0.031	0.036	0.042					

Exhibit 54

Cumulative issuer-weighted default rates by annual cohort, 1970-2018 (continued)

1/1/75																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	52	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
Aa	103	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.011	0.011	0.011	0.011	0.011	0.022	0.022	0.035	0.035	0.035	0.035	0.035
A	321	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004	0.007	0.007	0.015	0.015	0.019	0.028	0.032	0.037	0.037
Baa	412	0.000	0.000	0.003	0.008	0.008	0.014	0.014	0.024	0.031	0.039	0.046	0.050	0.058	0.063	0.072	0.092	0.113	0.113	0.113	0.113
Ba	200	0.010	0.021	0.033	0.039	0.039	0.039	0.046	0.084	0.093	0.093	0.111	0.170	0.203	0.215	0.227	0.241	0.296	0.311	0.327	0.327
B	33	0.062	0.062	0.062	0.095	0.095	0.095	0.134	0.221	0.221	0.221	0.221	0.286	0.286	0.286	0.286	0.388	0.490	0.490	0.490	0.490
Caa-C	3	0.000	0.000	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333				
IG	888	0.000	0.000	0.001	0.004	0.004	0.006	0.006	0.012	0.016	0.019	0.022	0.025	0.029	0.036	0.039	0.050	0.061	0.062	0.064	0.064
SG	236	0.017	0.027	0.041	0.051	0.051	0.051	0.063	0.108	0.115	0.115	0.130	0.189	0.217	0.227	0.237	0.260	0.320	0.333	0.348	0.348
All	1124	0.004	0.005	0.009	0.013	0.013	0.015	0.017	0.030	0.035	0.037	0.042	0.053	0.061	0.068	0.072	0.085	0.102	0.105	0.108	0.108
1/1/76																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	66	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
Aa	112	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.010	0.010	0.010	0.010	0.010	0.021	0.021	0.032	0.032	0.032	0.032	0.032	0.032
A	367	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.006	0.006	0.013	0.013	0.023	0.023	0.031	0.042	0.042	0.047	0.047	0.052
Baa	371	0.000	0.003	0.006	0.006	0.009	0.009	0.023	0.031	0.039	0.046	0.051	0.060	0.060	0.070	0.091	0.108	0.114	0.114	0.114	0.114
Ba	206	0.010	0.020	0.032	0.032	0.038	0.044	0.072	0.080	0.080	0.096	0.149	0.178	0.188	0.200	0.212	0.273	0.286	0.300	0.300	0.300
B	27	0.000	0.000	0.040	0.040	0.040	0.088	0.195	0.195	0.195	0.195	0.285	0.285	0.285	0.285	0.428	0.571	0.571	0.571	0.571	0.571
Caa-C	3	0.000	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333					
IG	916	0.000	0.001	0.002	0.002	0.003	0.003	0.010	0.015	0.018	0.021	0.025	0.029	0.036	0.039	0.050	0.061	0.062	0.064	0.064	0.066
SG	236	0.009	0.022	0.037	0.037	0.042	0.054	0.090	0.096	0.096	0.111	0.165	0.192	0.201	0.211	0.232	0.300	0.311	0.325	0.325	0.325
All	1152	0.002	0.005	0.009	0.009	0.011	0.013	0.025	0.030	0.033	0.037	0.049	0.057	0.063	0.067	0.080	0.098	0.101	0.104	0.104	0.106
1/1/77																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	67	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
Aa	119	0.000	0.000	0.000	0.000	0.000	0.009	0.009	0.009	0.009	0.009	0.009	0.019	0.019	0.030	0.030	0.030	0.030	0.030	0.030	0.030
A	388	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.006	0.006	0.012	0.012	0.028	0.028	0.039	0.050	0.050	0.054	0.054	0.059	0.059
Baa	355	0.003	0.006	0.006	0.006	0.006	0.021	0.028	0.036	0.044	0.048	0.057	0.057	0.068	0.084	0.101	0.107	0.107	0.107	0.107	0.107
Ba	195	0.005	0.017	0.017	0.023	0.029	0.057	0.065	0.065	0.081	0.134	0.163	0.173	0.184	0.196	0.258	0.271	0.285	0.285	0.285	0.285
B	31	0.032	0.066	0.066	0.106	0.149	0.249	0.249	0.249	0.249	0.332	0.332	0.332	0.332	0.466	0.599	0.599	0.599	0.599	0.599	0.599
Caa-C	3	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333						
IG	929	0.001	0.002	0.002	0.002	0.002	0.008	0.014	0.016	0.019	0.023	0.027	0.036	0.039	0.051	0.061	0.062	0.064	0.064	0.066	0.066
SG	229	0.014	0.028	0.028	0.038	0.050	0.086	0.092	0.092	0.106	0.161	0.186	0.195	0.205	0.226	0.293	0.305	0.319	0.319	0.319	0.319
All	1158	0.004	0.007	0.007	0.009	0.011	0.022	0.028	0.030	0.035	0.046	0.054	0.063	0.067	0.079	0.096	0.099	0.102	0.102	0.104	0.104
1/1/78																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	71	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0.016	0.016	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
Aa	131	0.000	0.000	0.000	0.000	0.008	0.008	0.008	0.008	0.008	0.008	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
A	380	0.000	0.000	0.000	0.000	0.000	0.006	0.006	0.006	0.012	0.012	0.026	0.026	0.040	0.047	0.047	0.052	0.052	0.056	0.056	0.056
Baa	341	0.000	0.000	0.000	0.000	0.014	0.018	0.025	0.029	0.033	0.047	0.051	0.061	0.077	0.099	0.104	0.104	0.104	0.104	0.104	0.104
Ba	187	0.011	0.011	0.011	0.018	0.046	0.061	0.061	0.093	0.154	0.174	0.184	0.196	0.219	0.281	0.294	0.323	0.323	0.323	0.323	0.323
B	37	0.054	0.054	0.117	0.150	0.224	0.224	0.269	0.269	0.326	0.387	0.387	0.387	0.474	0.606	0.606	0.606	0.606	0.606	0.606	0.606
Caa-C	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.500	0.500	0.500	0.500	0.500							
IG	923	0.000	0.000	0.000	0.000	0.006	0.010	0.012	0.014	0.018	0.023	0.032	0.035	0.048	0.057	0.059	0.061	0.061	0.063	0.063	0.063
SG	227	0.018	0.018	0.028	0.039	0.074	0.086	0.093	0.120	0.187	0.212	0.220	0.229	0.260	0.326	0.338	0.364	0.364	0.364	0.364	0.364
All	1150	0.004	0.004	0.005	0.007	0.018	0.024	0.027	0.032	0.046	0.054	0.063	0.067	0.082	0.098	0.101	0.106	0.106	0.108	0.108	0.108
1/1/79																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	75	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.015	0.015	0.015	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Aa	132	0.000	0.000	0.000	0.008	0.008	0.008	0.008	0.008	0.008	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
A	376	0.000	0.000	0.000	0.000	0.006	0.006	0.006	0.012	0.012	0.025	0.025	0.036	0.043	0.043	0.047	0.047	0.052	0.052	0.052	0.052
Baa	336	0.000	0.003	0.003	0.017	0.021	0.024	0.028	0.028	0.041	0.045	0.055	0.081	0.103	0.108	0.108	0.108	0.108	0.108	0.108	0.108
Ba	207	0.005	0.005	0.011	0.035	0.061	0.095	0.123	0.189	0.206	0.214	0.223	0.254	0.317	0.328	0.352	0.352	0.352	0.352	0.352	0.352
B	34	0.000	0.065	0.098	0.170	0.170	0.216	0.265	0.390	0.457	0.457	0.457	0.566	0.566							
Caa-C	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.500	0.500	0.500	0.500	0.500								
IG	919	0.000	0.001	0.001	0.007	0.011	0.012	0.013	0.016	0.021	0.030	0.033	0.047	0.056	0.058	0.060	0.060	0.062	0.062	0.062	0.062
SG	244	0.004	0.013	0.023	0.054	0.075	0.111	0.141	0.218	0.240	0.247	0.255	0.292	0.350	0.360	0.383	0.383	0.383	0.383	0.383	0.383
All	1163	0.001	0.0																		

Exhibit 55

Cumulative issuer-weighted default rates by annual cohort, 1970-2018 (continued)

1/1/80																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	87	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.013	0.013	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026
Aa	130	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018
A	381	0.000	0.000	0.003	0.008	0.008	0.008	0.017	0.020	0.030	0.030	0.041	0.048	0.048	0.052	0.052	0.056	0.056	0.056	0.056	0.067
Baa	336	0.000	0.000	0.010	0.014	0.017	0.025	0.025	0.033	0.041	0.055	0.080	0.105	0.115	0.115	0.115	0.115	0.115	0.115	0.115	0.115
Ba	207	0.000	0.005	0.039	0.051	0.089	0.121	0.182	0.205	0.213	0.239	0.268	0.330	0.353	0.377	0.377	0.377	0.377	0.392	0.392	0.392
B	41	0.050	0.076	0.157	0.215	0.279	0.316	0.448	0.494	0.494	0.494	0.614	0.691	0.691	0.691	0.691	0.691	0.691	0.691	0.691	0.691
Caa-C	6	0.333	0.333	0.333	0.333	0.333	0.333	0.556	0.556	0.556	0.556	0.556									
IG	934	0.000	0.000	0.005	0.008	0.009	0.012	0.016	0.022	0.030	0.035	0.048	0.059	0.062	0.064	0.064	0.065	0.065	0.065	0.065	0.070
SG	254	0.016	0.025	0.066	0.085	0.126	0.158	0.232	0.257	0.263	0.285	0.325	0.387	0.407	0.429	0.429	0.429	0.429	0.442	0.442	0.442
All	1188	0.003	0.005	0.017	0.024	0.033	0.041	0.057	0.067	0.075	0.082	0.099	0.117	0.123	0.127	0.127	0.128	0.128	0.130	0.130	0.134
1/1/81																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	91	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.012	0.012	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Aa	135	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.037
A	386	0.000	0.003	0.003	0.003	0.003	0.012	0.015	0.021	0.021	0.032	0.039	0.039	0.043	0.043	0.047	0.047	0.047	0.047	0.057	0.063
Baa	339	0.000	0.006	0.020	0.027	0.034	0.034	0.038	0.046	0.059	0.083	0.102	0.112	0.112	0.112	0.112	0.112	0.112	0.112	0.119	0.127
Ba	241	0.000	0.037	0.051	0.082	0.119	0.186	0.211	0.217	0.247	0.288	0.352	0.372	0.394	0.394	0.394	0.394	0.409	0.423	0.423	0.423
B	46	0.044	0.114	0.163	0.243	0.272	0.412	0.412	0.412	0.412	0.515	0.576	0.576	0.576	0.576	0.576	0.576	0.576	0.576	0.576	0.576
Caa-C	7	0.000	0.000	0.000	0.000	0.000	0.167	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333
IG	951	0.000	0.003	0.008	0.010	0.013	0.016	0.021	0.029	0.033	0.046	0.055	0.058	0.060	0.060	0.062	0.062	0.062	0.062	0.068	0.075
SG	294	0.007	0.048	0.068	0.105	0.140	0.219	0.245	0.250	0.275	0.322	0.383	0.401	0.420	0.420	0.420	0.420	0.431	0.444	0.444	0.444
All	1245	0.002	0.014	0.021	0.031	0.041	0.060	0.069	0.077	0.085	0.103	0.120	0.125	0.130	0.130	0.131	0.131	0.133	0.134	0.140	0.145
1/1/82																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	94	0.000	0.000	0.000	0.000	0.000	0.012	0.012	0.012	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024
Aa	147	0.000	0.000	0.000	0.000	0.000	0.008	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.033	0.033	0.033	0.033	0.033	0.045	0.045
A	395	0.003	0.003	0.003	0.003	0.011	0.011	0.017	0.017	0.031	0.038	0.038	0.042	0.042	0.042	0.042	0.042	0.042	0.047	0.052	0.083
Baa	326	0.003	0.003	0.014	0.021	0.025	0.033	0.042	0.055	0.079	0.098	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.123	0.131	0.131
Ba	254	0.028	0.054	0.081	0.118	0.186	0.208	0.214	0.241	0.285	0.326	0.345	0.365	0.365	0.365	0.365	0.379	0.394	0.394	0.394	0.427
B	45	0.022	0.091	0.141	0.168	0.292	0.292	0.292	0.292	0.346	0.532	0.532	0.532	0.532	0.532	0.532	0.532	0.532	0.532	0.532	0.532
Caa-C	13	0.231	0.462	0.462	0.462	0.551	0.641	0.641	0.641	0.641	0.641	0.641	0.641	0.641	0.641	0.641	0.641	0.641	0.641	0.641	0.641
IG	962	0.002	0.002	0.006	0.008	0.013	0.018	0.025	0.030	0.044	0.052	0.055	0.057	0.057	0.059	0.059	0.059	0.059	0.065	0.071	0.084
SG	312	0.036	0.077	0.106	0.140	0.217	0.239	0.244	0.266	0.309	0.363	0.380	0.397	0.397	0.397	0.397	0.408	0.420	0.420	0.420	0.447
All	1274	0.010	0.020	0.030	0.040	0.061	0.070	0.077	0.084	0.103	0.120	0.125	0.129	0.129	0.130	0.130	0.132	0.133	0.139	0.144	0.159
1/1/83																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	99	0.000	0.000	0.000	0.000	0.023	0.023	0.023	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Aa	233	0.000	0.000	0.000	0.000	0.005	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.026	0.026	0.026	0.026	0.026	0.026	0.033	0.042
A	475	0.000	0.000	0.000	0.002	0.002	0.010	0.010	0.023	0.035	0.040	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.048	0.060	0.065
Baa	324	0.000	0.010	0.013	0.028	0.032	0.036	0.046	0.070	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.105	0.121	0.138	0.173
Ba	178	0.012	0.024	0.044	0.103	0.120	0.156	0.199	0.234	0.269	0.269	0.286	0.286	0.286	0.286	0.286	0.310	0.335	0.362	0.415	0.442
B	135	0.023	0.071	0.138	0.243	0.272	0.281	0.304	0.376	0.486	0.533	0.558	0.558	0.558	0.558	0.595	0.595	0.595	0.595	0.595	0.595
Caa-C	20	0.423	0.538	0.596	0.596	0.731	0.731	0.731	0.731	0.731	0.731	0.731	0.731	0.731	0.731	0.731	0.731	0.731	0.731	0.731	0.731
IG	1131	0.000	0.003	0.004	0.009	0.013	0.020	0.023	0.036	0.045	0.048	0.049	0.049	0.051	0.051	0.051	0.051	0.054	0.060	0.071	0.082
SG	333	0.041	0.074	0.116	0.191	0.220	0.242	0.274	0.322	0.381	0.397	0.415	0.415	0.415	0.415	0.427	0.441	0.455	0.471	0.502	0.518
All	1464	0.009	0.018	0.028	0.048	0.057	0.067	0.074	0.093	0.110	0.114	0.118	0.118	0.119	0.119	0.120	0.122	0.126	0.133	0.146	0.157
1/1/84																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	85	0.000	0.000	0.000	0.013	0.013	0.013	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027
Aa	249	0.000	0.000	0.000	0.009	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.024	0.024	0.024	0.024	0.024	0.024	0.031	0.038	0.038
A	496	0.000	0.002	0.004	0.007	0.016	0.016	0.031	0.042	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.051	0.062	0.066	0.071
Baa	331	0.006	0.006	0.010	0.014	0.018	0.027	0.036	0.051	0.051	0.057	0.057	0.057	0.057	0.064	0.064	0.072	0.089	0.116	0.143	0.143
Ba	195	0.005	0.022	0.091	0.117	0.152	0.184	0.244	0.297	0.308	0.319	0.319	0.319	0.319	0.319	0.319	0.358	0.378	0.398	0.438	0.438
B	154	0.053	0.123	0.217	0.247	0.280	0.337	0.418	0.478	0.497	0.537	0.537	0.537	0.537	0.537	0.573	0.573	0.573	0.573	0.573	0.573
Caa-C	11	0.182	0.299	0.299	0.474	0.474	0.474	0.474	0.474	0.474	0.474	0.474	0.474	0.474	0.474	0.474	0.474	0.474	0.474	0.474	0.474
IG	1161	0.002	0.003	0.005	0.009	0.017	0.019	0.029	0.037	0.040	0.041	0.041	0.043	0.043	0.044	0.044	0.046	0.051	0.064	0.073	0.075
SG	360	0.031	0.073	0.151	0.182	0.215	0.257														

Exhibit 56

Cumulative issuer-weighted default rates by annual cohort, 1970-2018 (continued)

1/1/85																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	91	0.000	0.000	0.000	0.000	0.000	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
Aa	302	0.000	0.000	0.000	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.013	0.013	0.013	0.013	0.013	0.013	0.020	0.027	0.027	0.027
A	557	0.000	0.002	0.012	0.023	0.023	0.040	0.050	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.056	0.063	0.067	0.071	0.071
Baa	336	0.000	0.010	0.014	0.018	0.026	0.031	0.046	0.051	0.057	0.057	0.057	0.057	0.064	0.064	0.089	0.108	0.136	0.165	0.165	0.165
Ba	236	0.009	0.059	0.087	0.121	0.172	0.233	0.291	0.307	0.316	0.316	0.316	0.316	0.316	0.316	0.332	0.349	0.383	0.417	0.417	0.417
B	182	0.073	0.160	0.210	0.243	0.300	0.383	0.438	0.455	0.495	0.495	0.520	0.520	0.520	0.555	0.555	0.555	0.555	0.555	0.555	0.555
Caa-C	15	0.067	0.133	0.220	0.318	0.318	0.318	0.318	0.318	0.318	0.318	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591
IG	1286	0.000	0.003	0.009	0.016	0.018	0.028	0.036	0.038	0.039	0.039	0.041	0.041	0.042	0.042	0.047	0.052	0.063	0.072	0.074	0.074
SG	433	0.038	0.105	0.143	0.179	0.231	0.299	0.353	0.368	0.385	0.385	0.407	0.407	0.407	0.416	0.426	0.437	0.460	0.483	0.483	0.483
All	1719	0.010	0.029	0.043	0.057	0.070	0.092	0.108	0.113	0.117	0.117	0.122	0.122	0.123	0.124	0.130	0.135	0.147	0.158	0.159	0.159
1/1/86																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	136	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	351	0.000	0.000	0.006	0.006	0.013	0.013	0.013	0.013	0.013	0.018	0.018	0.018	0.018	0.018	0.018	0.024	0.030	0.030	0.030	0.030
A	625	0.000	0.002	0.007	0.009	0.019	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.032	0.038	0.045	0.049	0.049	0.053
Baa	364	0.009	0.012	0.025	0.037	0.052	0.065	0.074	0.079	0.084	0.084	0.084	0.090	0.090	0.105	0.112	0.128	0.144	0.144	0.144	0.144
Ba	314	0.024	0.069	0.094	0.136	0.203	0.264	0.284	0.306	0.314	0.314	0.314	0.324	0.324	0.324	0.339	0.397	0.427	0.427	0.427	0.443
B	223	0.105	0.149	0.190	0.240	0.318	0.391	0.438	0.465	0.465	0.487	0.487	0.487	0.511	0.569	0.599	0.599	0.599	0.599	0.599	0.599
Caa-C	19	0.171	0.235	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.770	0.770	0.770	0.770	0.770	0.770	0.770	0.770	0.770	0.770	0.770
IG	1476	0.002	0.004	0.011	0.014	0.023	0.029	0.031	0.032	0.033	0.034	0.034	0.035	0.035	0.038	0.042	0.050	0.057	0.059	0.059	0.061
SG	556	0.062	0.107	0.140	0.185	0.254	0.318	0.347	0.370	0.375	0.392	0.392	0.399	0.406	0.423	0.441	0.479	0.498	0.498	0.498	0.509
All	2032	0.018	0.031	0.045	0.058	0.081	0.098	0.105	0.110	0.112	0.115	0.115	0.118	0.119	0.123	0.129	0.140	0.149	0.151	0.151	0.154
1/1/87																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	156	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	365	0.000	0.000	0.000	0.003	0.003	0.003	0.003	0.003	0.007	0.007	0.007	0.007	0.007	0.007	0.013	0.018	0.018	0.018	0.018	0.018
A	594	0.000	0.000	0.002	0.011	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.021	0.027	0.034	0.042	0.042	0.046	0.050
Baa	402	0.000	0.009	0.018	0.034	0.048	0.063	0.075	0.075	0.075	0.075	0.081	0.086	0.098	0.105	0.119	0.126	0.126	0.126	0.126	0.126
Ba	422	0.030	0.050	0.087	0.159	0.239	0.265	0.290	0.307	0.313	0.320	0.336	0.336	0.336	0.347	0.382	0.441	0.441	0.441	0.455	0.470
B	303	0.054	0.119	0.194	0.295	0.381	0.431	0.449	0.449	0.461	0.461	0.461	0.476	0.511	0.565	0.584	0.605	0.605	0.605	0.605	0.605
Caa-C	33	0.098	0.168	0.168	0.501	0.501	0.501	0.501	0.501	0.501	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750
IG	1517	0.000	0.002	0.005	0.014	0.019	0.023	0.026	0.026	0.027	0.027	0.028	0.029	0.032	0.034	0.041	0.047	0.050	0.050	0.052	0.053
SG	758	0.043	0.083	0.135	0.224	0.304	0.338	0.359	0.370	0.385	0.390	0.399	0.404	0.417	0.443	0.470	0.513	0.513	0.513	0.522	0.531
All	2275	0.014	0.029	0.046	0.078	0.103	0.114	0.121	0.123	0.127	0.128	0.131	0.133	0.137	0.143	0.153	0.165	0.167	0.167	0.170	0.172
1/1/88																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	154	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	401	0.000	0.005	0.008	0.008	0.008	0.008	0.008	0.012	0.012	0.012	0.012	0.012	0.016	0.021	0.025	0.025	0.025	0.025	0.025	0.025
A	605	0.000	0.002	0.009	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.021	0.024	0.032	0.032	0.036	0.040	0.040
Baa	380	0.000	0.003	0.012	0.025	0.042	0.057	0.057	0.057	0.057	0.062	0.062	0.068	0.074	0.092	0.112	0.112	0.112	0.112	0.112	0.112
Ba	463	0.014	0.065	0.120	0.201	0.225	0.249	0.259	0.264	0.275	0.288	0.296	0.303	0.312	0.358	0.416	0.416	0.416	0.429	0.443	0.476
B	385	0.059	0.130	0.262	0.348	0.393	0.423	0.438	0.463	0.463	0.474	0.520	0.548	0.592	0.608	0.625	0.625	0.625	0.625	0.625	0.625
Caa-C	40	0.125	0.157	0.445	0.445	0.445	0.445	0.445	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723
IG	1540	0.000	0.003	0.009	0.014	0.018	0.021	0.021	0.022	0.022	0.023	0.023	0.024	0.027	0.035	0.041	0.044	0.044	0.046	0.047	0.047
SG	888	0.039	0.097	0.190	0.271	0.303	0.329	0.340	0.358	0.365	0.376	0.398	0.412	0.433	0.466	0.508	0.508	0.508	0.515	0.524	0.543
All	2428	0.014	0.036	0.069	0.098	0.109	0.119	0.121	0.126	0.128	0.131	0.135	0.139	0.145	0.157	0.169	0.172	0.172	0.174	0.177	0.179
1/1/89																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	172	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	412	0.005	0.005	0.005	0.005	0.005	0.005	0.008	0.008	0.008	0.008	0.008	0.013	0.017	0.021	0.021	0.021	0.021	0.021	0.021	0.033
A	642	0.000	0.003	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.017	0.020	0.024	0.024	0.028	0.031	0.031	0.044
Baa	398	0.005	0.016	0.022	0.040	0.047	0.047	0.047	0.047	0.052	0.052	0.057	0.062	0.084	0.101	0.107	0.107	0.107	0.107	0.107	0.115
Ba	437	0.030	0.098	0.178	0.201	0.227	0.231	0.236	0.247	0.260	0.281	0.289	0.305	0.347	0.410	0.410	0.410	0.410	0.422	0.448	0.463
B	423	0.075	0.211	0.295	0.346	0.379	0.402	0.436	0.443	0.468	0.496	0.519	0.557	0.557	0.588	0.588	0.588	0.611	0.611	0.611	0.662
Caa-C	49	0.203	0.490	0.554	0.554	0.554	0.554	0.554	0.554	0.554	0.554	0.554	0.554	0.777	0.777	0.777	0.777	0.777	0.777	0.777	0.777
IG	1624	0.003	0.006	0.010	0.014	0.016	0.016	0.017	0.017	0.018	0.018	0.019	0.021	0.030	0.037	0.039	0.039	0.041	0.042	0.042	0.052
SG																					

Exhibit 57

Cumulative issuer-weighted default rates by annual cohort, 1970-2018 (continued)

1/1/90																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	193	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	462	0.000	0.000	0.000	0.000	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.006	0.010	0.010	0.010	0.010	0.010	0.010	0.020	0.036
A	668	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.006	0.008	0.012	0.012	0.015	0.015	0.015	0.027	0.043
Baa	390	0.003	0.008	0.011	0.015	0.015	0.015	0.015	0.015	0.015	0.020	0.025	0.052	0.080	0.086	0.086	0.086	0.094	0.094	0.102	0.127
Ba	422	0.038	0.122	0.147	0.175	0.179	0.189	0.194	0.206	0.227	0.234	0.257	0.313	0.355	0.355	0.355	0.355	0.367	0.392	0.405	0.419
B	447	0.137	0.232	0.300	0.332	0.355	0.383	0.397	0.427	0.452	0.474	0.513	0.513	0.546	0.546	0.546	0.569	0.569	0.569	0.650	0.679
Caa-C	56	0.439	0.479	0.566	0.566	0.566	0.566	0.566	0.566	0.566	0.783	0.783	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
IG	1713	0.001	0.002	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.005	0.007	0.015	0.023	0.025	0.025	0.026	0.028	0.028	0.037	0.052
SG	925	0.105	0.192	0.239	0.267	0.280	0.298	0.306	0.325	0.347	0.364	0.391	0.429	0.465	0.465	0.465	0.472	0.479	0.494	0.527	0.545
All	2638	0.036	0.064	0.079	0.087	0.090	0.095	0.097	0.101	0.105	0.109	0.116	0.128	0.141	0.143	0.143	0.145	0.147	0.149	0.161	0.176
1/1/91																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	180	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	494	0.000	0.000	0.000	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.006	0.009	0.009	0.009	0.009	0.009	0.009	0.019	0.038	0.038
A	656	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.005	0.008	0.011	0.011	0.014	0.014	0.014	0.026	0.041	0.045
Baa	414	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.007	0.011	0.034	0.058	0.063	0.063	0.063	0.069	0.075	0.082	0.096	0.096
Ba	357	0.038	0.051	0.070	0.075	0.080	0.085	0.097	0.119	0.127	0.152	0.204	0.241	0.241	0.253	0.253	0.266	0.266	0.281	0.298	0.298
B	373	0.132	0.221	0.267	0.291	0.324	0.337	0.360	0.388	0.411	0.453	0.469	0.521	0.521	0.521	0.546	0.546	0.573	0.664	0.732	0.732
Caa-C	62	0.153	0.186	0.221	0.265	0.317	0.317	0.374	0.374	0.478	0.478	0.609	0.609	0.609	0.609	0.609	0.609	0.609	0.609	0.609	0.609
IG	1744	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.004	0.011	0.018	0.021	0.021	0.022	0.023	0.025	0.033	0.047	0.049
SG	792	0.091	0.141	0.173	0.188	0.208	0.216	0.235	0.258	0.275	0.304	0.345	0.383	0.383	0.390	0.397	0.405	0.413	0.449	0.478	0.478
All	2536	0.028	0.042	0.051	0.054	0.059	0.061	0.065	0.069	0.073	0.079	0.092	0.103	0.105	0.106	0.108	0.110	0.113	0.124	0.140	0.141
1/1/92																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	166	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	500	0.000	0.000	0.000	0.002	0.002	0.002	0.002	0.002	0.002	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.015	0.019	0.019
A	756	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.005	0.009	0.012	0.012	0.012	0.012	0.012	0.029	0.049	0.056	0.064
Baa	425	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.008	0.029	0.043	0.047	0.047	0.053	0.058	0.064	0.070	0.083	0.083	0.090
Ba	339	0.003	0.011	0.011	0.016	0.016	0.028	0.049	0.063	0.079	0.130	0.174	0.174	0.186	0.198	0.212	0.212	0.245	0.262	0.262	0.262
B	300	0.074	0.139	0.173	0.213	0.233	0.257	0.284	0.307	0.363	0.378	0.445	0.445	0.445	0.445	0.445	0.445	0.500	0.592	0.592	0.592
Caa-C	73	0.165	0.221	0.268	0.295	0.327	0.360	0.360	0.431	0.431	0.513	0.513	0.513	0.513	0.513	0.513	0.675	0.675	0.675	0.675	0.675
IG	1847	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.003	0.010	0.014	0.016	0.016	0.018	0.019	0.020	0.028	0.041	0.045	0.049
SG	712	0.049	0.086	0.104	0.125	0.136	0.154	0.176	0.197	0.225	0.264	0.311	0.311	0.317	0.324	0.333	0.341	0.378	0.420	0.420	0.420
All	2559	0.013	0.023	0.027	0.032	0.034	0.038	0.042	0.046	0.052	0.063	0.074	0.076	0.077	0.079	0.081	0.083	0.094	0.110	0.114	0.117
1/1/93																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	135	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	503	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.009	0.009	0.009
A	824	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.006	0.010	0.012	0.012	0.012	0.012	0.012	0.024	0.039	0.042	0.045	0.049
Baa	478	0.000	0.000	0.002	0.002	0.005	0.008	0.015	0.021	0.039	0.050	0.057	0.057	0.062	0.066	0.071	0.087	0.108	0.113	0.125	0.131
Ba	353	0.006	0.006	0.019	0.027	0.037	0.054	0.078	0.085	0.127	0.171	0.171	0.171	0.181	0.192	0.192	0.217	0.244	0.244	0.244	0.244
B	289	0.044	0.084	0.140	0.156	0.182	0.204	0.239	0.319	0.352	0.388	0.400	0.400	0.400	0.418	0.438	0.484	0.566	0.566	0.566	0.566
Caa-C	75	0.135	0.193	0.239	0.266	0.266	0.266	0.327	0.327	0.402	0.402	0.402	0.487	0.487	0.487	0.487	0.487	0.487	0.487	0.487	0.487
IG	1940	0.000	0.000	0.001	0.001	0.001	0.002	0.003	0.006	0.012	0.016	0.019	0.019	0.020	0.021	0.022	0.030	0.042	0.046	0.050	0.052
SG	717	0.034	0.056	0.090	0.103	0.118	0.136	0.166	0.199	0.239	0.277	0.282	0.287	0.292	0.305	0.311	0.342	0.383	0.383	0.383	0.383
All	2657	0.009	0.015	0.023	0.026	0.029	0.033	0.040	0.048	0.059	0.069	0.072	0.073	0.075	0.077	0.079	0.090	0.105	0.109	0.112	0.114
1/1/94																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	137	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	475	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004	0.004
A	1004	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.005	0.008	0.011	0.011	0.011	0.011	0.011	0.020	0.035	0.037	0.045	0.048	0.048
Baa	539	0.000	0.002	0.002	0.004	0.007	0.019	0.024	0.037	0.045	0.051	0.051	0.055	0.058	0.062	0.079	0.101	0.105	0.115	0.120	0.120
Ba	397	0.000	0.009	0.012	0.022	0.043	0.074	0.103	0.135	0.174	0.180	0.180	0.188	0.206	0.206	0.240	0.301	0.301	0.301	0.317	0.317
B	381	0.042	0.091	0.126	0.143	0.172	0.219	0.273	0.331	0.379	0.414	0.433	0.433	0.445	0.458	0.489	0.522	0.522	0.522	0.522	0.522
Caa-C	84	0.054	0.104	0.144	0.144	0.144	0.237	0.237	0.322	0.322	0.322	0.435	0.435	0.435	0.435	0.435	0.435	0.435	0.435	0.435	0.435
IG	2155	0.000	0.000	0.000	0.001	0.002	0.005	0.007	0.011	0.015	0.018	0.018	0.019	0.020	0.021	0.029	0.040	0.043			

Exhibit 58

Cumulative issuer-weighted default rates by annual cohort, 1970-2018 (continued)

1/1/95																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	139	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	562	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.008	0.008	0.008	0.008	0.008
A	1080	0.000	0.000	0.000	0.000	0.000	0.001	0.004	0.008	0.011	0.011	0.011	0.011	0.011	0.020	0.030	0.033	0.040	0.042	0.042	0.045
Baa	553	0.000	0.000	0.000	0.002	0.013	0.018	0.033	0.041	0.044	0.044	0.047	0.050	0.054	0.070	0.091	0.095	0.104	0.109	0.109	0.109
Ba	409	0.003	0.005	0.018	0.036	0.071	0.096	0.127	0.151	0.167	0.167	0.174	0.190	0.190	0.219	0.297	0.297	0.297	0.311	0.311	0.311
B	501	0.040	0.066	0.090	0.123	0.167	0.221	0.312	0.386	0.429	0.453	0.460	0.467	0.476	0.494	0.524	0.524	0.524	0.524	0.524	0.524
Caa-C	95	0.104	0.163	0.163	0.204	0.306	0.405	0.532	0.598	0.598	0.598	0.598	0.598	0.598	0.598	0.598	0.598	0.598	0.598	0.598	0.598
IG	2334	0.000	0.000	0.000	0.001	0.003	0.005	0.010	0.014	0.016	0.016	0.016	0.017	0.018	0.025	0.036	0.039	0.044	0.046	0.046	0.048
SG	1005	0.031	0.049	0.066	0.094	0.136	0.178	0.240	0.289	0.317	0.329	0.336	0.347	0.351	0.375	0.425	0.425	0.425	0.432	0.432	0.432
All	3339	0.009	0.014	0.019	0.026	0.038	0.049	0.066	0.080	0.087	0.089	0.091	0.094	0.095	0.105	0.121	0.124	0.128	0.131	0.131	0.132
1/1/96																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	142	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	604	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.007	0.007	0.007	0.007	0.007	0.007
A	1155	0.000	0.000	0.000	0.000	0.001	0.004	0.006	0.009	0.009	0.009	0.009	0.009	0.016	0.028	0.030	0.036	0.039	0.039	0.041	0.041
Baa	651	0.000	0.000	0.002	0.007	0.013	0.027	0.033	0.038	0.040	0.042	0.048	0.048	0.064	0.081	0.084	0.095	0.099	0.099	0.099	0.112
Ba	466	0.000	0.007	0.021	0.057	0.076	0.110	0.137	0.154	0.154	0.165	0.177	0.184	0.207	0.258	0.258	0.258	0.268	0.268	0.268	0.268
B	571	0.015	0.040	0.088	0.121	0.177	0.253	0.328	0.368	0.393	0.399	0.406	0.413	0.438	0.490	0.490	0.490	0.490	0.490	0.490	0.516
Caa-C	109	0.100	0.147	0.191	0.329	0.421	0.533	0.575	0.575	0.575	0.575	0.575	0.575	0.575	0.575	0.575	0.575	0.575	0.575	0.575	0.575
IG	2552	0.000	0.000	0.000	0.002	0.004	0.009	0.011	0.014	0.014	0.015	0.017	0.017	0.024	0.034	0.037	0.042	0.044	0.044	0.045	0.048
SG	1146	0.016	0.036	0.069	0.110	0.150	0.207	0.258	0.284	0.296	0.305	0.313	0.320	0.343	0.392	0.392	0.392	0.397	0.397	0.397	0.409
All	3698	0.005	0.011	0.020	0.032	0.044	0.061	0.075	0.083	0.086	0.088	0.091	0.092	0.102	0.118	0.120	0.125	0.127	0.127	0.128	0.132
1/1/97																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	138	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	683	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.006	0.006	0.006	0.006	0.006	0.006	0.006
A	1177	0.000	0.000	0.000	0.001	0.003	0.005	0.010	0.010	0.010	0.010	0.010	0.020	0.030	0.032	0.040	0.044	0.052	0.054	0.054	0.054
Baa	822	0.000	0.001	0.005	0.010	0.020	0.027	0.030	0.032	0.036	0.040	0.040	0.051	0.069	0.072	0.081	0.087	0.087	0.087	0.103	0.103
Ba	582	0.002	0.014	0.051	0.083	0.108	0.142	0.157	0.157	0.165	0.174	0.179	0.196	0.231	0.231	0.231	0.238	0.238	0.238	0.262	0.262
B	690	0.020	0.063	0.103	0.156	0.251	0.314	0.353	0.378	0.382	0.397	0.408	0.438	0.503	0.503	0.503	0.503	0.512	0.512	0.512	0.521
Caa-C	135	0.092	0.161	0.280	0.423	0.515	0.543	0.543	0.543	0.635	0.635	0.635	0.635	0.635	0.635	0.635	0.635	0.635	0.635	0.635	0.635
IG	2820	0.000	0.000	0.002	0.003	0.007	0.010	0.013	0.014	0.015	0.016	0.016	0.023	0.033	0.036	0.041	0.044	0.048	0.049	0.053	0.053
SG	1407	0.019	0.051	0.096	0.144	0.206	0.253	0.279	0.291	0.299	0.310	0.317	0.339	0.386	0.386	0.386	0.389	0.393	0.393	0.405	0.409
All	4227	0.006	0.017	0.030	0.045	0.065	0.080	0.089	0.092	0.094	0.098	0.099	0.109	0.126	0.128	0.132	0.135	0.139	0.139	0.145	0.146
1/1/98																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	737	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002	0.002	0.002	0.005	0.008	0.011	0.011	0.011	0.011	0.011	0.011	0.015
A	1178	0.000	0.000	0.001	0.003	0.005	0.009	0.009	0.009	0.009	0.009	0.019	0.030	0.031	0.037	0.043	0.052	0.054	0.054	0.054	0.058
Baa	972	0.001	0.004	0.008	0.018	0.028	0.031	0.034	0.037	0.041	0.041	0.049	0.067	0.072	0.079	0.082	0.084	0.084	0.098	0.098	0.098
Ba	702	0.009	0.035	0.065	0.101	0.132	0.150	0.153	0.159	0.163	0.167	0.183	0.222	0.222	0.222	0.232	0.232	0.232	0.249	0.260	0.260
B	936	0.038	0.095	0.164	0.260	0.319	0.366	0.402	0.410	0.431	0.448	0.467	0.504	0.504	0.504	0.504	0.509	0.509	0.514	0.514	0.520
Caa-C	154	0.083	0.260	0.372	0.521	0.579	0.622	0.653	0.685	0.685	0.685	0.842	0.842	0.842							
IG	3012	0.000	0.001	0.003	0.007	0.011	0.014	0.015	0.016	0.018	0.018	0.024	0.034	0.037	0.042	0.046	0.050	0.051	0.055	0.055	0.058
SG	1792	0.030	0.084	0.140	0.214	0.261	0.295	0.315	0.323	0.335	0.346	0.364	0.400	0.400	0.400	0.405	0.407	0.407	0.418	0.423	0.426
All	4804	0.011	0.031	0.051	0.079	0.097	0.110	0.117	0.120	0.123	0.126	0.135	0.152	0.154	0.157	0.161	0.165	0.165	0.171	0.172	0.175
1/1/99																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	112	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	733	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002	0.002	0.002	0.005	0.010	0.013	0.013	0.013	0.013	0.013	0.013	0.017	0.017
A	1220	0.000	0.000	0.002	0.003	0.007	0.007	0.007	0.007	0.007	0.017	0.028	0.028	0.035	0.040	0.049	0.051	0.051	0.051	0.055	0.055
Baa	1115	0.001	0.005	0.013	0.025	0.030	0.032	0.035	0.038	0.038	0.047	0.068	0.072	0.078	0.083	0.085	0.085	0.097	0.097	0.097	0.097
Ba	690	0.014	0.035	0.060	0.087	0.106	0.109	0.114	0.121	0.124	0.150	0.185	0.190	0.190	0.199	0.199	0.199	0.205	0.221	0.221	0.221
B	1083	0.050	0.135	0.231	0.315	0.362	0.400	0.415	0.435	0.453	0.474	0.522	0.522	0.527	0.531	0.531	0.531	0.553	0.559	0.577	0.583
Caa-C	319	0.152	0.236	0.392	0.432	0.472	0.487	0.496	0.496	0.508	0.522	0.522	0.522	0.538	0.538	0.538	0.538	0.538	0.538	0.538	0.538
IG	3180	0.000	0.002	0.005	0.010	0.013	0.015	0.015	0.016	0.016	0.023	0.035	0.038	0.043	0.047	0.051	0.052	0.056	0.056	0.058	0.058
SG	2092	0.054	0.117</																		

Exhibit 59

Cumulative issuer-weighted default rates by annual cohort, 1970-2018 (continued)

1/1/00																				
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Aaa	117	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	729	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.008	0.008	0.008	0.008	0.008	0.008	0.011	0.011
A	1251	0.000	0.002	0.004	0.007	0.008	0.008	0.008	0.008	0.020	0.033	0.033	0.039	0.044	0.052	0.054	0.058	0.058	0.061	0.061
Baa	1190	0.003	0.008	0.019	0.025	0.028	0.031	0.034	0.034	0.038	0.060	0.063	0.069	0.075	0.077	0.077	0.083	0.083	0.083	0.083
Ba	654	0.014	0.033	0.054	0.070	0.070	0.078	0.081	0.084	0.117	0.166	0.170	0.170	0.179	0.179	0.179	0.189	0.205	0.205	0.205
B	1159	0.055	0.155	0.241	0.292	0.330	0.348	0.377	0.395	0.419	0.478	0.481	0.485	0.485	0.490	0.494	0.515	0.526	0.543	0.549
Caa-C	331	0.176	0.386	0.482	0.545	0.591	0.602	0.602	0.602	0.602	0.620	0.620	0.640	0.640	0.640	0.640	0.640	0.640	0.640	0.640
IG	3287	0.001	0.004	0.008	0.012	0.013	0.015	0.015	0.015	0.022	0.034	0.036	0.041	0.045	0.049	0.050	0.054	0.054	0.056	0.056
SG	2144	0.061	0.150	0.216	0.256	0.280	0.294	0.309	0.319	0.343	0.392	0.395	0.399	0.403	0.404	0.407	0.419	0.430	0.437	0.440
All	5431	0.024	0.060	0.088	0.104	0.113	0.118	0.123	0.126	0.137	0.158	0.161	0.165	0.169	0.172	0.173	0.179	0.181	0.185	0.185
1/1/01																				
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Aaa	117	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Aa	757	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.007	0.007	0.010	0.010	0.010	0.010	0.013	0.013	
A	1296	0.002	0.004	0.007	0.007	0.007	0.007	0.007	0.020	0.032	0.033	0.039	0.042	0.049	0.053	0.057	0.057	0.061	0.061	
Baa	1168	0.002	0.014	0.020	0.025	0.028	0.031	0.031	0.033	0.054	0.055	0.061	0.070	0.072	0.072	0.076	0.078	0.078	0.080	
Ba	618	0.012	0.028	0.046	0.046	0.057	0.060	0.063	0.097	0.151	0.156	0.156	0.165	0.165	0.165	0.176	0.186	0.192	0.192	
B	1102	0.092	0.188	0.244	0.282	0.300	0.330	0.348	0.377	0.455	0.459	0.463	0.463	0.468	0.473	0.496	0.514	0.534	0.541	
Caa-C	325	0.288	0.404	0.528	0.590	0.611	0.611	0.611	0.611	0.628	0.628	0.648	0.648	0.648	0.648	0.648	0.648	0.648	0.648	
IG	3338	0.001	0.007	0.010	0.011	0.012	0.013	0.013	0.020	0.031	0.033	0.038	0.042	0.046	0.048	0.051	0.052	0.054	0.055	
SG	2045	0.096	0.169	0.218	0.245	0.260	0.276	0.286	0.313	0.373	0.376	0.380	0.384	0.386	0.388	0.402	0.414	0.424	0.427	
All	5383	0.037	0.066	0.086	0.095	0.100	0.105	0.108	0.119	0.141	0.144	0.148	0.152	0.156	0.157	0.163	0.166	0.169	0.171	
1/1/02																				
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		
Aaa	125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
Aa	765	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.007	0.007	0.010	0.010	0.010	0.010	0.013	0.013		
A	1301	0.002	0.003	0.003	0.003	0.003	0.003	0.016	0.025	0.028	0.033	0.037	0.044	0.047	0.052	0.052	0.055	0.055		
Baa	1256	0.010	0.014	0.015	0.017	0.019	0.019	0.022	0.040	0.040	0.042	0.050	0.052	0.052	0.055	0.057	0.057	0.059		
Ba	597	0.014	0.037	0.046	0.055	0.064	0.067	0.095	0.147	0.151	0.155	0.169	0.169	0.169	0.184	0.189	0.194	0.194		
B	897	0.046	0.097	0.127	0.150	0.181	0.197	0.240	0.337	0.352	0.366	0.366	0.371	0.376	0.394	0.420	0.447	0.455		
Caa-C	366	0.266	0.406	0.485	0.498	0.527	0.538	0.553	0.600	0.600	0.618	0.618	0.618	0.618	0.618	0.618	0.618	0.618		
IG	3447	0.004	0.007	0.007	0.008	0.008	0.008	0.014	0.024	0.026	0.029	0.034	0.038	0.039	0.042	0.043	0.045	0.045		
SG	1860	0.076	0.131	0.160	0.176	0.197	0.207	0.239	0.309	0.317	0.327	0.333	0.335	0.337	0.351	0.363	0.375	0.378		
All	5307	0.029	0.049	0.057	0.063	0.068	0.071	0.083	0.106	0.110	0.114	0.119	0.122	0.124	0.129	0.132	0.136	0.137		
1/1/03																				
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
Aaa	124	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
Aa	699	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.007	0.007	0.010	0.010	0.010	0.010	0.013	0.013			
A	1290	0.000	0.000	0.000	0.000	0.000	0.012	0.020	0.023	0.029	0.032	0.039	0.042	0.046	0.046	0.049	0.049			
Baa	1213	0.000	0.000	0.002	0.003	0.004	0.005	0.017	0.017	0.017	0.024	0.026	0.026	0.029	0.031	0.031	0.033			
Ba	585	0.009	0.013	0.019	0.024	0.027	0.056	0.107	0.114	0.114	0.127	0.127	0.127	0.136	0.146	0.151	0.151			
B	880	0.027	0.046	0.068	0.094	0.108	0.152	0.247	0.263	0.274	0.289	0.297	0.302	0.321	0.341	0.362	0.380			
Caa-C	366	0.201	0.309	0.335	0.372	0.380	0.391	0.482	0.482	0.529	0.529	0.529	0.529	0.529	0.529	0.529	0.529			
IG	3326	0.000	0.000	0.001	0.001	0.001	0.007	0.014	0.016	0.019	0.023	0.026	0.028	0.031	0.031	0.033	0.034			
SG	1831	0.053	0.081	0.098	0.117	0.126	0.159	0.234	0.244	0.254	0.267	0.270	0.272	0.285	0.298	0.309	0.316			
All	5157	0.018	0.027	0.033	0.039	0.041	0.053	0.077	0.081	0.086	0.091	0.095	0.097	0.102	0.105	0.109	0.111			
1/1/04																				
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15				
Aaa	143	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000				
Aa	662	0.000	0.000	0.000	0.000	0.002	0.002	0.007	0.009	0.009	0.012	0.012	0.012	0.012	0.015	0.015				
A	1294	0.000	0.000	0.000	0.000	0.011	0.016	0.018	0.024	0.025	0.033	0.036	0.040	0.040	0.043	0.043				
Baa	1274	0.000	0.002	0.002	0.002	0.003	0.019	0.019	0.019	0.027	0.028	0.028	0.033	0.034	0.034	0.036				
Ba	563	0.004	0.006	0.013	0.018	0.046	0.099	0.103	0.103	0.111	0.111	0.111	0.126	0.136	0.141	0.141				
B	963	0.008	0.021	0.040	0.049	0.091	0.197	0.209	0.218	0.237	0.243	0.247	0.259	0.272	0.294	0.309				
Caa-C	329	0.113	0.177	0.219	0.249	0.276	0.410	0.421	0.493	0.508	0.508	0.508	0.508	0.530	0.530	0.530				
IG	3373	0.000	0.001	0.001	0.001	0.006	0.013	0.015	0.018	0.022	0.026	0.027	0.030	0.031	0.032	0.033				
SG	1855	0.024	0.041	0.060	0.070	0.104	0.194	0.203	0.215	0.229	0.233	0.234	0.246	0.258	0.271	0.278				
All	5228	0.008	0.014	0.020	0.023	0.035	0.065	0.068	0.073	0.079	0.083	0.084	0.089	0.092	0.097	0.098				

Data in percent

Source: Moody's Investors Service

Exhibit 60

Cumulative issuer-weighted default rates by annual cohort, 1970-2018 (continued)

1/1/05															
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Aaa	132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	680	0.000	0.000	0.000	0.000	0.002	0.002	0.008	0.010	0.010	0.013	0.013	0.013	0.016	0.016
A	1346	0.000	0.000	0.000	0.008	0.012	0.015	0.020	0.021	0.028	0.030	0.034	0.034	0.037	0.037
Baa	1296	0.002	0.002	0.002	0.007	0.021	0.021	0.021	0.028	0.031	0.031	0.035	0.036	0.036	0.038
Ba	552	0.000	0.007	0.009	0.037	0.090	0.096	0.096	0.107	0.107	0.107	0.125	0.129	0.138	0.138
B	1049	0.008	0.026	0.037	0.085	0.199	0.211	0.221	0.239	0.250	0.254	0.268	0.286	0.303	0.316
Caa-C	360	0.071	0.110	0.141	0.212	0.379	0.411	0.501	0.513	0.526	0.542	0.560	0.580	0.580	0.580
IG	3454	0.001	0.001	0.001	0.006	0.013	0.015	0.018	0.021	0.025	0.026	0.029	0.029	0.031	0.032
SG	1961	0.017	0.035	0.047	0.092	0.194	0.206	0.221	0.236	0.243	0.246	0.262	0.274	0.285	0.291
All	5415	0.006	0.012	0.016	0.033	0.067	0.072	0.078	0.084	0.089	0.090	0.096	0.099	0.103	0.105
1/1/06															
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	
Aaa	127	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Aa	697	0.000	0.000	0.002	0.002	0.008	0.010	0.010	0.012	0.012	0.012	0.012	0.014	0.014	
A	1406	0.000	0.000	0.007	0.010	0.012	0.017	0.019	0.026	0.029	0.032	0.032	0.035	0.035	
Baa	1283	0.000	0.000	0.006	0.016	0.016	0.016	0.022	0.024	0.024	0.027	0.028	0.028	0.030	
Ba	559	0.002	0.002	0.031	0.095	0.095	0.095	0.105	0.108	0.112	0.134	0.137	0.145	0.150	
B	1120	0.011	0.020	0.082	0.188	0.210	0.226	0.251	0.260	0.266	0.290	0.317	0.347	0.359	
Caa-C	385	0.058	0.098	0.195	0.384	0.438	0.502	0.511	0.531	0.543	0.556	0.602	0.602	0.602	
IG	3513	0.000	0.000	0.005	0.010	0.012	0.015	0.017	0.022	0.023	0.025	0.026	0.027	0.028	
SG	2064	0.017	0.029	0.086	0.192	0.212	0.228	0.245	0.254	0.259	0.281	0.299	0.315	0.323	
All	5577	0.006	0.010	0.031	0.068	0.076	0.082	0.089	0.094	0.096	0.103	0.108	0.113	0.115	
1/1/07															
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12		
Aaa	136	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
Aa	744	0.000	0.002	0.002	0.007	0.009	0.009	0.011	0.011	0.011	0.011	0.013	0.013		
A	1401	0.000	0.007	0.010	0.012	0.017	0.019	0.029	0.031	0.034	0.034	0.037	0.037		
Baa	1278	0.000	0.007	0.018	0.018	0.018	0.023	0.026	0.026	0.028	0.029	0.031	0.032		
Ba	618	0.000	0.018	0.077	0.084	0.084	0.097	0.105	0.108	0.130	0.143	0.150	0.157		
B	1147	0.000	0.065	0.179	0.208	0.228	0.256	0.269	0.279	0.307	0.334	0.355	0.366		
Caa-C	432	0.049	0.159	0.340	0.388	0.427	0.452	0.482	0.491	0.501	0.581	0.609	0.609		
IG	3559	0.000	0.006	0.011	0.013	0.015	0.018	0.023	0.023	0.026	0.026	0.028	0.029		
SG	2197	0.009	0.069	0.179	0.204	0.220	0.242	0.255	0.262	0.285	0.310	0.325	0.332		
All	5756	0.003	0.028	0.070	0.080	0.086	0.095	0.102	0.104	0.112	0.119	0.124	0.126		
1/1/08															
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11			
Aaa	170	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
Aa	828	0.005	0.005	0.009	0.014	0.014	0.017	0.019	0.023	0.023	0.027	0.027			
A	1320	0.004	0.009	0.011	0.014	0.018	0.028	0.029	0.031	0.031	0.032	0.032			
Baa	1246	0.010	0.018	0.018	0.018	0.022	0.023	0.023	0.023	0.025	0.026	0.029			
Ba	625	0.024	0.072	0.074	0.074	0.086	0.093	0.098	0.119	0.131	0.140	0.146			
B	1017	0.039	0.148	0.176	0.195	0.217	0.228	0.238	0.271	0.293	0.317	0.329			
Caa-C	665	0.107	0.285	0.342	0.375	0.408	0.437	0.463	0.485	0.548	0.562	0.570			
IG	3564	0.006	0.011	0.013	0.015	0.017	0.022	0.023	0.025	0.025	0.027	0.028			
SG	2307	0.054	0.166	0.195	0.211	0.232	0.246	0.257	0.282	0.306	0.321	0.329			
All	5871	0.025	0.071	0.083	0.090	0.099	0.106	0.110	0.118	0.126	0.131	0.134			
1/1/09															
Rating	n(0)	1	2	3	4	5	6	7	8	9	10				
Aaa	148	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000				
Aa	742	0.000	0.002	0.005	0.005	0.008	0.010	0.016	0.016	0.020	0.020				
A	1305	0.002	0.004	0.007	0.010	0.019	0.020	0.022	0.022	0.023	0.023				
Baa	1235	0.009	0.009	0.012	0.014	0.015	0.016	0.016	0.019	0.020	0.022				
Ba	599	0.018	0.022	0.022	0.035	0.042	0.050	0.066	0.075	0.084	0.094				
B	859	0.071	0.083	0.099	0.116	0.125	0.138	0.184	0.206	0.231	0.240				
Caa-C	765	0.260	0.333	0.365	0.406	0.434	0.458	0.475	0.534	0.549	0.556				
IG	3430	0.004	0.005	0.008	0.010	0.014	0.016	0.018	0.018	0.020	0.021				
SG	2223	0.121	0.151	0.167	0.190	0.203	0.217	0.243	0.267	0.283	0.291				
All	5653	0.050	0.062	0.069	0.078	0.085	0.090	0.099	0.107	0.112	0.115				

Data in percent

Source: Moody's Investors Service

Exhibit 61

Cumulative issuer-weighted default rates by annual cohort, 1970-2018 (continued)

1/1/10										
Rating	n(0)	1	2	3	4	5	6	7	8	9
Aaa	99	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	581	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002
A	1248	0.002	0.005	0.008	0.016	0.019	0.023	0.023	0.026	0.026
Baa	1342	0.001	0.003	0.005	0.008	0.009	0.010	0.013	0.015	0.019
Ba	593	0.000	0.000	0.006	0.015	0.020	0.037	0.045	0.054	0.060
B	824	0.004	0.018	0.038	0.046	0.067	0.112	0.135	0.156	0.163
Caa-C	731	0.085	0.129	0.187	0.229	0.261	0.288	0.346	0.371	0.386
IG	3270	0.001	0.003	0.005	0.009	0.011	0.013	0.014	0.016	0.018
SG	2148	0.030	0.050	0.077	0.096	0.114	0.143	0.170	0.186	0.195
All	5418	0.012	0.021	0.032	0.041	0.048	0.058	0.066	0.072	0.076
1/1/11										
Rating	n(0)	1	2	3	4	5	6	7	8	
Aaa	86	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Aa	548	0.002	0.002	0.002	0.002	0.002	0.002	0.004	0.004	
A	1238	0.000	0.001	0.007	0.008	0.010	0.010	0.012	0.012	
Baa	1436	0.004	0.004	0.008	0.011	0.012	0.015	0.016	0.020	
Ba	651	0.002	0.012	0.019	0.027	0.049	0.058	0.065	0.072	
B	954	0.003	0.018	0.031	0.052	0.097	0.134	0.153	0.162	
Caa-C	751	0.060	0.131	0.179	0.217	0.255	0.312	0.337	0.357	
IG	3308	0.002	0.003	0.007	0.008	0.009	0.011	0.012	0.014	
SG	2356	0.020	0.050	0.071	0.092	0.126	0.157	0.173	0.183	
All	5664	0.009	0.021	0.032	0.040	0.052	0.063	0.069	0.073	
1/1/12										
Rating	n(0)	1	2	3	4	5	6	7		
Aaa	84	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
Aa	440	0.000	0.000	0.002	0.002	0.002	0.002	0.002		
A	1207	0.000	0.001	0.001	0.001	0.001	0.002	0.002		
Baa	1471	0.001	0.004	0.005	0.005	0.008	0.009	0.013		
Ba	728	0.001	0.015	0.020	0.034	0.049	0.059	0.064		
B	996	0.005	0.017	0.038	0.079	0.113	0.140	0.146		
Caa-C	840	0.076	0.128	0.171	0.225	0.282	0.318	0.353		
IG	3202	0.000	0.002	0.003	0.003	0.004	0.005	0.007		
SG	2564	0.027	0.051	0.074	0.109	0.142	0.164	0.176		
All	5766	0.012	0.023	0.033	0.046	0.058	0.067	0.072		
1/1/13										
Rating	n(0)	1	2	3	4	5	6			
Aaa	60	0.000	0.000	0.000	0.000	0.000	0.000			
Aa	301	0.000	0.000	0.000	0.000	0.000	0.000			
A	1171	0.001	0.002	0.002	0.002	0.002	0.002			
Baa	1660	0.001	0.002	0.002	0.003	0.004	0.007			
Ba	708	0.006	0.011	0.020	0.033	0.049	0.051			
B	1055	0.009	0.024	0.068	0.108	0.128	0.137			
Caa-C	947	0.062	0.102	0.170	0.232	0.278	0.318			
IG	3192	0.001	0.002	0.002	0.002	0.003	0.004			
SG	2710	0.026	0.047	0.087	0.125	0.150	0.164			
All	5902	0.012	0.021	0.038	0.053	0.062	0.068			
1/1/14										
Rating	n(0)	1	2	3	4	5				
Aaa	55	0.000	0.000	0.000	0.000	0.000				
Aa	296	0.000	0.000	0.000	0.000	0.000				
A	1164	0.001	0.001	0.001	0.001	0.001				
Baa	1723	0.001	0.001	0.002	0.002	0.005				
Ba	737	0.001	0.006	0.016	0.027	0.029				
B	1104	0.005	0.036	0.073	0.100	0.114				
Caa-C	1147	0.047	0.118	0.185	0.245	0.288				
IG	3238	0.001	0.001	0.001	0.001	0.003				
SG	2988	0.020	0.058	0.098	0.131	0.150				
All	6226	0.010	0.027	0.044	0.057	0.065				

Data in percent

Source: Moody's Investors Service

Exhibit 62

Cumulative issuer-weighted default rates by annual cohort, 1970-2018 (continued)

1/1/15					
Rating	n(0)	1	2	3	4
Aaa	55	0.000	0.000	0.000	0.000
Aa	306	0.000	0.000	0.000	0.000
A	1233	0.000	0.000	0.000	0.000
Baa	1727	0.000	0.000	0.000	0.003
Ba	743	0.003	0.015	0.023	0.025
B	1088	0.024	0.058	0.076	0.095
Caa-C	1370	0.066	0.129	0.191	0.233
IG	3321	0.000	0.000	0.000	0.001
SG	3201	0.037	0.077	0.109	0.131
All	6522	0.017	0.036	0.050	0.060
1/1/16					
Rating	n(0)	1	2	3	
Aaa	51	0.000	0.000	0.000	
Aa	310	0.000	0.000	0.000	
A	1289	0.000	0.000	0.000	
Baa	1712	0.000	0.000	0.002	
Ba	757	0.001	0.004	0.006	
B	1027	0.016	0.029	0.044	
Caa-C	1439	0.089	0.157	0.198	
IG	3362	0.000	0.000	0.001	
SG	3223	0.045	0.078	0.100	
All	6585	0.022	0.036	0.046	
1/1/17					
Rating	n(0)	1	2		
Aaa	51	0.000	0.000		
Aa	303	0.000	0.000		
A	1256	0.000	0.000		
Baa	1699	0.000	0.000		
Ba	826	0.002	0.002		
B	994	0.004	0.011		
Caa-C	1450	0.074	0.128		
IG	3309	0.000	0.000		
SG	3270	0.034	0.059		
All	6579	0.016	0.028		
1/1/18					
Rating	n(0)	1			
Aaa	53	0.000			
Aa	258	0.000			
A	1287	0.000			
Baa	1747	0.000			
Ba	873	0.000			
B	987	0.006			
Caa-C	1439	0.050			
IG	3345	0.000			
SG	3299	0.023			
All	6644	0.011			

Data in percent

Source: Moody's Investors Service

Moody's related publications

- » [Cross-Sector: The performance of Moody's corporate debt ratings - 2018 Q4](#), January 28, 2019
- » [Cross-Sector: Investment-grade transition risk quarterly update - Fourth quarter 2018](#), January 25, 2019
- » [Nonfinancial Corporates - US: Credit strengths of Baa-rated companies mitigate risks of higher leverage](#), January 23, 2019
- » [Cross-Sector - Global: December 2018 Default Report](#), January 9, 2019
- » [Leveraged Finance Interest](#), January 2019
- » [Cross-Sector - Latin America: Latin American corporate default and recovery rates, 1990 to 2018](#), December 27, 2018
- » [Corporates: Industry credit risk: recent trends for global non-financial corporations, 2018](#), December 6, 2018
- » [Global growth to decelerate amid tightening global liquidity and elevated trade tensions](#), November 8, 2018
- » [Infrastructure & Project Finance: Infrastructure default and recovery rates, 1983-2017](#), September 27, 2018
- » [Glossary of Moody's Ratings Performance Metrics](#), July 2015
- » [Introducing Moody's Credit Transition Model](#), August 2007
- » [A Cyclical Model of Multiple-Horizon Credit Rating Transitions and Default](#), August 2007

To access any of these reports, click on the entry above. Note that these references are current as of the date of publication of this report and that more recent reports may be available. All research may not be available to all clients.

Endnotes

- 1 Only 71 were included in the January 1 cohort. See details in Exhibit 18.
- 2 The company was previously known as Clear Channel Communications, Inc.
- 3 2018 also recorded the default by the [Government of Barbados](#), which is outside the scope of this report.
- 4 The dollar-weighted bond default rates only include bonds issued by US and European issuers. Therefore, the dollar-weighted bond default rate in 2017 did not reflect the large volume of defaulted bonds from Petroleos de Venezuela, S.A. which was based in Venezuela.
- 5 For example, Petroleos de Venezuela, S.A. experienced a series of payment defaults, which began in 2017 and continued into 2018. Its defaulted debts are included in the years in which they defaulted.
- 6 This default rate speaks to the entire rated universe.
- 7 See [Leveraged Finance Interest](#), January 2019.
- 8 Average recovery rates of senior unsecured bonds and other debts can be based on different defaulters because some defaulters may have senior unsecured bonds and no other debts. See Exhibit 22 for more details.
- 9 Moody's research shows that initial distressed exchanges generally have higher recovery rates than non-distressed exchange defaults. However, distressed exchanges do not always sufficiently repair the capital structures of struggling companies and unsecured creditors suffered more in re-default scenarios. For details, see [A Closer Look at Distressed Exchanges](#), December 2017 and [The changing face of defaults – distressed exchanges and re-defaults](#), March 2018.
- 10 For distressed exchanges, we take trading prices at default. For other types of defaults, we take trading prices approximately one month after default.
- 11 For details, see [Lessons from a Trillion Dollars in Defaults](#), April 2017.
- 12 The analysis on ultimate recovery is provided by David Keisman and Julia Chursin. The data is from Moody's Ultimate Recovery Database, which includes robust detailed recovery information for more than 5,600 loans and bonds from more than 1,100 North American corporate defaulters since 1987.
- 13 For a given issuer, the firm-wide recovery rate is the weighted-average recovery rate across all of the issuer's debts where the weights are the size of the debt instruments.
- 14 Of the 10 companies that were resolved in 2018, three defaulted in 2017 while the rest took place in 2018.
- 15 Actual rates are from Bloomberg and the US Labor Department while forecasts are from Moody's Investors Service and Moody's Analytics.
- 16 For details, see [High corporate leverage signals future credit stress even as the default rate remains very low](#), May 2018.
- 17 Corporate family rating represent the creditworthiness of the entire corporate family. It can be rated the same or 1-2 notches higher than the corresponding senior unsecured rating.
- 18 See [The pace of monetary policy normalization will likely slow in 2019](#), January 2019.
- 19 See Moody's Special Comment: [Refunding Risk 2019-23: Spec-grade maturities again top \\$1 trillion amid weakening market conditions](#), January 2019.
- 20 The industry default rate forecasts include both investment-grade and speculative-grade issuers.
- 21 See [Media - US: 2019 outlook mixed as cable rides broadband growth, newspapers struggle](#), December 2018.
- 22 See [Retail, Apparel and Restaurants - US: 2019 Outlook](#), December 2018.
- 23 See [Oil and Gas - Global: 2019 outlooks mostly positive as firmer prices take hold](#), December 2018.
- 24 The EDF-implied default rate forecast includes rated and unrated issuers.
- 25 Expected Default Frequency metrics are forward-looking probabilities of default generated by Moody's EDF model, which belongs to a class of credit risk models referred to as structural models. Their basic assumption is that there is a causal, economically motivated reason why firms default. Default is highly likely to occur when the market value of a firm's assets is insufficient to cover its liabilities at some future date – in other words, when it is insolvent. For details, see Public Firm Expected [Default Frequency \(EDF\) Credit Measures Methodology, Performance, and Model Extensions](#), Moody's [Capital Markets Research](#), June, 2012.
- 26 See [Convergence of bonds and loans sets stage for worse recoveries in the next downturn](#), August 2018.
- 27 For a detailed discussion of average default position and the mathematical derivation of accuracy ratio from the average default position, see [Measuring Ratings Accuracy Using Average Default Position, February 2011](#).

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