

# MOODY'S

## INVESTORS SERVICE

### DATA REPORT

15 February 2018

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### Cross-Sector

## Annual Default Study: Corporate Default and Recovery Rates, 1920 - 2017

### Summary

We expect the default rate for our rated speculative-grade corporate issuers to decline to 1.7% in 2018 from 2.9% in 2017. Faster GDP growth in the G-20 countries, a sustained recovery in commodity prices, generally healthy corporate earnings and relatively low refunding risk will support credit conditions and keep defaults low. Our 2018 forecast is below the 1.9% rate at the end of 2014<sup>1</sup>, reflecting our view that the default cycle driven by low commodity prices has ended.

- » We expect the default rate for all of our rated corporate issuers to retreat to 0.8% in 2018 from 1.4% in 2017, implying about 53 defaults in 2018, which would be the fewest since 2011.
- » Defaults will decline in the commodity<sup>2</sup> and retail sectors, which had the most defaults in 2017. We expect the commodity sector default rate to fall to 1.8% in 2018 from 4.9% in 2017, and the retail sector default rate to decline to 3.9% from 7.0%.
- » Total defaults declined by more than one third to 91 in 2017 from the prior year's 143. The dollar volume of defaults was \$78 billion in 2017, down from \$136 billion a year earlier. The largest defaulter in 2017 was Petroleos de Venezuela, S.A., which missed payments on more than \$20 billion in debt.
- » By sector, 31% of the 2017 defaults were from commodity sectors (25 from Energy: Oil & Gas and three from Metals & Mining) and 14% (13) were from the retail sector; by region, defaults remained concentrated in North America (61), followed by Europe (21) and Asia-Pacific (6).
- » Corporate credit quality improved in 2017, with rating upgrades catching up with downgrades. Rating drift, which is calculated as the average upgraded notches per issuer minus the average downgraded notches per issuer, rose to zero in 2017 from -16% of a rating notch in 2016. Rating drift improved the most in Metals & Mining and weakened the most in Media: Diversified & Production.

THIS REPORT WAS REPUBLISHED ON 23 FEB 2018 WHEN WE CORRECTED DATA IN THE CHANGE OF PERCENT BY VOLUME IN EXHIBIT 3. IN ADDITION, WE ALSO REMOVED THE FOOTNOTE IN EXHIBIT 41.

- » Measured by post-default trading prices, the issuer-weighted average recovery rate for senior unsecured bonds was 53.9% in 2017, up sharply from 31.5% in 2016, reflecting higher recoveries in distressed exchanges and improved recoveries in commodity sectors.
- » 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 91.6%.

## Introduction

We saw strong fundamentals in 2017, with steady economic growth, strong debt issuance, improving corporate earnings and low defaults. Potentially transformational elections took place in several major developed countries, but none led to material changes in the credit markets. The year also marked a decisive reversal of accommodative monetary policy by the Federal Reserve. Other major central banks are expected to follow in the same direction over the next few years. Nonetheless, global central bank policy remained generally supportive to credit markets, with rate increases that were gradual and well communicated to the market.

Against this favorable credit backdrop, we update our annual default report, which examines corporate defaults among our rated long-term debt issuers and the performance of our ratings in 2017, as well as the historical period since 1920. The first section of this study reviews some of the major trends in defaults, recoveries and rating actions in 2017, 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.

Results presented in this study 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 corporate issuers that had long-term rated bonds, loans and/or deposits between 1920 and 2017.

## Defaults fall below 100 in 2017

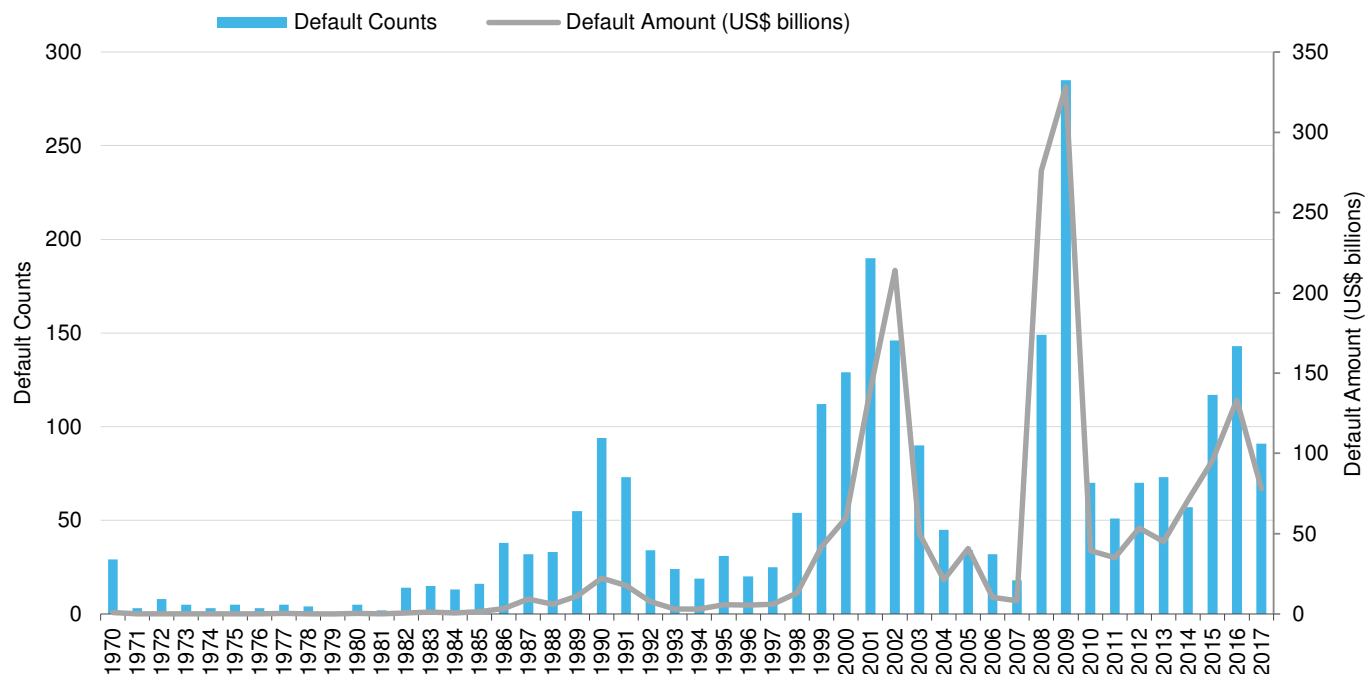
### The end of a two-year rise

The number of corporate defaults declined in 2017 after rising significantly during the prior two years as a result of stress in the commodity sector. Last year, 91 of our rated corporate issuers defaulted, the first year since 2014 that global defaults numbered fewer than 100, as the surge of defaults in the commodity sectors subsided.<sup>3</sup> Measured by volume, about \$78 billion of debt went into default in 2017, which was comprised of \$52 billion in bonds and \$26 billion in loans. In comparison, the default volume was \$136 billion in 2016, consisting of \$93 billion in bonds and \$43 billion in loans. The largest defaulter in 2017 was Petroleos de Venezuela, S.A., which missed payments on more than \$20 billion in debt.

Most of the corporate defaults occurred in North America, where the majority of our rated issuers are domiciled. Of the 91 defaults, 61, or two thirds, were in North America. Europe had 21 (23%) while the rest were in Asia-Pacific (6), Latin America (2) and the Middle East (1). In terms of dollar volume, \$39 billion, or half of defaulted debt, was from North America, followed by Latin America and Europe, which had defaulted debt of \$21 billion (27%) and \$16 billion (20%), respectively.<sup>4</sup>

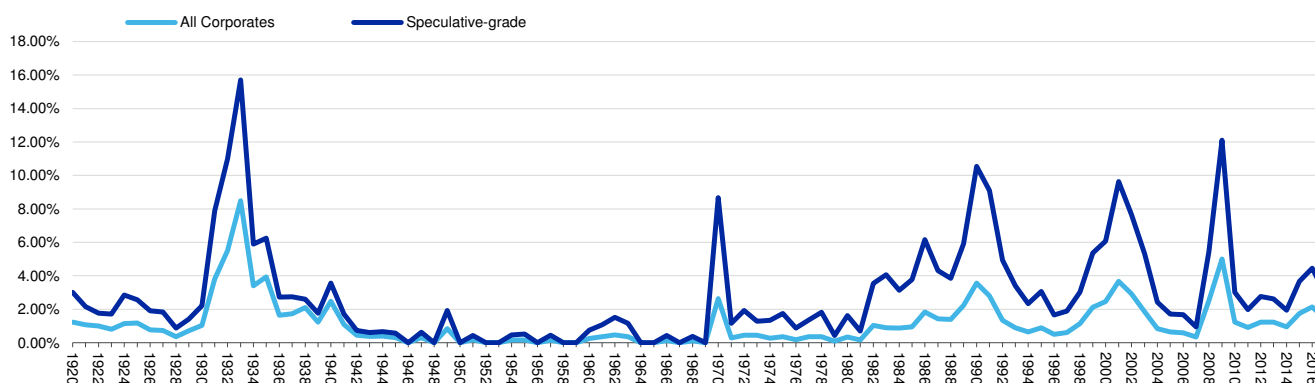
Last year's defaults were mainly due to distressed exchanges and bankruptcies, each accounting for 40% of the defaults. The rest were payment defaults. Exhibit 1 presents the annual default counts and defaulted debt volumes for the period 1970-2017.

Exhibit 1

**Defaults fell in 2017****Default rate fell below historical average**

The issuer-weighted annual default rate finished at 1.4% in 2017, down from 2.1% in 2016 (see Exhibit 2). The decline came as financial distress in commodity sectors receded rapidly. Among speculative-grade issuers, the default rate showed a similar trend, declining to 2.9% from 4.5%. The latest figures are below the average one-year default rate since 1983 of 1.6% for all rated issuers and 4.2% for speculative-grade issuers. Measured on a dollar volume basis, our speculative-grade corporate bond default rates dropped to 1.5% in 2017 from 3.5% in 2016 and the rate for all of our rated issuers finished 2017 at 0.3%, down from 0.7% in 2016.<sup>5</sup>

Exhibit 2

**Default rate fell below historical average****Oil & Gas had the most defaulters but risk shifted to the Retail sector**

Amid a growing economy, defaults are usually driven by sector-specific issues. Last year, commodity sectors, especially the Oil & Gas industry, still had the most defaulters as they struggled with the lingering credit effects of the 2015-2016 commodities downturn. Oil &

Gas recorded 25 defaults, or 27% of the total count. Retail had the second most defaults at 13, or 14% of the total, as it suffered from structural shifts in consumer buying behavior and rising e-commerce penetration.

Although Oil & Gas had the most defaults in 2017, its contribution to the total default count fell significantly from 46% in 2016 to 27% in 2017. In contrast, Retail's contribution increased noticeably from 6% to 14%. When measured by dollar volume, Oil & Gas topped the list again by accounting for 49% of the total, with the next highest share coming from Retail (12%). Besides Petroleos de Venezuela, S.A., there were other sizeable defaults in 2017 including Avaya, Inc. (\$6 billion) and Toys 'R' Us-Delaware, Inc. (\$2.5 billion).<sup>6</sup> Exhibit 3 shows the distribution of defaults by specific industries in 2016 and 2017 as well as the changes between those two years.

Exhibit 3

**Oil & Gas still had the most defaults but risk shifted to Retail**

Industry Group	Percent by count			Percent by volume		
	2017	2016	Change	2017	2016	Change
Aerospace & Defense	2%	1%	1%	0%	0%	0%
Automotive	0%	1%	-1%	0%	0%	0%
Banking	5%	1%	4%	3%	0%	3%
Beverage, Food, & Tobacco	0%	1%	-1%	0%	0%	0%
Capital Equipment	1%	1%	0%	1%	0%	0%
Chemicals, Plastics, & Rubber	2%	2%	0%	0%	1%	0%
Construction & Building	1%	2%	-1%	1%	8%	-7%
Consumer goods: Durable	0%	1%	-1%	0%	0%	0%
Consumer goods: Non-durable	0%	1%	-1%	0%	0%	0%
Energy: Electricity	3%	1%	3%	3%	1%	3%
Energy: Oil & Gas	27%	46%	-19%	49%	51%	-1%
Environmental Industries	2%	1%	1%	1%	0%	0%
FIRE: Finance	2%	3%	-1%	1%	1%	-1%
FIRE: Real Estate	1%	1%	0%	3%	0%	3%
Forest Products & Paper	4%	1%	3%	2%	2%	0%
Healthcare & Pharmaceuticals	1%	1%	0%	1%	0%	1%
High Tech Industries	3%	1%	2%	2%	1%	1%
Hotel, Gaming, & Leisure	0%	1%	-1%	0%	0%	0%
Media: Advertising, Printing & Publishing	0%	6%	-6%	0%	2%	-2%
Media: Broadcasting & Subscription	4%	0%	4%	4%	0%	4%
Media: Diversified & Production	1%	0%	1%	1%	0%	1%
Metals & Mining	3%	11%	-8%	1%	14%	-13%
Retail	14%	6%	9%	12%	2%	10%
Services: Business	10%	2%	8%	3%	1%	2%
Services: Consumer	1%	0%	1%	0%	0%	0%
Sovereign & Public Finance	0%	0%	0%	0%	0%	0%
Telecommunications	3%	3%	1%	10%	12%	-2%
Transportation: Cargo	3%	1%	2%	1%	0%	1%
Transportation: Consumer	0%	1%	-1%	0%	0%	0%
Utilities: Electric	0%	1%	-1%	0%	1%	-1%
Wholesale	2%	3%	-1%	0%	1%	0%

\*We omitted those industries which had no defaults in 2016 and 2017

Although the Oil & Gas sector accounted for more than a quarter of the defaults last year, it was not the sector with the highest rate of default: that distinction belongs to Forest Products & Paper, which had a 9.0% default rate in 2017.<sup>7</sup> Retail followed right behind with a rate of 7.0% (see Exhibit 4).

Exhibit 4

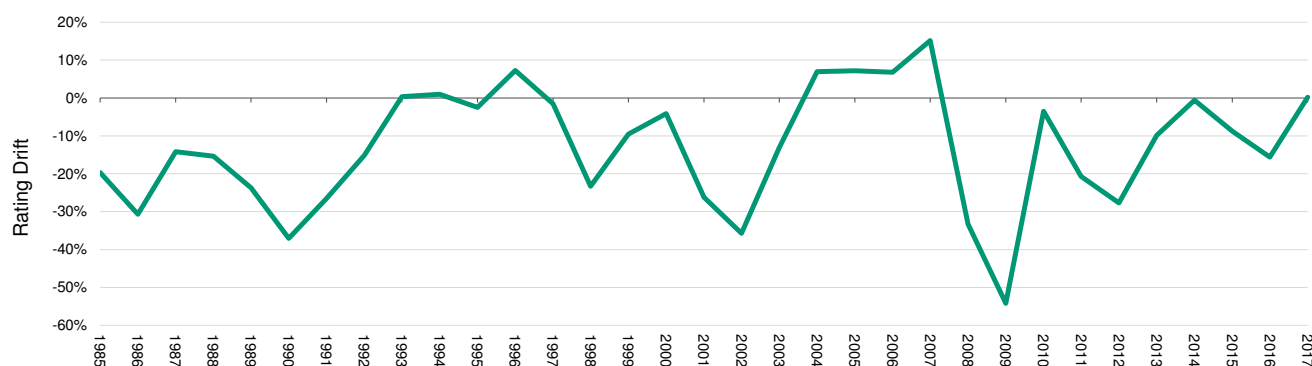
**One year default rate led by Forest Products and Paper, followed by Retail**

Industry Group	Default Rate*	Industry Group	Default Rate*
Forest Products & Paper	8.99%	FIRE: Real Estate	0.49%
Retail	7.01%	Construction & Building	0.44%
Energy: Oil & Gas	6.09%	Capital Equipment	0.43%
Environmental Industries	5.56%	Banking	0.38%
Energy: Electricity	5.36%	Automotive	0.00%
Media: Broadcasting & Subscription	3.74%	Beverage, Food, & Tobacco	0.00%
Media: Diversified & Production	3.57%	Consumer goods: Durable	0.00%
Services: Business	3.09%	Consumer goods: Non-durable	0.00%
Wholesale	3.01%	Containers, Packaging, & Glass	0.00%
Transportation: Cargo	2.93%	FIRE: Insurance	0.00%
Aerospace & Defense	2.63%	Hotel, Gaming, & Leisure	0.00%
Metals & Mining	1.91%	Media: Advertising, Printing & Publishing	0.00%
Telecommunications	1.61%	Sovereign & Public Finance	0.00%
High Tech Industries	1.28%	Transportation: Consumer	0.00%
Services: Consumer	1.18%	Utilities: Electric	0.00%
Chemicals, Plastics, & Rubber	1.02%	Utilities: Oil & Gas	0.00%
Healthcare & Pharmaceuticals	0.62%	Utilities: Water	0.00%
FIRE: Finance	0.50%		

\*Issuer-weighted.<sup>8</sup>**Credit quality improved, especially in Metals & Mining and Oil & Gas**

Credit quality among our rated issuers improved in 2017, with rating upgrades catching up and breaking even with downgrades. Rating drift, which is calculated as the average upgraded notches per issuer minus the average downgraded notches per issuer, rose to zero in 2017 from -16% of a rating notch in 2016 (see Exhibit 5). Of our 35 industry groups, 24 had better rating drifts in 2017 than in 2016, while 31 recorded higher drifts relative to their historical averages.

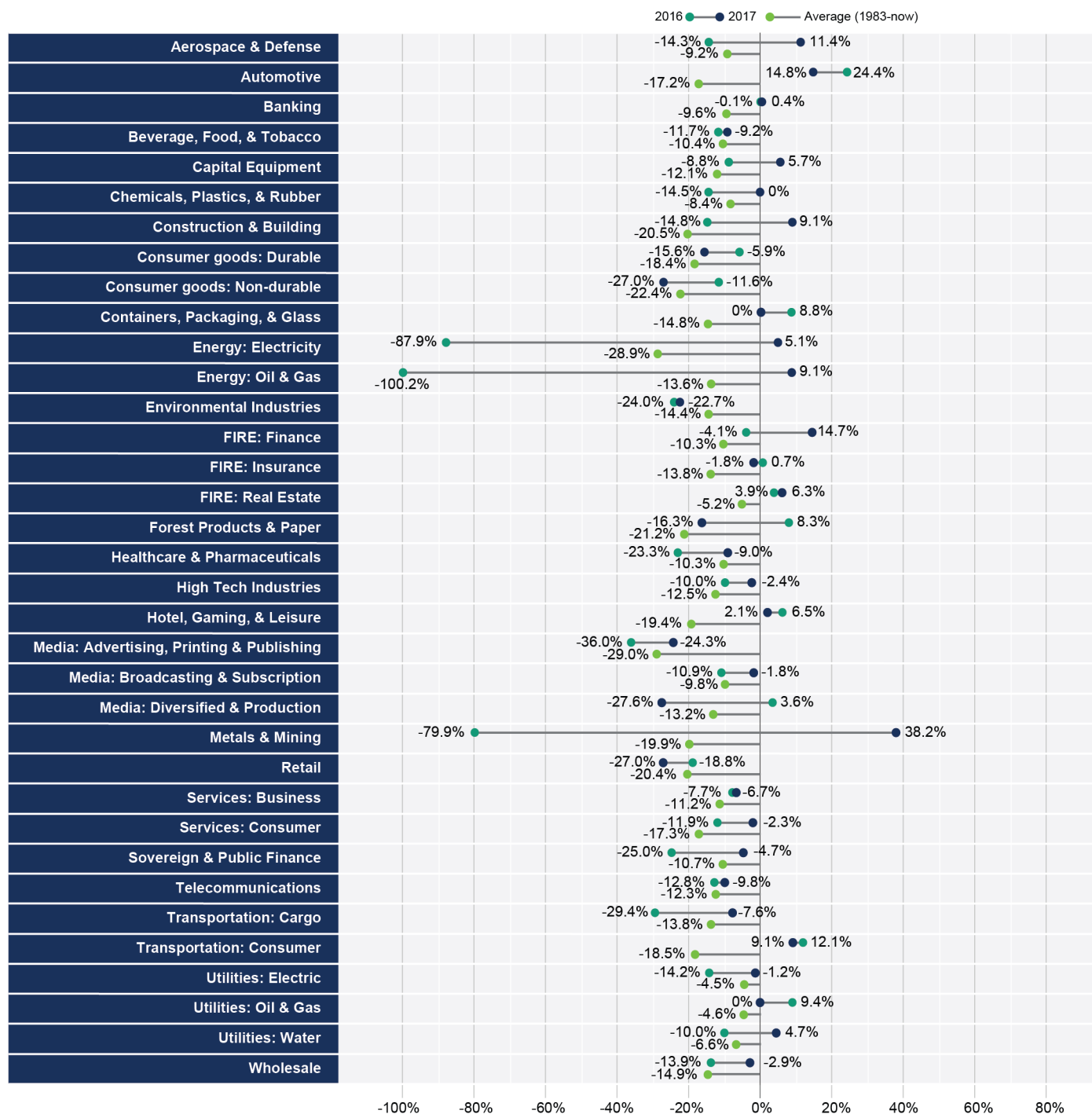
Exhibit 5

**Upgrades broke even with downgrades**

Across sectors, the most notable credit improvement was found in Metals & Mining, which had a one-year rating drift of 38% of a rating notch in 2017, compared with -80% a year earlier (see Exhibit 6). Similarly, Oil & Gas saw its comparable metrics increase to 9% from -100%. On the other hand, Media: Diversified & Production had the largest deterioration in rating drift, closing at -28% in 2017, down from 4% in 2016. Forest Products & Paper followed (-16% down from 8%). Ranked by the 2017 rating drift alone, Metals & Mining had the highest drift while Media: Diversified & Production had the lowest. Retail, and Non-durable Consumer goods were close to the bottom, both had drifts of -27%.

Exhibit 6

## Credit quality improved significantly in commodity sectors\*



\*Rating drift, which is shown above, is the average upgraded notches per issuer minus the average downgrade notches per issuer.

## Distressed exchanges push senior unsecured bond recovery rates higher

In Exhibit 7, we present the average recovery rates for debt that defaulted in the past two years and compare them with historical averages.<sup>9</sup> The table shows that over the past three decades, recovery rates have been generally correlated with the priority of claim in the capital structure, with a higher priority of claim enjoying a higher average rate of recovery.<sup>10</sup> 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 shows that the average senior unsecured bond recovery rate increased to 54% in 2017 from 31% in 2016 and above its long-term average of 38%. The relatively high recovery rate in 2017 primarily stemmed from distressed exchanges, which experienced an average recovery rate of 69% in 2017 versus 41% for other types of defaults.<sup>11</sup> In addition, recovery rates in the Oil & Gas sector, the main default driver in the past three years, were higher last year (57% in 2017 versus 23% in 2016). Measured by dollar volume, the senior unsecured bond recovery rate averaged 40% in 2017, also substantially higher than the 27% rate in 2016. For first lien bank loans, the volume-weighted average recovery rate was 75% in 2017, down from 78% in 2016.

Exhibit 7

**Average corporate debt recovery rates measured by trading prices**

Average corporate debt recovery rates measured by trading prices						
Panel A - Recoveries		Issuer-weighted recoveries			Volume-weighted recoveries	
Priority Position	2017	2016	1983-2017	2017	2016	1983-2017
1st Lien Bank Loan	69.04%	75.05%	67.07%	74.73%	77.95%	63.74%
2nd Lien Bank Loan	17.87%	22.50%	30.38%	30.29%	22.50%	27.73%
Sr. Unsecured Bank Loan	9.00%	n.a.	45.87%	9.00%	n.a.	40.21%
1st Lien Bond	62.43%	48.72%	53.62%	66.21%	40.89%	53.80%
2nd Lien Bond	52.75%	34.07%	45.18%	36.61%	35.82%	43.63%
Sr. Unsecured Bond	53.85%	31.45%	37.74%	39.79%	27.10%	33.48%
Sr. Subordinated Bond	38.00%	36.72%	31.10%	50.62%	56.10%	26.34%
Subordinated Bond	74.38%	24.50%	32.05%	76.37%	24.50%	27.55%
Jr. Subordinated Bond	17.50%	0.63%	22.79%	4.84%	0.63%	13.97%
Panel B - Observation count	Issuer count			Dollar volume (in billions of USD)		
Priority Position	2017	2016	1983-2017	2017	2016	1983-2017
1st Lien Bank Loan	25	17	487	20.3	10.7	291.9
2nd Lien Bank Loan	5	1	72	1.2	0.2	12.9
Sr. Unsecured Bank Loan	1	0	67	0.0	0.0	33.8
1st Lien Bond	20	14	326	10.4	4.5	136.2
2nd Lien Bond	5	19	69	2.5	9.1	36.7
Sr. Unsecured Bond	39	64	1028	34.1	53.1	715.7
Sr. Subordinated Bond	2	3	511	0.9	1.3	114.5
Subordinated Bond	2	1	413	0.8	0.0	81.2
Jr. Subordinated Bond	2	1	26	0.1	0.7	3.9

The recovery data above are based on trading prices at or post default.<sup>12</sup> 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.

In Exhibit 8, we present data on ultimate recovery rates for North American companies included in Moody's Ultimate Recovery Database.<sup>13</sup> In 2017, the average "firm-wide" recovery rate<sup>14,15</sup> for the 17 default resolutions was 64%, compared with 39% for the 30 companies that emerged from default in 2016. Unlike the preceding year, in 2017 the overall firm-wide average recovery was above the historical average (55%), buoyed by a significant improvement in recoveries of bankrupt oil & gas companies. The sector represented more than half of the 2017 default resolutions that we studied. Out of nine bankruptcy resolutions in the oil and gas sector, six experienced high family recoveries averaging 83%. This turnaround in recovery rates of oil and gas companies may be attributable to improved investor sentiment. As the market became more optimistic and commodity prices rebounded, investors started bidding up asset prices, leading to higher valuations for defaulted securities and for assets of companies in bankruptcy. Other than bankruptcy



resolutions, three distressed exchanges that we recorded in 2017 also helped to lift the overall firm-wide recovery rate by returning 85 cents on the dollar at the firm-wide level.

Improved family-level recoveries of defaulters emerging in 2017 mainly stemmed from a sharp rise in recoveries from companies in the energy sector and benefitted all creditor classes. As shown in Exhibit 8, in 2017 every debt instrument type realized on average a higher recovery rate than in 2016.

Exhibit 8

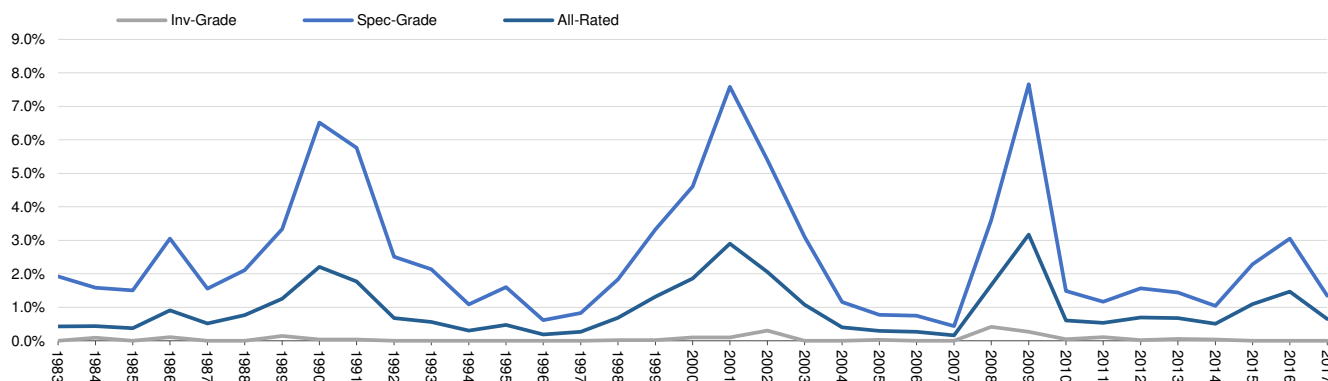
#### Average Corporate Debt Recovery Rates Measured by Ultimate Recoveries, 1987-2017

Priority Position	Emergence Year			Default Year		
	2017	2016	1987-2017	2017	2016	1987-2017
Loans	81.3%	72.6%	80.4%	80.2%	78.3%	80.4%
Senior Secured Bonds	52.3%	35.9%	62.3%	57.5%	46.9%	62.3%
Senior Unsecured Bonds	54.1%	11.7%	47.9%	47.4%	29.2%	47.9%
Subordinated Bonds	4.5%	6.6%	28.0%	n.a.	8.0%	28.0%

Our credit ratings are opinions of relative expected credit losses, which are a function of both the probability of default and loss given default (LGD). Exhibit 9 shows annual average credit loss rates from 1983 through 2017 for our rated corporate issuers. The chart indicates that the average credit loss rate among all of our rated issuers fell to 0.7% in 2017 from 1.5% in 2016. Historically, the average annual credit loss rate for our rated issuers has been 0.9% since 1983.

Exhibit 9

#### Annual credit loss rates down in 2017



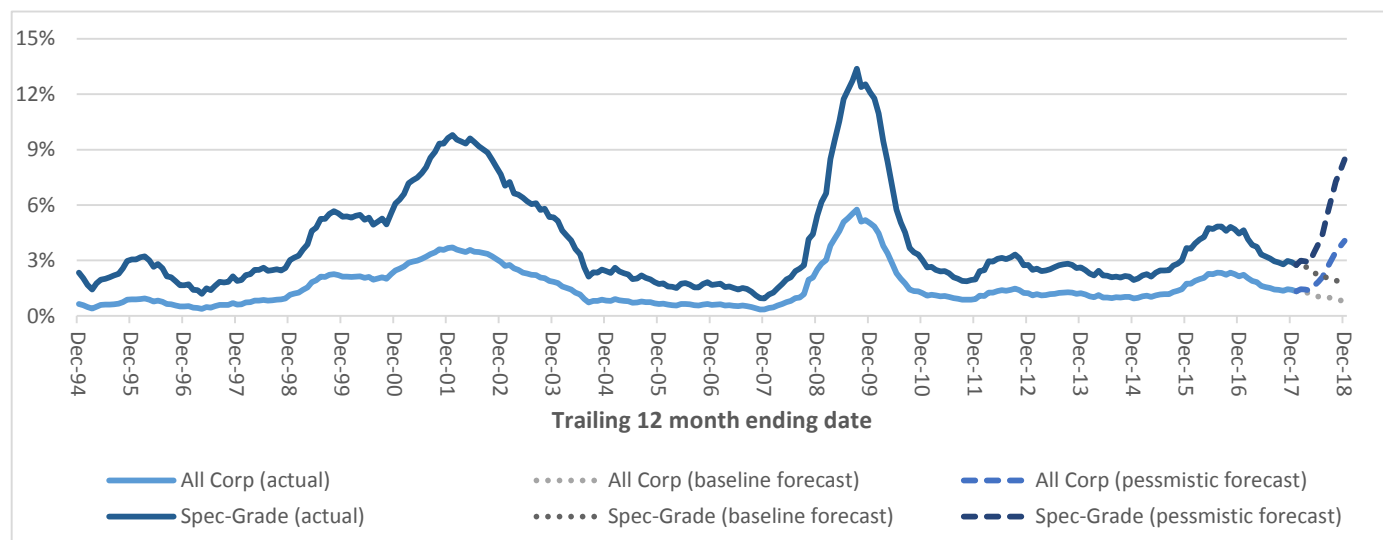
## Default rates to slide further in 2018

### Default rate to fall below 2% this year

In the past three years, the global default rate has moved with the rise and fall of defaults from the commodity sectors. For 2018, we expect the default outlook to remain benign for global corporate issuers. Underpinning this forecast is a strong fundamental credit environment. The anticipation of faster GDP growth in the G-20 countries, a sustained recovery in commodity prices, generally healthy corporate earnings and relatively low refunding risk after a wave of refinancing all support a low default rate forecast. Although many central banks have begun to reduce stimulus, monetary policies are still accommodative and provide sufficient liquidity to the credit market.

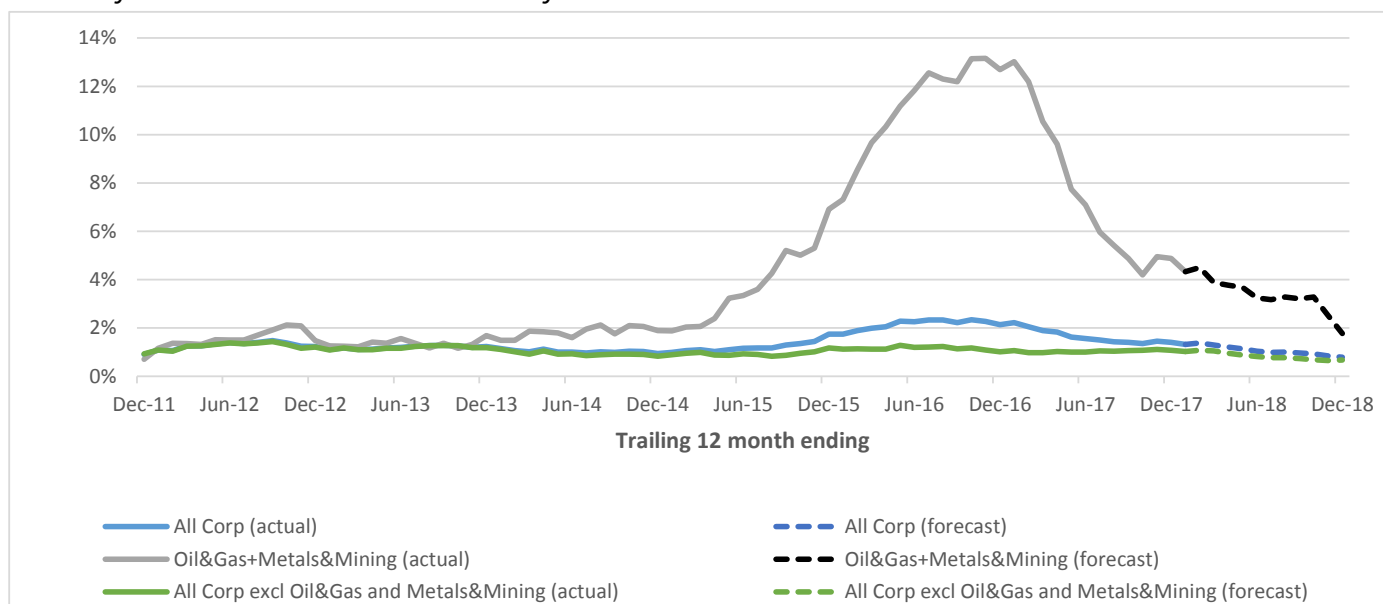
Based on Moody's Credit Transition Model, the default rate for all of our rated issuers is expected to fall to 0.8% by the end of 2018, which - if realized - will be lower than the average of 1.6% since 1983. Among speculative-grade issuers, the default rate is predicted to decline to 1.7%, also below the historical average of 4.2% (see dotted lines in Exhibit 10). These forecasts are made under our baseline scenario, which assumes the US high-yield spread will remain thin from the latest quarter's average of 335 basis points (bps) to 373 bps in the fourth quarter of 2018, whereas the US unemployment rate will ease to 3.5% from 4.1%.<sup>16</sup>

Exhibit 10

**Default rates to trend down in 2018****Commodity stress to recede**

Commodity sectors have been the major driving force of defaults in the past three years, but we expect defaults in these sectors to be relatively muted in 2018, with the default rate for the combined portfolio of Oil & Gas and Metals & Mining issuers falling to 1.8% in 2018 from 4.9% in 2017. This forecast reflects the sectors' stabilizing fundamentals following the rise in commodity prices. In addition, most of the weakest companies have already restructured or defaulted. Our industry outlooks for commodities anticipate stable credit conditions.<sup>17</sup> In Oil & Gas, three out of the five subsectors—exploration & production, oilfield services & drilling, and midstream—have positive outlooks, while the other two—integrated oil and refining & marketing—are stable. Moreover, commodity companies have taken advantage of market access in recent years to refinance their debt and push out near-term maturities (see Exhibit 11).

Exhibit 11

**Commodity sectors' default rates to slide further this year**

In Exhibit 11, we also plot the default rate for all sectors, both with and without the combined Oil & Gas and Metals & Mining sector. As shown in the chart, while the default rate for our rated universe fell to 1.4% in 2017 from 2.1% in 2016, the comparable rate actually

edged higher to 1.1% from 1.0% when we exclude issuers in the Oil & Gas and Metals & Mining sectors. Looking into 2018, we expect default risk to decline outside of the commodity sectors, finishing at 0.7% in December.

In order to take a closer look at industry-specific default risk, we provide the one-year baseline global default forecasts by industry in Exhibit 12.<sup>18</sup> In this chart, we apply the same economic assumption to all industries, so the only factor driving the different forecasted default rates is the rating histories and current ratings of the companies in those industries. Measured by default rate, the most troubled sector is Durable Consumer Goods (4.1%). The next highest forecast belongs to Retail (3.9%). These forecasts, if realized, will be higher than their historical averages of 2.7% and 3.1%, respectively. While our Credit Transition Model predicts that Retail will have the second-highest default risk in 2018, the risk is concentrated in only some pockets of the sector. Take US retailers as an example, out of the 14 retail sub-sectors, five are forecast to have operating income growth above 5% this year—led by online retailers, dollar stores and home improvement.<sup>19</sup> On the other hand, department stores, office supply, discounters/warehouses, drug stores and apparel & footwear are sectors that will be a drag on broader industry performance in 2018.

Exhibit 12

## One-year corporate default rate forecasts by industry

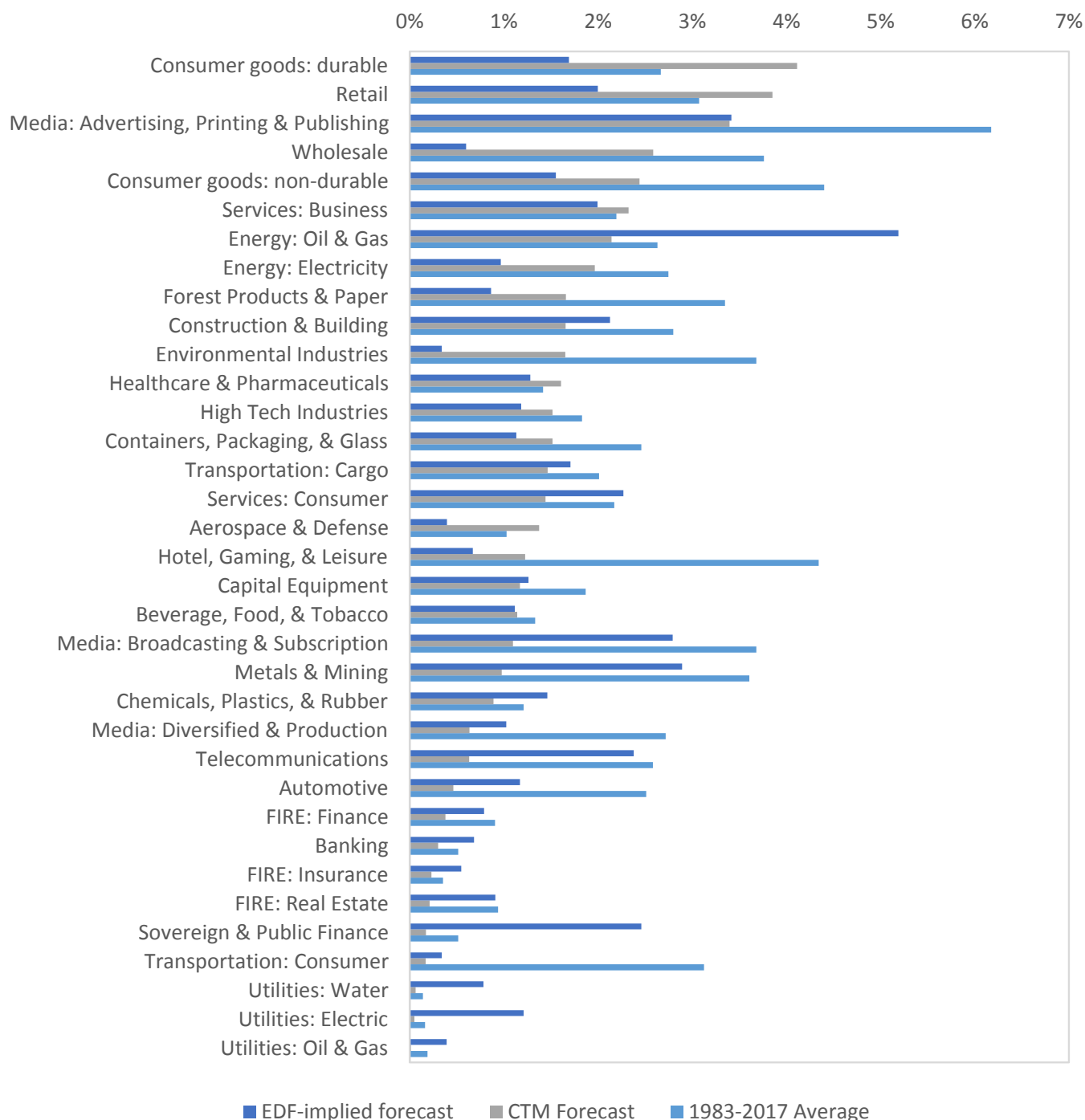


Exhibit 12 also shows the default rate forecast implied by Expected Default Frequency (EDF).<sup>20,21</sup> As shown in the chart, EDF-implied ratings indicate a worse default rate outlook for commodity sectors than those suggested by the Credit Transition Model. This certainly reflects the volatility in the equity market, which may not be fully captured in the high-yield spread or rating actions. In addition, the EDF-implied default rate may also be higher as 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 predictions reinforce the message that

default rates are expected to drift noticeably lower in 2018 relative to 2017 for both Oil & Gas (5.2% vs. 6.5%) and Metals & Mining (2.9% vs. 3.9%).

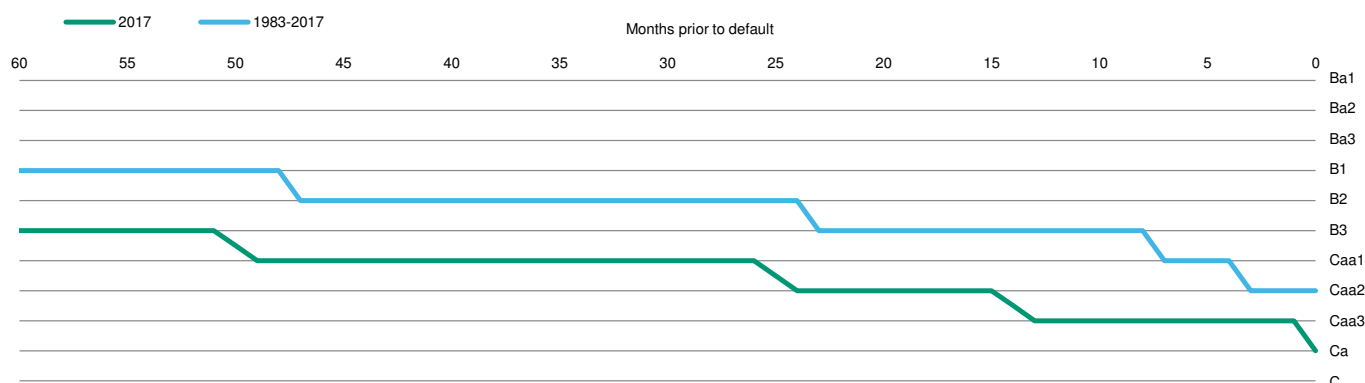
While our baseline forecast represents our central view, we acknowledge that global economic conditions can pose significant risks in 2018. Potential disruptions to the benign outlook include the possibility of the US Federal Reserve and European Central Bank tapering their quantitative easing policies faster than expected. In addition, a number of lingering political risks, such as the Italian general elections, Brexit negotiations and US mid-term elections will remain a challenge for global credit in 2018 and beyond. Furthermore, risk associated with loosening credit terms and increased issuance of lower-quality debt may also add upward pressure once the cycle turns and credit conditions tighten. In our pessimistic scenario,<sup>22</sup> which has a 4% chance probability of materializing, the worldwide economy could fall back into a deep recession with the US unemployment rate rising to 8.2% and the US high-yield bond spread widening to 1,063 bps. In that case, the global default rate is expected to rise to 4.1% for all rated issuers and 8.5% for speculative-grade issuers (see dashed lines in Exhibit 10).

## Rating Accuracy Metrics

Our ratings have historically proven to be effective predictors of default. This can be seen in Exhibit 13, which plots the median ratings of more than 2,000 corporate issuers that defaulted from 1983 to 2017. The chart demonstrates that, historically, our rated issuers have been downgraded to the B1 level as early as five years prior to default. The comparable rating was lower at B3 among issuers that defaulted in 2017. The median rating one year prior to default was Caa3 among last year's defaulters, three notches below the rating measured over the entire period 1983-2017.

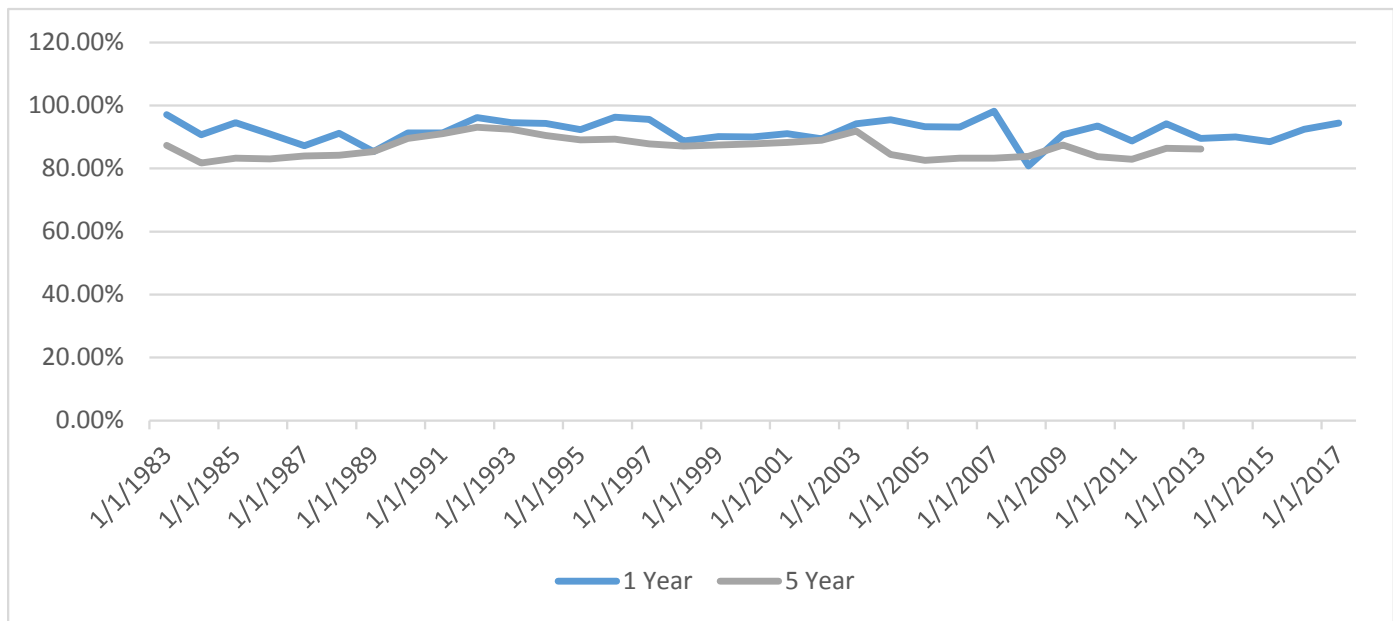
Exhibit 13

### Median Ratings Prior to Default, 2017 vs. Long-Term Average



The evolution of median ratings presented in Exhibit 13 above 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 14).<sup>23</sup> 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 as there are more issuers rated higher than the defaulters, or equivalently that defaulters are generally found in lower rating categories. Exhibit 14 reveals that between 1983 and 2017, the AP of defaults has been consistently high during the entire period, with an average of 91.6% for the one-year horizon and 86.6% for the five-year horizon. This indicates that our ratings have been effective in predicting defaults over both the short- and long-term periods.

Exhibit 14

**One- and Five-Year Average Default Position by Cohort Year, 1983-2017**

## 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 2017. As of January 1, 2017, 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 1982-2017 period, the dataset includes post-default prices for approximately 5,000 defaulted instruments issued by over 1,700 defaulting corporations. Moody's makes the 1970-2017 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 13 was derived by mapping Moody's ratings to a linear scale, then taking the median values of the numerically mapped ratings. Exhibit 21 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 21 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 22.

Exhibits 32 through 37 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 21.4% average rate between 1983 and 2017 (see Exhibit 34). 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 40 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 41 shows the cumulative issuer-weighted historical default rates of cohorts formed between the years 1970 and 2017 (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 15

### Moody's-Rated 2017 Corporate Bond And Loan Defaults\*

Company	Country	Default Month	Broad Default Type	Bond (US \$ mil)	Loans (US \$ mil)	In Jan 2017 cohort?
99 Cents Only Stores LLC	United States	2017-11	Distressed exchange	242	590	1
Agrokor D.D.	Croatia	2017-5	Payment default	337		1
Ameriforge Group, Inc.	United States	2017-4	Bankruptcy		690	1
Approach Resources Inc.	United States	2017-1	Distressed exchange	131		1
Appvion, Inc.	United States	2017-10	Bankruptcy	250	211	1
Armstrong Energy, Inc.	United States	2017-7	Payment default	200		1
Artel, LLC	United States	2017-4	Distressed exchange	15		1
Ascent Resources - Marcellus LLC	United States	2017-6	Payment default		750	1
Aurora Diagnostics Holdings, LLC	United States	2017-5	Distressed exchange	198		1
Avaya, Inc.	United States	2017-1	Bankruptcy	2683	3309	1
Banco Popular Espanol, S.A.	Spain	2017-6	Distressed exchange	770		1
Bibby Offshore Holdings Ltd	United Kingdom	2017-12	Bankruptcy	0	20	1
Bibby Offshore Services Plc	United Kingdom	2017-12	Bankruptcy	234		1
Boart Longyear Management Pty Limited	United States	2017-9	Distressed exchange	396		1
Bonanza Creek Energy, Inc.	United States	2017-1	Bankruptcy	800	192	1
Brunswick Rail Limited	Russia	2017-10	Distressed exchange	600		1
Carboclor S.A.	Argentina	2017-1	Bankruptcy		2	1
CGG Holding (U.S.) Inc	United States	2017-6	Bankruptcy	0	0	1
CGG SA	France	2017-6	Bankruptcy	1921	325	1
CHARMING CHARLIE LLC	United States	2017-12	Bankruptcy		132	1
Chinos Intermediate Holdings A, Inc.	United States	2017-7	Distressed exchange	566		1
Concordia International Corp.	Canada	2017-10	Payment default		33	1
Cumulus Media Holdings Inc.	United States	2017-11	Bankruptcy	610	1729	1
Denbury Resources Inc.	United States	2017-12	Distressed exchange	610		1
Drill Rigs Holdings Inc.	Cyprus	2017-3	Bankruptcy	460		1
Drillships Financing Holding Inc.	Cyprus	2017-3	Bankruptcy		1834	1
Drillships Ocean Ventures Inc.	Cyprus	2017-3	Bankruptcy		1268	1
Eastcomtrans LLP	Kazakhstan	2017-4	Distressed exchange	79		1
Emeco Holdings Limited	Australia	2017-3	Distressed exchange	0		1
Emeco Pty Limited	Australia	2017-3	Distressed exchange	283		1
EP Energy LLC	United States	2017-12	Distressed exchange	1147		1
EXCO Resources, Inc.	United States	2017-12	Payment default		709	1
Expro Holdings UK 3 Limited	United Kingdom	2017-12	Bankruptcy		1420	0
Fieldwood Energy LLC	United States	2017-9	Distressed exchange		781	1
Floworks International LLC	United States	2017-9	Distressed exchange	221		1
GenOn Americas Generation, LLC	United States	2017-6	Bankruptcy	694		1
GenOn Energy, Inc.	United States	2017-6	Bankruptcy	1827		1
GenOn Mid-Atlantic, LLC	United States	2017-7	Payment default	106		1
Global A&T Electronics Ltd.	Singapore	2017-8	Payment default	1127		1
Goodman Networks, Inc.	United States	2017-1	Bankruptcy	325	8	1
GulfMark Offshore, Inc.	United States	2017-4	Payment default	430		1
Gymboree Corporation (The)	United States	2017-6	Bankruptcy	171	809	1
HBC Holdings LLC	United States	2017-3	Distressed exchange		55	1
iHeartCommunications, Inc.	United States	2017-1	Payment default	795		1
Imperial Metals Corporation	Canada	2017-11	Distressed exchange		191	1
Intelsat S.A.	Luxembourg	2017-1	Distressed exchange	1027		1
International Bank of Azerbaijan	Azerbaijan	2017-5	Payment default	500	100	1
iPayment Inc.	United States	2017-4	Distressed exchange	280		1
Jack Cooper Enterprises, Inc.	United States	2017-6	Distressed exchange	429		1
Jack Cooper Holdings Corp.	United States	2017-6	Distressed exchange	374		1
LBI Media, Inc.	United States	2017-4	Distressed exchange	23		1
Millar Western Forest Products Ltd.	Canada	2017-5	Distressed exchange	210		1
Mood Media Corporation	Canada	2017-5	Bankruptcy	350	236	1
Neovia Logistics Intermediate Holdings, LP	United States	2017-3	Distressed exchange	46		1
Norske Skogindustrier ASA	Norway	2017-7	Payment default	461		1

Novo Banco, S.A.	Portugal	2017-10	Distressed exchange	785		1
Nuverra Environmental Solutions, Inc.	United States	2017-5	Bankruptcy	397	61	0
Ocean Rig UDW Inc.	Cyprus	2017-3	Bankruptcy	131	0	1
Onsite Rental Group Pty Ltd	Australia	2017-10	Distressed exchange		0	1
Opal Acquisition, Inc.	United States	2017-7	Distressed exchange	604		1
Orchard Acquisition Company, LLC	United States	2017-12	Bankruptcy		450	1
Pacific Drilling S.A.	Luxembourg	2017-11	Bankruptcy	750	1193	1
Pacific Drilling V Ltd.	Luxembourg	2017-11	Bankruptcy	439		1
Payless Inc.	United States	2017-4	Bankruptcy		665	1
Perpetual Energy Inc.	Canada	2017-1	Distressed exchange	13		1
Petroleos de Venezuela, S.A.	Venezuela	2017-11	Payment default	20420		1
Pinnacle Holdco S.A.R.L.	United States	2017-9	Payment default		345	1
Pinnacle Operating Corporation	United States	2017-3	Distressed exchange	300		1
Production Resource Group, Inc.	United States	2017-5	Distressed exchange	210		1
Quintis Limited	Australia	2017-8	Payment default	250		1
Real Alloy Holding, Inc.	United States	2017-11	Bankruptcy	305	100	1
Reliance Communications Limited	India	2017-11	Payment default	300		1
Rosenergobank	Russia	2017-4	Bankruptcy			1
rue21, inc.	United States	2017-5	Bankruptcy	239	593	1
Sable Permian Resources, LLC	United States	2017-5	Distressed exchange	327		1
Sequa Corporation	United States	2017-1	Payment default	350		1
Shelf Drilling Midco, Ltd.	United Arab Emirates	2017-1	Distressed exchange	475	78	1
Sierra Hamilton LLC	United States	2017-1	Payment default	110		1
Spanish Broadcasting System, Inc.	United States	2017-4	Payment default	275		1
Sprint Industrial Holdings, LLC	United States	2017-4	Distressed exchange		83	1
Stafford Logistics, Inc.	United States	2017-10	Distressed exchange		166	1
Tatfondbank	Russia	2017-1	Payment default	67		1
The J.G. Wentworth Company	United States	2017-12	Bankruptcy		0	0
Tops Holding II Corporation	United States	2017-8	Distressed exchange	76		1
Toys 'R' US, Inc.	United States	2017-9	Bankruptcy	791		1
Toys 'R' Us-Delaware, Inc.	United States	2017-9	Bankruptcy	22	2453	1
True Religion Apparel, Inc.	United States	2017-7	Bankruptcy		471	1
Vanguard Natural Resources, LLC	United States	2017-2	Bankruptcy	382	1250	1
Velocity Pooling Vehicle, LLC	United States	2017-11	Bankruptcy		440	1
Vivarte	France	2017-6	Distressed exchange	891	2	1
Walter Investment Management Corp	United States	2017-11	Bankruptcy	820	1245	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. Furthermore, the list only includes 91 companies, which initially defaulted in 2017. Besides these 91 companies, there are five issuers, which initially defaulted in prior years but experienced follow-on defaults on \$1.4 billion of debt in 2017 (\$0.4 billion in bonds and \$0.9 billion in loans). We include such \$1.4 billion in the 2017 default volume.

Exhibit 16

## Annual Moody's-Rated Global Corporate Issuer Default Counts, 1920-2017\*

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	188	197
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
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	42	48
2012	1	67	68
2013	3	67	70
2014	2	54	56
2015	0	109	109
2016	0	136	136
2017	0	88	88

\*Only includes issuers in the Jan 1st cohort.

Exhibit 17

## Annual Rated Global Corporate Bond And Loan Default Volumes, 1970-2017\*

Year	Investment Grade			Speculative Grade			All Ratings		
	Bond	Loan	Total	Bond	Loan	Total	Bond	Loan	Total
1970	\$154	\$0	\$154	\$756	\$0	\$756	\$910	\$0	\$910
1971	\$0	\$0	\$0	\$132	\$0	\$132	\$132	\$0	\$132
1972	\$0	\$0	\$0	\$215	\$0	\$215	\$215	\$0	\$215
1973	\$17	\$0	\$17	\$94	\$0	\$94	\$112	\$0	\$112
1974	\$0	\$0	\$0	\$69	\$0	\$69	\$69	\$0	\$69
1975	\$0	\$0	\$0	\$176	\$0	\$176	\$176	\$0	\$176
1976	\$0	\$0	\$0	\$34	\$0	\$34	\$34	\$0	\$34
1977	\$68	\$0	\$68	\$179	\$0	\$179	\$247	\$0	\$247
1978	\$0	\$0	\$0	\$112	\$0	\$112	\$112	\$0	\$112
1979	\$0	\$0	\$0	\$18	\$0	\$18	\$18	\$0	\$18
1980	\$0	\$0	\$0	\$302	\$0	\$302	\$302	\$0	\$302
1981	\$0	\$0	\$0	\$47	\$0	\$47	\$47	\$0	\$47
1982	\$243	\$0	\$243	\$515	\$0	\$515	\$758	\$0	\$758
1983	\$0	\$0	\$0	\$1,110	\$0	\$1,110	\$1,110	\$0	\$1,110
1984	\$215	\$0	\$215	\$367	\$0	\$367	\$582	\$0	\$582
1985	\$0	\$0	\$0	\$1,354	\$0	\$1,354	\$1,354	\$0	\$1,354
1986	\$138	\$0	\$138	\$3,213	\$0	\$3,213	\$3,351	\$0	\$3,351
1987	\$0	\$0	\$0	\$8,941	\$242	\$9,182	\$8,941	\$242	\$9,182
1988	\$0	\$0	\$0	\$5,642	\$361	\$6,003	\$5,642	\$361	\$6,003
1989	\$1,506	\$0	\$1,506	\$9,657	\$0	\$9,657	\$11,162	\$0	\$11,162
1990	\$0	\$0	\$0	\$20,429	\$1,831	\$22,260	\$20,429	\$1,831	\$22,260
1991	\$1,348	\$0	\$1,348	\$15,546	\$678	\$16,224	\$16,894	\$678	\$17,572
1992	\$0	\$0	\$0	\$6,667	\$956	\$7,623	\$6,667	\$956	\$7,623
1993	\$0	\$0	\$0	\$2,617	\$487	\$3,103	\$2,617	\$487	\$3,103
1994	\$0	\$0	\$0	\$2,713	\$299	\$3,013	\$2,713	\$299	\$3,013
1995	\$0	\$0	\$0	\$5,401	\$372	\$5,773	\$5,401	\$372	\$5,773
1996	\$0	\$0	\$0	\$4,106	\$1,435	\$5,541	\$4,106	\$1,435	\$5,541
1997	\$0	\$0	\$0	\$5,024	\$948	\$5,972	\$5,024	\$948	\$5,972
1998	\$399	\$0	\$399	\$9,469	\$3,299	\$12,768	\$9,868	\$3,299	\$13,167
1999	\$461	\$1,225	\$1,686	\$26,217	\$14,054	\$40,270	\$26,678	\$15,279	\$41,956
2000	\$4,115	\$3,950	\$8,065	\$25,360	\$26,206	\$51,566	\$29,475	\$30,156	\$59,631
2001	\$21,195	\$5,363	\$26,558	\$78,864	\$34,103	\$112,967	\$100,059	\$39,466	\$139,525
2002	\$44,214	\$13,658	\$57,872	\$115,631	\$40,471	\$156,101	\$159,845	\$54,129	\$213,973
2003	\$0	\$870	\$870	\$38,667	\$10,308	\$48,976	\$38,667	\$11,178	\$49,845
2004	\$0	\$0	\$0	\$16,409	\$4,712	\$21,122	\$16,409	\$4,712	\$21,122
2005	\$2,155	\$2,825	\$4,980	\$26,923	\$8,745	\$35,668	\$29,078	\$11,570	\$40,648
2006	\$0	\$0	\$0	\$7,758	\$2,630	\$10,388	\$7,758	\$2,630	\$10,388
2007	\$0	\$0	\$0	\$6,214	\$1,983	\$8,197	\$6,214	\$1,983	\$8,197
2008	\$182,073	\$10,380	\$192,452	\$51,362	\$32,322	\$83,684	\$233,435	\$42,701	\$276,136
2009	\$35,704	\$21,931	\$57,634	\$148,231	\$122,350	\$270,580	\$183,934	\$144,280	\$328,215
2010	\$4,047	\$0	\$4,047	\$21,323	\$14,042	\$35,365	\$25,370	\$14,042	\$39,411
2011	\$6,561	\$1,411	\$7,972	\$22,108	\$4,906	\$27,014	\$28,669	\$6,317	\$34,986
2012	\$323	\$0	\$323	\$34,835	\$18,289	\$53,125	\$35,159	\$18,289	\$53,448
2013	\$2,408	\$0	\$2,408	\$28,781	\$13,826	\$42,607	\$31,189	\$13,826	\$45,015
2014	\$939	\$0	\$939	\$39,811	\$30,029	\$69,839	\$40,750	\$30,029	\$70,778
2015	\$0	\$0	\$0	\$75,662	\$19,794	\$95,456	\$75,662	\$19,794	\$95,456
2016	\$0	\$0	\$0	\$90,603	\$42,508	\$133,112	\$90,603	\$42,508	\$133,112
2017	\$0	\$0	\$0	\$51,704	\$24,453	\$76,157	\$51,704	\$24,453	\$76,157

\*Default volume in millions of USD. Only include companies in the Jan 1st cohort.

Exhibit 18

## Annual Issuer Default Counts And Volume Totals By Geographical Region, 1986-2017\*

Year	Count					Dollar Volumes (US\$ mil)				
	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	0	0	0	4142
1987	0	0	0	0	32	0	0	0	0	9262
1988	0	0	0	0	33	0	0	0	0	6003
1989	0	4	0	0	51	0	969	0	0	10253
1990	0	1	1	0	92	0	200	516	0	22097
1991	0	0	2	0	71	0	0	1228	0	16753
1992	0	0	0	0	34	0	0	0	0	7673
1993	0	0	0	0	24	0	0	0	0	3104
1994	0	0	1	0	18	0	0	774	0	2238
1995	0	0	0	1	30	0	0	0	100	5774
1996	0	0	0	1	19	0	0	0	207	5930
1997	0	2	0	2	21	0	614	0	310	5048
1998	0	5	5	0	44	0	1444	707	0	11241
1999	0	8	9	8	87	0	4458	3950	2018	33299
2000	0	3	4	3	119	0	4453	866	305	54074
2001	4	15	15	6	150	2758	7832	10540	2034	116675
2002	0	2	25	17	102	0	1842	45418	10424	156289
2003	0	2	7	11	70	0	625	3708	4152	41485
2004	1	0	5	1	38	183	0	2311	1093	18304
2005	0	0	1	1	32	0	0	207	100	40445
2006	0	0	7	2	23	0	0	1601	167	9113
2007	0	0	3	0	15	0	0	2230	0	5967
2008	0	3	51	2	93	0	625	53374	555	227946
2009	1	16	31	11	226	650	6989	28013	3031	294547
2010	0	3	11	3	53	0	6913	9225	487	25270
2011	0	0	15	1	35	0	0	10064	358	26599
2012	1	1	12	5	51	48	1805	17275	3077	33780
2013	0	2	25	10	36	0	546	24095	4880	23112
2014	1	5	14	5	32	350	3397	9654	4539	53092
2015	1	9	29	9	69	456	4114	16149	4314	75136
2016	2	2	20	12	107	945	1806	18108	26135	88565
2017	1	6	21	2	61	553	1960	15856	20822	38844

\* Include defaults outside of the Jan 1st cohorts.

Exhibit 19

## 2017 Defaulted Corporate Bond And Loan Recoveries\*

Company	Default Type	Loans			Bonds					
		1st Lien	2nd Lien	Sr. Unsec.	1st Lien	2nd Lien	Sr. Unsec.	Sr. Sub.	Sub.	Jr. Sub.
Perpetual Energy Inc.	distressed exchange						98.0			
Approach Resources Inc.	distressed exchange						92.0			
GenOn Americas Generation, LLC	bankruptcy						90.5			
Tops Holding II Corporation	distressed exchange						90.0			
Aurora Diagnostics Holdings, LLC	distressed exchange						88.3			
99 Cents Only Stores LLC	distressed exchange	95.6					85.5			
Opal Acquisition, Inc.	distressed exchange						84.8			
Brunswick Rail Limited	distressed exchange						84.0			
International Bank of Azerbaijan	payment default						83.4			
Sable Permian Resources, LLC	distressed exchange				98.0	81.1				31.0
iHeartCommunications, Inc.	payment default						78.5			
Real People Investment Holdings Limited	distressed exchange						78.1		72.8	
Production Resource Group, Inc.	distressed exchange						76.3			
Neovia Logistics Intermediate Holdings, LP	distressed exchange						73.0			
Vanguard Natural Resources, LLC	bankruptcy	91.0					70.1			
Chinos Intermediate Holdings A, Inc.	distressed exchange						68.5			
GenOn Energy, Inc.	bankruptcy						64.7			
Mood Media Corporation	bankruptcy	99.6					64.0			
EP Energy LLC	distressed exchange						62.8			
Millar Western Forest Products Ltd.	distressed exchange						62.0			
Walter Investment Management Corp	bankruptcy	97.5					60.5	10.0		
Intelsat S.A.	distressed exchange						59.0			
Frigoglass SAIC	payment default						57.0			
Sequa Corporation	payment default						55.0			
GulfMark Offshore, Inc.	payment default						47.0			
Toys 'R' US, Inc.	bankruptcy				97.0		41.5			
Toys 'R' Us-Delaware, Inc.	bankruptcy	47.4					41.0			
Novo Banco, S.A.	distressed exchange						28.0			
Petroleos de Venezuela, S.A.	payment default				76.8		25.3			
CGG SA	bankruptcy	100.9					24.1			
Boart Longyear Management Pty Limited	distressed exchange				80.5		20.5			
Cumulus Media Holdings Inc.	bankruptcy	86.2					18.0			
Agrokor D.D.	payment default						16.6			
Jack Cooper Enterprises, Inc.	distressed exchange						13.0			
Ocean Rig UDW Inc.	bankruptcy						11.0			
rue21, inc.	bankruptcy						3.5			
Norske Skogindustrier ASA	payment default						1.9			4.0
Gymboree Corporation (The)	bankruptcy	35.8					1.5			
Nuverra Environmental Solutions, Inc.	bankruptcy					20.0	0.5			
21st Century Oncology, Inc	payment default	93.7								
Ameriforge Group, Inc.	bankruptcy	61.5	10.5							
Appvion, Inc.	bankruptcy	96.5				37.0				
Armstrong Energy, Inc.	payment default				11.5					
Avanti Communications Group plc	distressed exchange				60.0					
Avaya, Inc.	bankruptcy	89.6			78.9	24.3				
Banco Popular Espanol, S.A.	distressed exchange								76.0	
Bibby Offshore Services Plc	bankruptcy				13.8					
CHARMING CHARLIE LLC	bankruptcy	3.9								
Concordia International Corp.	payment default			9.0						
Denbury Resources Inc.	distressed exchange							66.0		
Drill Rigs Holdings Inc.	bankruptcy				29.5					
Drillships Financing Holding Inc.	bankruptcy	75.7								
Drillships Ocean Ventures Inc.	bankruptcy	93.3								
Eastcomtrans LLP	distressed exchange				93.4					
Emeco Pty Limited	distressed exchange				90.0					

EXCO Resources, Inc.	payment default	48.0	
Expro Holdings UK 3 Limited	bankruptcy	58.8	
Fieldwood Energy LLC	distressed exchange	41.6	
Floworks International LLC	distressed exchange		60.0
Global A&T Electronics Ltd.	payment default		62.3
Jack Cooper Holdings Corp.	distressed exchange		52.8
Onsite Rental Group Operations Pty Ltd	distressed exchange	87.8	
Orchard Acquisition Company, LLC	bankruptcy	54.3	
Pacific Drilling S.A.	bankruptcy	64.4	38.0
Pacific Drilling V Ltd.	bankruptcy		48.0
Payless Inc.	bankruptcy	51.0 5.3	
Pinnacle Operating Corporation	distressed exchange		73.0
Quintis Limited	payment default		70.0
Real Alloy Holding, Inc.	bankruptcy		72.5
Reliance Communications Limited	payment default		38.8
Shelf Drilling Midco, Ltd.	distressed exchange		84.5
Spanish Broadcasting System, Inc.	payment default		102.0
Sprint Industrial Holdings, LLC	distressed exchange	76.4 27.5	
Stafford Logistics, Inc.	distressed exchange	53.5	
True Religion Apparel, Inc.	bankruptcy	28.6	
Velocity Pooling Vehicle, LLC	bankruptcy	35.2 4.5	

\*Measured by trading prices and in percents.



Exhibit 20

## Annual Defaulted Corporate Bond And Loan Recoveries\*

Year	Loan		Bond				All Bonds
	Sr. Sec. (1st Lien)	Sr. Sec. (1st Lien)	Sr. Unsec.	Sr. Sub.	Sub.	Jr. Sub.	
1983		40.0%	52.7%	43.5%	41.1%		44.5%
1984			49.4%	67.9%	44.3%		45.5%
1985		83.6%	60.2%	29.6%	39.7%	48.5%	43.6%
1986		59.2%	50.4%	46.8%	40.4%		46.8%
1987		71.0%	63.8%	46.5%	46.9%		51.3%
1988		55.4%	45.2%	31.4%	33.8%	36.5%	38.5%
1989		46.5%	43.6%	35.7%	26.8%	16.9%	32.5%
1990	72.0%	33.8%	38.2%	25.5%	19.5%	10.7%	25.8%
1991	67.9%	48.4%	36.7%	41.8%	24.4%	7.8%	35.5%
1992	60.6%	62.1%	49.2%	49.4%	38.0%	13.5%	45.9%
1993	53.4%		37.1%	51.9%	44.1%		43.1%
1994	67.6%	69.3%	53.7%	29.6%	38.0%	40.0%	45.6%
1995	75.4%	62.0%	47.6%	34.3%	41.5%		43.3%
1996	85.5%	47.6%	62.8%	43.8%	22.6%		41.5%
1997	81.3%	72.0%	56.1%	44.7%	33.1%	30.6%	47.6%
1998	56.7%	46.8%	39.5%	45.0%	18.2%	62.0%	38.3%
1999	73.5%	39.1%	38.0%	26.9%	35.6%		34.3%
2000	68.8%	39.2%	24.2%	20.8%	31.9%	15.5%	25.2%
2001	64.9%	31.7%	21.2%	19.8%	15.9%	47.0%	21.6%
2002	58.4%	50.6%	29.5%	21.4%	23.4%		29.5%
2003	73.4%	69.2%	41.9%	37.8%	12.3%		41.4%
2004	87.7%	73.3%	52.1%	42.3%	94.0%		58.5%
2005	83.8%	69.2%	54.9%	32.8%	51.3%		56.5%
2006	83.6%	74.6%	55.0%	41.4%	56.1%		55.0%
2007	68.6%	82.3%	53.7%	56.2%	0.0%		55.1%
2008	61.7%	52.5%	33.5%	23.3%	29.5%		34.1%
2009	53.6%	37.3%	36.7%	23.1%	45.3%		33.9%
2010	70.9%	57.6%	50.7%	37.5%	33.7%		51.5%
2011	70.9%	70.5%	41.3%	36.7%	31.9%		45.7%
2012	66.4%	57.6%	43.3%	33.7%	37.3%		44.5%
2013	76.2%	68.1%	45.0%	20.7%	26.4%		46.1%
2014	78.4%	73.6%	46.1%	39.1%	38.8%		47.9%
2015	64.1%	54.8%	37.6%	36.6%	58.5%	14.0%	40.6%
2016	75.0%	48.7%	31.5%	36.7%	24.5%	0.6%	36.1%
2017	69.0%	62.4%	53.9%	38.0%	74.4%	17.5%	56.5%

\*Based on trading prices.

Exhibit 21

**Average Sr. Unsecured Bond Recovery Rates By Year Prior To Default, 1983-2017\***

	Year 1	Year 2	Year 3	Year 4	Year 5
Aaa**		3.33%	3.33%	61.88%	69.58%
Aa	37.24%	39.02%	38.08%	43.95%	43.18%
A	30.36%	42.57%	44.97%	44.48%	44.17%
Baa	42.89%	44.16%	43.99%	43.79%	43.52%
Ba	44.63%	43.30%	42.13%	41.60%	41.59%
B	37.62%	36.77%	37.21%	37.71%	38.36%
Caa-C	38.10%	38.43%	38.50%	38.83%	38.86%
Investment Grade	40.04%	43.33%	43.96%	44.11%	43.85%
Speculative Grade	38.34%	38.19%	38.31%	38.66%	38.99%
All Rated	38.40%	38.47%	38.71%	39.11%	39.45%

\*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%.

Exhibit 22

**Average Cumulative Credit Loss Rates By Letter Rating, 1983-2017\***

	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%	0.20%	0.31%	0.45%
Baa	0.10%	0.26%	0.43%	0.65%	0.87%
Ba	0.51%	1.46%	2.64%	3.89%	4.96%
B	2.14%	5.17%	8.17%	10.83%	13.19%
Caa-C	6.28%	11.04%	15.10%	18.42%	21.16%
Investment Grade	0.06%	0.14%	0.25%	0.38%	0.52%
Speculative Grade	2.58%	5.26%	7.80%	9.99%	11.86%
All Rated	1.01%	2.02%	2.94%	3.71%	4.35%

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

Exhibit 23

## Annual Credit Loss Rates By Letter Rating, 1983-2017\*

Year	Aaa	Aa	A	Baa	Ba	B	Caa-C	Inv-Grade	Spec-Grade	All Rated
1983	0.0%	0.0%	0.0%	0.0%	0.6%	1.1%	20.0%	0.0%	1.9%	0.4%
1984	0.0%	0.0%	0.0%	0.3%	0.3%	2.7%	9.2%	0.1%	1.6%	0.4%
1985	0.0%	0.0%	0.0%	0.0%	0.3%	2.9%	2.7%	0.0%	1.5%	0.4%
1986	0.0%	0.0%	0.0%	0.4%	1.2%	5.2%	8.5%	0.1%	3.1%	0.9%
1987	0.0%	0.0%	0.0%	0.0%	1.1%	2.0%	3.6%	0.0%	1.6%	0.5%
1988	0.0%	0.0%	0.0%	0.0%	0.7%	3.2%	6.8%	0.0%	2.1%	0.8%
1989	0.0%	0.3%	0.0%	0.3%	1.7%	4.3%	11.5%	0.1%	3.3%	1.3%
1990	0.0%	0.0%	0.0%	0.2%	2.3%	8.5%	27.2%	0.0%	6.5%	2.2%
1991	0.0%	0.0%	0.0%	0.2%	2.4%	8.4%	9.7%	0.0%	5.8%	1.8%
1992	0.0%	0.0%	0.0%	0.0%	0.2%	3.7%	8.4%	0.0%	2.5%	0.7%
1993	0.0%	0.0%	0.0%	0.0%	0.4%	2.8%	8.5%	0.0%	2.1%	0.6%
1994	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	2.5%	0.0%	1.1%	0.3%
1995	0.0%	0.0%	0.0%	0.0%	0.1%	2.1%	5.5%	0.0%	1.6%	0.5%
1996	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	3.8%	0.0%	0.6%	0.2%
1997	0.0%	0.0%	0.0%	0.0%	0.1%	0.9%	4.3%	0.0%	0.8%	0.3%
1998	0.0%	0.0%	0.0%	0.1%	0.5%	2.3%	5.0%	0.0%	1.8%	0.7%
1999	0.0%	0.0%	0.0%	0.1%	0.9%	3.0%	10.0%	0.0%	3.3%	1.3%
2000	0.0%	0.0%	0.0%	0.3%	1.0%	4.4%	13.6%	0.1%	4.6%	1.9%
2001	0.0%	0.0%	0.1%	0.1%	0.9%	7.3%	23.6%	0.1%	7.6%	2.9%
2002	0.0%	0.0%	0.1%	0.7%	1.0%	3.3%	18.9%	0.3%	5.4%	2.1%
2003	0.0%	0.0%	0.0%	0.0%	0.5%	1.6%	12.0%	0.0%	3.1%	1.1%
2004	0.0%	0.0%	0.0%	0.0%	0.2%	0.4%	5.7%	0.0%	1.2%	0.4%
2005	0.0%	0.0%	0.0%	0.1%	0.0%	0.4%	3.3%	0.0%	0.8%	0.3%
2006	0.0%	0.0%	0.0%	0.0%	0.1%	0.5%	2.7%	0.0%	0.8%	0.3%
2007	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.3%	0.0%	0.4%	0.2%
2008	0.0%	0.3%	0.3%	0.7%	1.6%	2.7%	7.1%	0.4%	3.6%	1.7%
2009	0.0%	0.0%	0.2%	0.6%	1.1%	4.6%	16.5%	0.3%	7.7%	3.2%
2010	0.0%	0.0%	0.1%	0.0%	0.0%	0.2%	4.2%	0.0%	1.5%	0.6%
2011	0.0%	0.1%	0.0%	0.2%	0.1%	0.2%	3.4%	0.1%	1.2%	0.5%
2012	0.0%	0.0%	0.0%	0.0%	0.1%	0.3%	4.4%	0.0%	1.6%	0.7%
2013	0.0%	0.0%	0.0%	0.1%	0.3%	0.5%	3.4%	0.1%	1.4%	0.7%
2014	0.0%	0.0%	0.0%	0.0%	0.1%	0.3%	2.5%	0.0%	1.0%	0.5%
2015	0.0%	0.0%	0.0%	0.0%	0.2%	1.4%	4.3%	0.0%	2.3%	1.1%
2016	0.0%	0.0%	0.0%	0.0%	0.1%	1.1%	6.2%	0.0%	3.1%	1.5%
2017	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	3.0%	0.0%	1.3%	0.7%
Average	0.0%	0.0%	0.0%	0.1%	0.6%	2.4%	8.1%	0.1%	2.6%	0.9%
Max	0.0%	0.3%	0.3%	0.7%	2.4%	8.5%	27.2%	0.4%	7.7%	3.2%
Min	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.3%	0.0%	0.4%	0.2%

\*Based on issuer-weighted average default rates and issuer-weighted senior unsecured bond recovery rates.

Exhibit 24

**2017 One-Year Letter Rating Migration Rates**

From/To	Aaa	Aa	A	Baa	Ba	B	Caa	Ca-C	WR	Default
Aaa	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Aa	0.00%	75.08%	20.20%	0.00%	0.00%	0.00%	0.00%	0.00%	4.71%	0.00%
A	0.00%	1.35%	90.08%	3.89%	0.24%	0.00%	0.08%	0.00%	4.37%	0.00%
Baa	0.00%	0.06%	2.88%	90.13%	1.29%	0.29%	0.00%	0.00%	5.35%	0.00%
Ba	0.00%	0.00%	0.00%	6.74%	82.07%	3.97%	0.12%	0.00%	6.86%	0.24%
B	0.00%	0.00%	0.00%	0.10%	7.23%	72.15%	5.45%	0.00%	14.77%	0.30%
Caa	0.00%	0.08%	0.00%	0.00%	0.08%	4.99%	70.38%	3.07%	17.65%	3.76%
Ca-C	0.00%	0.00%	0.00%	0.00%	0.00%	0.81%	19.51%	35.77%	16.26%	27.64%

Exhibit 25

**Average One-Year Letter Rating Migration Rates, 1920-2017**

From/To	Aaa	Aa	A	Baa	Ba	B	Caa	Ca-C	WR	Default
Aaa	86.86%	7.77%	0.79%	0.19%	0.03%	0.00%	0.00%	0.00%	4.36%	0.00%
Aa	1.05%	84.11%	7.73%	0.72%	0.16%	0.05%	0.01%	0.00%	6.11%	0.06%
A	0.07%	2.70%	85.06%	5.56%	0.64%	0.12%	0.04%	0.01%	5.73%	0.08%
Baa	0.03%	0.23%	4.20%	82.90%	4.55%	0.72%	0.13%	0.02%	6.96%	0.25%
Ba	0.01%	0.07%	0.49%	6.15%	74.05%	6.85%	0.67%	0.09%	10.49%	1.14%
B	0.00%	0.04%	0.16%	0.61%	5.56%	71.76%	6.19%	0.46%	12.00%	3.21%
Caa	0.00%	0.01%	0.03%	0.11%	0.51%	6.71%	67.72%	2.95%	13.90%	8.06%
Ca-C	0.00%	0.02%	0.10%	0.04%	0.57%	2.82%	8.19%	47.69%	18.45%	22.13%

Exhibit 26

**Average One-Year Letter Rating Migration Rates, 1970-2017**

From/To	Aaa	Aa	A	Baa	Ba	B	Caa	Ca-C	WR	Default
Aaa	87.71%	7.94%	0.58%	0.07%	0.02%	0.00%	0.00%	0.00%	3.67%	0.00%
Aa	0.82%	85.15%	8.51%	0.42%	0.06%	0.03%	0.02%	0.00%	4.95%	0.02%
A	0.05%	2.46%	86.78%	5.37%	0.48%	0.11%	0.04%	0.00%	4.64%	0.05%
Baa	0.03%	0.14%	4.12%	85.72%	3.79%	0.69%	0.15%	0.02%	5.17%	0.17%
Ba	0.01%	0.04%	0.42%	6.12%	76.32%	7.17%	0.71%	0.11%	8.22%	0.88%
B	0.01%	0.03%	0.14%	0.45%	4.78%	73.49%	6.62%	0.52%	10.70%	3.27%
Caa	0.00%	0.01%	0.02%	0.08%	0.34%	6.51%	67.87%	2.85%	14.35%	7.96%
Ca-C	0.00%	0.00%	0.05%	0.00%	0.56%	2.29%	8.94%	39.39%	22.12%	26.66%

Exhibit 27

**Average Five-Year Letter Rating Migration Rates, 1970-2017\***

From/To	Aaa	Aa	A	Baa	Ba	B	Caa	Ca-C	WR	Default
Aaa	53.36%	23.51%	4.99%	0.64%	0.31%	0.03%	0.05%	0.00%	17.04%	0.07%
Aa	2.20%	45.70%	23.68%	4.00%	0.81%	0.26%	0.12%	0.03%	22.94%	0.26%
A	0.19%	7.33%	51.37%	14.64%	2.47%	0.80%	0.16%	0.02%	22.35%	0.67%
Baa	0.16%	1.04%	12.32%	49.33%	7.96%	2.55%	0.59%	0.09%	24.50%	1.46%
Ba	0.03%	0.19%	2.60%	14.20%	27.81%	11.51%	1.99%	0.13%	34.74%	6.80%
B	0.02%	0.07%	0.46%	2.39%	7.37%	22.25%	6.30%	0.63%	43.92%	16.59%
Caa	0.00%	0.00%	0.13%	0.70%	1.78%	8.27%	13.27%	0.97%	48.81%	26.07%
Ca-C	0.00%	0.00%	0.03%	0.80%	1.80%	4.74%	2.87%	3.26%	51.07%	35.44%

\*Last cohort formed on 1/1/2013.

Exhibit 28

## 2017 One-Year Alphanumeric Rating Migration Rates

From/To	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa1	Caa2	Caa3	Ca-C	WR	Default
Aaa	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%	0.00%
Aa1	0.00%	78.79%	21.21%	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%	0.00%	79.00%	15.00%	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%	6.00%	0.00%
Aa3	0.00%	0.00%	0.00%	58.54%	35.98%	0.00%	0.61%	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%	4.88%	0.00%
A1	0.00%	0.00%	0.00%	4.42%	82.32%	8.56%	0.55%	0.28%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.87%	0.00%
A2	0.00%	0.00%	0.00%	0.26%	6.77%	81.25%	5.47%	0.26%	0.52%	0.26%	0.00%	0.78%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.26%	0.00%	4.17%	0.00%
A3	0.00%	0.00%	0.00%	0.00%	0.00%	7.59%	78.99%	6.81%	1.56%	0.19%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.86%	0.00%
Baa1	0.00%	0.00%	0.00%	0.18%	0.00%	0.36%	8.05%	84.08%	2.86%	0.36%	0.00%	0.00%	0.18%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.94%	0.00%
Baa2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.32%	8.28%	78.90%	6.33%	0.32%	0.00%	0.16%	0.00%	0.00%	0.16%	0.00%	0.00%	0.00%	0.00%	5.52%	0.00%
Baa3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.76%	10.06%	78.37%	2.85%	0.57%	0.00%	0.57%	0.19%	0.00%	0.00%	0.00%	0.00%	0.00%	6.64%	0.00%
Ba1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.69%	11.81%	73.26%	5.21%	2.78%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	6.25%	0.00%
Ba2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.40%	6.77%	6.77%	72.11%	4.78%	1.59%	0.80%	0.00%	0.00%	0.00%	0.00%	0.00%	6.37%	0.40%
Ba3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.68%	0.00%	4.79%	8.22%	68.49%	6.51%	2.40%	0.34%	0.00%	0.34%	0.00%	0.00%	7.88%	0.34%
B1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.31%	0.00%	0.31%	1.23%	14.77%	56.92%	7.69%	2.77%	1.23%	0.31%	0.00%	0.00%	14.46%	0.00%
B2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.36%	0.72%	2.51%	11.83%	55.20%	10.39%	1.79%	1.43%	1.08%	0.00%	14.34%	0.36%
B3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.25%	0.74%	1.48%	3.46%	12.84%	56.05%	7.65%	1.48%	0.25%	0.00%	15.31%	0.49%
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%	0.00%	0.16%	0.65%	7.42%	61.61%	9.03%	1.61%	0.16%	18.39%	0.97%
Caa2	0.00%	0.00%	0.21%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.21%	0.42%	1.48%	9.51%	59.20%	5.50%	2.11%	17.12%	4.23%
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%	0.48%	0.00%	0.48%	1.43%	3.33%	5.71%	47.14%	13.81%	16.67%	10.95%
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%	0.81%	1.63%	4.88%	13.01%	35.77%	16.26%	27.64%

Exhibit 29

## Average One-Year Alphanumeric Rating Migration Rates, 1983-2017

From/To	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa1	Caa2	Caa3	Ca-C	WR	Default
Aaa	86.84%	5.42%	2.38%	0.56%	0.28%	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%	4.24%	0.00%
Aa1	1.73%	76.01%	8.21%	6.10%	1.50%	0.94%	0.19%	0.13%	0.08%	0.01%	0.04%	0.00%	0.01%	0.04%	0.03%	0.01%	0.02%	0.02%	0.00%	0.00%	4.95%	0.00%
Aa2	1.06%	4.35%	73.12%	10.25%	3.59%	1.68%	0.40%	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%	5.10%	0.00%
Aa3	0.16%	1.05%	4.19%	75.23%	8.58%	3.66%	0.85%	0.24%	0.25%	0.13%	0.03%	0.03%	0.01%	0.01%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	5.52%	0.04%
A1	0.05%	0.10%	1.01%	5.12%	75.70%	7.78%	2.88%	0.67%	0.48%	0.22%	0.19%	0.13%	0.05%	0.06%	0.01%	0.01%	0.02%	0.01%	0.01%	0.00%	5.44%	0.07%
A2	0.05%	0.03%	0.21%	1.06%	5.78%	76.04%	7.46%	2.67%	1.04%	0.39%	0.18%	0.14%	0.17%	0.06%	0.03%	0.01%	0.02%	0.02%	0.01%	0.00%	4.58%	0.05%
A3	0.05%	0.05%	0.10%	0.31%	1.58%	6.33%	74.78%	6.95%	2.81%	0.92%	0.38%	0.16%	0.13%	0.11%	0.04%	0.02%	0.03%	0.01%	0.00%	0.02%	5.18%	0.05%
Baa1	0.03%	0.03%	0.08%	0.12%	0.21%	1.68%	6.75%	74.56%	7.17%	2.44%	0.65%	0.36%	0.24%	0.28%	0.06%	0.04%	0.06%	0.03%	0.01%	0.02%	5.07%	0.13%
Baa2	0.04%	0.04%	0.02%	0.06%	0.18%	0.59%	2.05%	6.52%	75.08%	6.60%	1.41%	0.66%	0.47%	0.34%	0.20%	0.09%	0.11%	0.01%	0.02%	0.01%	5.31%	0.17%
Baa3	0.03%	0.01%	0.02%	0.04%	0.08%	0.18%	0.50%	1.93%	8.59%	72.69%	4.89%	2.17%	1.04%	0.74%	0.30%	0.25%	0.16%	0.07%	0.06%	0.04%	5.97%	0.25%
Ba1	0.02%	0.00%	0.02%	0.02%	0.16%	0.13%	0.22%	0.76%	2.58%	9.97%	65.34%	5.09%	4.27%	1.62%	0.64%	0.54%	0.13%	0.21%	0.03%	0.11%	7.71%	0.44%
Ba2	0.00%	0.00%	0.02%	0.03%	0.09%	0.12%	0.17%	0.39%	0.72%	3.81%	7.91%	63.59%	6.82%	3.79%	1.34%	0.95%	0.32%	0.22%	0.09%	0.13%	8.78%	0.71%
Ba3	0.00%	0.01%	0.01%	0.01%	0.07%	0.18%	0.18%	0.10%	0.47%	0.81%	2.85%	6.63%	63.98%	7.39%	3.24%	1.89%	0.63%	0.42%	0.10%	0.13%	9.54%	1.36%
B1	0.01%	0.01%	0.02%	0.01%	0.05%	0.03%	0.08%	0.10%	0.22%	0.32%	0.73%	2.88%	6.44%	63.64%	6.17%	4.45%	1.35%	0.73%	0.22%	0.26%	10.32%	1.97%
B2	0.00%	0.01%	0.00%	0.01%	0.02%	0.02%	0.10%	0.13%	0.14%	0.27%	0.21%	0.68%	2.06%	7.26%	61.90%	7.94%	3.66%	1.79%	0.43%	0.49%	9.94%	2.95%
B3	0.01%	0.00%	0.02%	0.00%	0.03%	0.03%	0.06%	0.03%	0.04%	0.11%	0.13%	0.22%	0.63%	2.27%	6.27%	60.20%	7.51%	3.36%	1.16%	0.84%	12.19%	4.87%
Caa1	0.00%	0.01%	0.00%	0.00%	0.00%	0.01%	0.00%	0.02%	0.00%	0.03%	0.06%	0.12%	0.22%	0.40%	1.35%	7.68%	59.37%	8.19%	2.77%	1.39%	13.85%	4.51%
Caa2	0.00%	0.00%	0.01%	0.00%	0.02%	0.01%	0.00%	0.00%	0.06%	0.10%	0.05%	0.06%	0.18%	0.38%	0.84%	2.37%	7.92%	53.92%	6.05%	3.01%	15.43%	9.59%
Caa3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.07%	0.04%	0.05%	0.22%	0.18%	1.01%	3.29%	8.16%	44.86%	9.43%	13.99%	18.70%
Ca-C	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.03%	0.00%	0.00%	0.00%	0.26%	0.15%	0.16%	0.16%	0.23%	1.85%	2.01%	3.28%	3.80%	38.70%	22.49%	26.86%

Exhibit 30

## Annual Issuer-Weighted Corporate Default Rates By Letter Rating, 1920-2017

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%	0.45%	0.82%	0.92%	9.73%	0.24%	1.40%	0.72%
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%	3.81%
1932	0.00%	0.67%	1.10%	0.93%	6.10%	13.98%	24.06%	0.86%	10.99%	5.50%
1933	0.00%	0.00%	0.26%	1.77%	11.55%	16.15%	25.92%	0.79%	15.71%	8.49%
1934	0.00%	0.62%	0.31%	0.86%	2.53%	4.22%	16.50%	0.59%	5.90%	3.40%
1935	0.00%	0.00%	1.43%	1.92%	5.13%	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%	2.72%	1.63%
1937	0.00%	0.00%	0.51%	1.04%	1.00%	2.67%	9.07%	0.62%	2.75%	1.72%
1938	0.00%	0.85%	1.64%	1.99%	0.99%	1.47%	12.81%	1.55%	2.60%	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%	3.31%	11.83%	0.59%	3.56%	2.47%
1941	0.00%	0.00%	0.00%	0.00%	0.97%	0.81%	5.07%	0.00%	1.71%	1.09%
1942	0.00%	0.00%	0.00%	0.00%	0.00%	0.79%	2.00%	0.00%	0.74%	0.46%
1943	0.00%	0.00%	0.00%	0.00%	0.00%	1.36%	0.00%	0.00%	0.62%	0.37%
1944	0.00%	0.00%	0.00%	0.00%	0.00%	0.50%	2.55%	0.00%	0.67%	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%	0.72%	2.78%	0.00%	0.64%	0.32%
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%	1.03%	8.57%	0.00%	1.93%	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%
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%	2.23%
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%	4.01%	10.55%	0.00%	3.06%	0.90%
1996	0.00%	0.00%	0.00%	0.00%	0.00%	1.50%	10.31%	0.00%	1.65%	0.51%
1997	0.00%	0.00%	0.00%	0.00%	0.18%	2.00%	9.82%	0.00%	1.89%	0.62%
1998	0.00%	0.00%	0.00%	0.11%	0.90%	3.88%	8.34%	0.03%	3.03%	1.14%
1999	0.00%	0.00%	0.00%	0.09%	1.50%	4.90%	16.18%	0.03%	5.36%	2.12%
2000	0.00%	0.00%	0.00%	0.35%	1.27%	5.74%	17.90%	0.13%	6.08%	2.45%
2001	0.00%	0.00%	0.16%	0.18%	1.16%	9.24%	29.96%	0.12%	9.63%	3.68%
2002	0.00%	0.00%	0.16%	1.01%	1.40%	4.68%	26.81%	0.43%	7.66%	2.92%
2003	0.00%	0.00%	0.00%	0.00%	0.88%	2.70%	20.58%	0.00%	5.33%	1.85%
2004	0.00%	0.00%	0.00%	0.00%	0.38%	0.80%	11.82%	0.00%	2.42%	0.83%
2005	0.00%	0.00%	0.00%	0.16%	0.00%	0.82%	7.32%	0.06%	1.72%	0.65%
2006	0.00%	0.00%	0.00%	0.00%	0.19%	1.07%	5.91%	0.00%	1.67%	0.59%
2007	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.95%	0.00%	0.95%	0.35%
2008	0.00%	0.51%	0.40%	1.02%	2.34%	3.99%	10.69%	0.63%	5.43%	2.51%
2009	0.00%	0.00%	0.24%	0.93%	1.76%	7.21%	26.07%	0.43%	12.11%	5.01%
2010	0.00%	0.00%	0.17%	0.07%	0.00%	0.38%	8.54%	0.10%	3.01%	1.23%
2011	0.00%	0.19%	0.00%	0.35%	0.16%	0.34%	5.87%	0.19%	1.98%	0.91%
2012	0.00%	0.00%	0.00%	0.07%	0.14%	0.54%	7.77%	0.03%	2.76%	1.23%
2013	0.00%	0.00%	0.09%	0.12%	0.58%	0.91%	6.22%	0.10%	2.63%	1.23%
2014	0.00%	0.00%	0.09%	0.06%	0.14%	0.50%	4.58%	0.06%	1.94%	0.94%
2015	0.00%	0.00%	0.00%	0.00%	0.29%	2.25%	6.81%	0.00%	3.67%	1.75%
2016	0.00%	0.00%	0.00%	0.00%	0.13%	1.54%	9.02%	0.00%	4.45%	2.14%
2017	0.00%	0.00%	0.00%	0.00%	0.25%	0.32%	6.43%	0.00%	2.91%	1.41%
Mean	0.00%	0.06%	0.09%	0.27%	1.02%	3.17%	10.50%	0.15%	2.81%	1.16%
Median	0.00%	0.00%	0.00%	0.00%	0.53%	1.99%	7.74%	0.00%	1.90%	0.82%
St Dev	0.00%	0.17%	0.26%	0.45%	1.60%	3.81%	11.22%	0.27%	2.96%	1.36%
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%	11.55%	19.44%	50.00%	1.55%	15.71%	8.49%



Exhibit 31

## Annual Issuer-Weighted Corporate Default Rates By Alphanumeric Rating, 1983-2017

Year	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%	2.23%
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%	3.68%	5.74%	1.97%		6.23%		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%	1.27%	4.06%		11.13%		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%	0.45%	0.32%	0.51%	7.20%		8.68%		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%	1.16%	1.54%	2.69%	4.43%	5.28%	4.55%	8.06%	37.50%	5.26%	0.03%	3.03%	1.14%
1999	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.30%	0.47%	0.91%	3.02%	3.05%	3.85%	8.92%	10.72%	26.35%	14.43%	18.96%	0.03%	5.36%	2.12%
2000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.27%	0.00%	0.88%	0.48%	1.38%	1.98%	2.28%	4.22%	11.81%	13.08%	26.39%	19.19%	17.19%	0.13%	6.08%	2.45%
2001	0.00%	0.00%	0.00%	0.00%	0.00%	0.41%	0.00%	0.28%	0.25%	0.00%	0.00%	1.00%	2.54%	3.27%	9.63%	15.60%	27.23%	28.32%	37.89%	34.63%	0.12%	9.63%	3.68%
2002	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.43%	0.99%	0.90%	1.18%	2.07%	1.14%	0.99%	2.55%	5.08%	6.61%	18.18%	21.55%	31.95%	39.13%	0.43%	7.66%	2.92%
2003	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.54%	0.62%	1.39%	0.70%	2.66%	5.21%	9.68%	22.39%	27.42%	30.32%	0.00%	5.33%	1.85%
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%	0.98%	0.00%	0.56%	2.20%	7.81%	9.17%	11.91%	29.13%	0.00%	2.42%	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%	0.50%	2.02%	4.50%	6.07%	23.48%	13.82%	0.06%	1.72%	0.65%
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%	0.64%	0.65%	0.30%	2.11%	2.39%	7.51%	13.71%	14.59%	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%	1.85%	10.52%	6.91%	41.39%	0.00%	0.95%	0.35%
2008	0.00%	0.00%	0.00%	1.49%	1.05%	0.23%	0.00%	0.97%	1.38%	0.61%	0.92%	2.97%	3.30%	3.04%	3.98%	4.60%	5.92%	17.52%	35.32%	42.40%	0.63%	5.43%	2.51%
2009	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.69%	1.02%	0.87%	0.91%	1.43%	1.21%	2.58%	3.37%	6.89%	10.00%	11.61%	34.77%	54.00%	64.84%	0.43%	12.11%	5.01%
2010	0.00%	0.00%	0.00%	0.00%	0.31%	0.00%	0.22%	0.00%	0.00%	0.24%	0.00%	0.00%	0.00%	0.84%	0.00%	0.28%	1.77%	7.33%	23.79%	25.20%	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%	0.87%	0.00%	0.56%	0.00%	0.00%	0.46%	0.52%	1.96%	7.65%	15.74%	20.11%	0.19%	1.98%	0.91%
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%	0.75%	2.73%	9.07%	17.26%	44.89%	0.03%	2.76%	1.23%
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%	0.70%	1.26%	0.84%	2.27%	6.46%	10.50%	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%	0.35%	0.34%	1.09%	0.23%	1.99%	4.18%	11.24%	25.55%	0.06%	1.94%	0.94%
2015	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.90%	0.00%	0.00%	0.69%	2.99%	2.78%	4.31%	5.28%	15.14%	34.13%	0.00%	3.67%	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%	0.39%	1.00%	1.01%	2.34%	3.84%	5.63%	18.11%	47.19%	0.00%	4.45%	2.14%
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%	0.35%	0.00%	0.39%	0.55%	1.08%	4.71%	12.19%	30.80%	0.00%	2.91%	1.41%
Mean	0.00%	0.00%	0.00%	0.09%	0.05%	0.02%	0.04%	0.13%	0.17%	0.32%	0.49%	0.70%	1.56%	2.47%	3.29%	7.74%		14.85%			0.09%	4.37%	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%	0.98%	2.28%	2.66%	5.28%		10.52%			0.03%	3.67%	1.23%
St Dev	0.00%	0.00%	0.00%	0.31%	0.19%	0.08%	0.14%	0.30%	0.34%	0.53%	0.96%	1.16%	1.69%	2.43%	3.50%	7.51%		10.65%			0.15%	2.69%	1.04%
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%	1.08%	4.18%	6.91%	0.00%	0.00%	0.95%	0.35%

Max	0.00%	0.00%	0.00%	1.49%	1.05%	0.41%	0.69%	1.02%	1.38%	1.94%	5.05%	5.84%	7.22%	8.66%	16.72%	30.14%	27.23%	45.16%	54.00%	64.84%	0.63%	12.11%	5.01%
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Exhibit 32

**Average Cumulative Issuer-Weighted Global Default Rates By Letter Rating, 1920-2017**

Rating	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%	0.43%	0.56%	0.71%	0.84%	0.95%	1.06%	1.09%	1.12%	1.18%	1.24%	1.29%	1.35%	1.39%
Aa	0.06%	0.18%	0.28%	0.43%	0.66%	0.93%	1.20%	1.45%	1.69%	1.96%	2.26%	2.59%	2.92%	3.24%	3.47%	3.66%	3.83%	4.03%	4.27%	4.48%
A	0.08%	0.25%	0.51%	0.81%	1.12%	1.47%	1.83%	2.19%	2.58%	2.99%	3.40%	3.81%	4.18%	4.55%	4.99%	5.37%	5.68%	5.98%	6.27%	6.56%
Baa	0.26%	0.72%	1.26%	1.86%	2.48%	3.10%	3.70%	4.31%	4.96%	5.59%	6.24%	6.89%	7.55%	8.14%	8.68%	9.25%	9.81%	10.32%	10.81%	11.30%
Ba	1.21%	2.87%	4.71%	6.64%	8.50%	10.27%	11.88%	13.44%	14.95%	16.54%	17.92%	19.30%	20.62%	21.80%	22.93%	24.02%	25.09%	26.12%	27.05%	27.90%
B	3.42%	7.78%	12.15%	16.12%	19.67%	22.79%	25.61%	28.01%	30.16%	32.01%	33.67%	35.16%	36.60%	38.07%	39.46%	40.84%	42.11%	43.14%	43.92%	44.49%
Caa-C	10.11%	17.72%	23.85%	28.87%	32.89%	36.06%	38.80%	41.29%	43.68%	45.73%	47.75%	49.56%	51.12%	52.68%	54.33%	55.94%	57.42%	58.82%	60.21%	61.68%
IG	0.14%	0.40%	0.72%	1.08%	1.48%	1.88%	2.29%	2.70%	3.13%	3.56%	4.01%	4.46%	4.89%	5.30%	5.69%	6.06%	6.39%	6.71%	7.03%	7.34%
SG	3.71%	7.44%	10.93%	14.06%	16.82%	19.22%	21.36%	23.27%	25.04%	26.71%	28.19%	29.60%	30.93%	32.20%	33.41%	34.58%	35.71%	36.73%	37.62%	38.42%
All	1.50%	3.01%	4.42%	5.68%	6.80%	7.78%	8.66%	9.45%	10.21%	10.94%	11.62%	12.28%	12.90%	13.48%	14.03%	14.56%	15.04%	15.49%	15.91%	16.30%

Exhibit 33

**Average Cumulative Issuer-Weighted Global Default Rates By Letter Rating, 1970-2017**

Rating	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%	0.14%	0.19%	0.25%	0.31%	0.38%	0.45%	0.52%	0.60%	0.64%	0.68%	0.73%	0.78%	0.80%	0.80%	0.80%
Aa	0.02%	0.06%	0.11%	0.19%	0.29%	0.40%	0.52%	0.63%	0.71%	0.79%	0.89%	1.02%	1.17%	1.29%	1.39%	1.49%	1.62%	1.78%	2.02%	2.26%
A	0.05%	0.16%	0.33%	0.52%	0.74%	0.99%	1.26%	1.54%	1.85%	2.15%	2.45%	2.74%	3.04%	3.36%	3.72%	4.08%	4.44%	4.82%	5.17%	5.53%
Baa	0.17%	0.44%	0.77%	1.16%	1.55%	1.95%	2.35%	2.77%	3.24%	3.75%	4.30%	4.88%	5.48%	6.07%	6.65%	7.29%	7.94%	8.56%	9.13%	9.65%
Ba	0.92%	2.52%	4.38%	6.36%	8.20%	9.90%	11.39%	12.85%	14.34%	15.88%	17.33%	18.81%	20.19%	21.53%	22.93%	24.31%	25.54%	26.64%	27.80%	28.71%
B	3.45%	8.15%	12.96%	17.32%	21.31%	24.92%	28.17%	30.92%	33.42%	35.51%	37.25%	38.76%	40.18%	41.71%	43.16%	44.52%	45.77%	46.87%	47.79%	48.71%
Caa-C	10.22%	18.04%	24.64%	30.17%	34.67%	38.09%	41.12%	44.04%	46.76%	48.90%	50.57%	51.34%	51.75%	51.84%	52.04%	52.43%	52.53%	52.53%	52.53%	52.53%
IG	0.09%	0.24%	0.43%	0.66%	0.90%	1.17%	1.43%	1.71%	2.00%	2.31%	2.62%	2.95%	3.29%	3.62%	3.96%	4.32%	4.68%	5.04%	5.39%	5.72%
SG	4.07%	8.23%	12.17%	15.67%	18.72%	21.35%	23.65%	25.68%	27.58%	29.29%	30.79%	32.17%	33.43%	34.69%	35.95%	37.17%	38.26%	39.23%	40.18%	40.98%
All	1.53%	3.06%	4.45%	5.66%	6.68%	7.56%	8.32%	8.99%	9.63%	10.22%	10.76%	11.28%	11.78%	12.26%	12.75%	13.23%	13.69%	14.13%	14.54%	14.93%

Exhibit 34

**Average Cumulative Issuer-Weighted Global Default Rates By Letter Rating, 1983-2017**

Rating	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%	0.07%	0.10%	0.13%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%
Aa	0.02%	0.06%	0.12%	0.20%	0.31%	0.40%	0.50%	0.58%	0.66%	0.74%	0.85%	0.99%	1.13%	1.23%	1.33%	1.43%	1.54%	1.72%	1.97%	2.19%
A	0.06%	0.17%	0.36%	0.56%	0.80%	1.07%	1.35%	1.63%	1.92%	2.20%	2.48%	2.74%	3.03%	3.36%	3.75%	4.15%	4.54%	4.96%	5.30%	5.64%
Baa	0.18%	0.46%	0.78%	1.15%	1.53%	1.93%	2.30%	2.67%	3.05%	3.46%	3.93%	4.43%	4.97%	5.48%	5.99%	6.57%	7.19%	7.77%	8.31%	8.69%
Ba	0.91%	2.57%	4.57%	6.66%	8.50%	10.15%	11.63%	13.01%	14.36%	15.70%	16.87%	18.05%	19.14%	20.27%	21.49%	22.62%	23.60%	24.57%	25.67%	26.39%
B	3.44%	8.18%	13.02%	17.38%	21.40%	25.04%	28.31%	31.06%	33.49%	35.50%	37.15%	38.61%	39.99%	41.50%	42.87%	44.14%	45.44%	46.67%	47.69%	48.74%
Caa-C	10.14%	17.93%	24.55%	30.12%	34.61%	37.99%	40.99%	43.87%	46.64%	48.91%	50.70%	51.54%	51.98%	52.07%	52.29%	52.71%	52.83%	52.83%	52.83%	52.83%
IG	0.09%	0.25%	0.45%	0.67%	0.92%	1.18%	1.43%	1.68%	1.93%	2.19%	2.46%	2.74%	3.05%	3.35%	3.67%	4.01%	4.35%	4.71%	5.05%	5.33%
SG	4.19%	8.51%	12.64%	16.29%	19.44%	22.16%	24.53%	26.60%	28.47%	30.10%	31.46%	32.67%	33.79%	34.94%	36.08%	37.15%	38.12%	39.05%	40.00%	40.75%
All	1.64%	3.29%	4.80%	6.09%	7.18%	8.10%	8.88%	9.56%	10.17%	10.72%	11.21%	11.66%	12.11%	12.56%	13.01%	13.46%	13.89%	14.32%	14.73%	15.06%

Exhibit 35

## Average Cumulative Issuer-Weighted Global Default Rates By Alphanumeric Rating, 1983-2017

Rating	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%	0.07%	0.10%	0.13%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%
Aa1	0.00%	0.00%	0.00%	0.05%	0.10%	0.14%	0.15%	0.15%	0.17%	0.23%	0.29%	0.37%	0.52%	0.69%	0.88%	1.02%	1.13%	1.27%	1.40%	1.40%
Aa2	0.00%	0.01%	0.11%	0.24%	0.35%	0.43%	0.52%	0.62%	0.75%	0.90%	1.03%	1.17%	1.30%	1.36%	1.43%	1.56%	1.79%	2.05%	2.30%	2.55%
Aa3	0.05%	0.12%	0.17%	0.25%	0.37%	0.49%	0.64%	0.76%	0.82%	0.88%	0.99%	1.15%	1.29%	1.39%	1.47%	1.53%	1.58%	1.72%	2.01%	2.30%
A1	0.07%	0.21%	0.42%	0.63%	0.83%	1.06%	1.26%	1.44%	1.59%	1.77%	1.96%	2.15%	2.37%	2.64%	2.91%	3.17%	3.44%	3.68%	3.81%	3.94%
A2	0.05%	0.14%	0.30%	0.51%	0.75%	1.09%	1.43%	1.79%	2.16%	2.53%	2.89%	3.21%	3.52%	3.89%	4.31%	4.78%	5.34%	5.89%	6.31%	6.70%
A3	0.06%	0.17%	0.38%	0.56%	0.83%	1.06%	1.33%	1.64%	1.98%	2.26%	2.51%	2.77%	3.10%	3.47%	3.96%	4.40%	4.71%	5.18%	5.68%	6.20%
Baa1	0.13%	0.35%	0.61%	0.88%	1.13%	1.37%	1.60%	1.77%	1.95%	2.19%	2.51%	2.94%	3.40%	3.80%	4.30%	4.91%	5.50%	5.93%	6.15%	6.30%
Baa2	0.17%	0.43%	0.72%	1.10%	1.44%	1.81%	2.19%	2.55%	2.97%	3.44%	4.01%	4.59%	5.19%	5.73%	6.22%	6.64%	7.04%	7.53%	8.14%	8.61%
Baa3	0.25%	0.62%	1.03%	1.52%	2.11%	2.72%	3.25%	3.89%	4.48%	5.05%	5.57%	6.04%	6.62%	7.25%	7.78%	8.57%	9.52%	10.41%	11.33%	11.91%
Ba1	0.45%	1.50%	2.76%	4.00%	5.31%	6.54%	7.52%	8.31%	9.08%	9.91%	10.78%	11.65%	12.41%	13.05%	13.96%	14.86%	15.50%	16.38%	17.81%	19.03%
Ba2	0.74%	1.92%	3.36%	4.85%	6.16%	7.24%	8.25%	9.39%	10.71%	12.09%	13.16%	14.19%	14.90%	15.74%	16.81%	17.48%	18.17%	18.70%	19.40%	19.50%
Ba3	1.43%	4.00%	7.06%	10.40%	13.17%	15.72%	18.10%	20.32%	22.32%	24.19%	25.81%	27.49%	29.40%	31.47%	33.29%	35.30%	37.11%	38.73%	39.87%	40.47%
B1	2.09%	5.59%	9.44%	13.07%	16.73%	20.10%	23.46%	26.44%	29.11%	31.22%	33.04%	34.54%	36.27%	38.24%	39.77%	40.97%	42.16%	43.43%	44.76%	46.10%
B2	3.11%	7.90%	12.68%	17.12%	20.87%	24.29%	27.29%	29.70%	32.02%	34.07%	35.71%	37.50%	38.85%	40.19%	41.84%	43.67%	45.31%	46.55%	47.15%	48.04%
B3	5.15%	11.18%	17.23%	22.40%	27.23%	31.64%	35.22%	38.20%	40.52%	42.36%	43.80%	44.64%	45.39%	46.20%	46.64%	46.95%	47.93%	49.17%	50.27%	50.62%
Caa	8.35%	15.99%	22.60%	28.24%	32.87%	36.44%	39.55%	42.63%	45.70%	48.35%	50.36%	51.12%	51.50%	51.63%	51.93%	52.51%	52.67%	52.67%	52.67%	52.67%
Ca-C	30.44%	40.31%	47.28%	52.11%	54.98%	56.27%	58.09%	59.19%	59.57%	59.57%	60.16%	61.08%	61.65%	61.65%	61.65%	61.65%	61.65%	61.65%	61.65%	61.65%
IG	0.09%	0.25%	0.45%	0.67%	0.92%	1.18%	1.43%	1.68%	1.93%	2.19%	2.46%	2.74%	3.05%	3.35%	3.67%	4.01%	4.35%	4.71%	5.05%	5.33%
SG	4.19%	8.51%	12.64%	16.29%	19.44%	22.16%	24.53%	26.60%	28.47%	30.10%	31.46%	32.67%	33.79%	34.94%	36.08%	37.15%	38.12%	39.05%	40.00%	40.75%
All	1.64%	3.29%	4.80%	6.09%	7.18%	8.10%	8.88%	9.56%	10.17%	10.72%	11.21%	11.66%	12.11%	12.56%	13.01%	13.46%	13.89%	14.32%	14.73%	15.06%

Exhibit 36

**Average Cumulative Issuer-Weighted Global Default Rates By Alphanumeric Rating, 1998-2017**

Rating	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%	0.09%	0.09%	0.09%	0.14%	0.24%
Aa2	0.00%	0.01%	0.14%	0.29%	0.38%	0.48%	0.59%	0.71%	0.89%	1.05%
Aa3	0.05%	0.13%	0.18%	0.25%	0.39%	0.54%	0.80%	1.00%	1.10%	1.20%
A1	0.11%	0.25%	0.43%	0.64%	0.89%	1.18%	1.47%	1.73%	1.97%	2.23%
A2	0.07%	0.20%	0.39%	0.58%	0.85%	1.26%	1.64%	2.08%	2.60%	3.23%
A3	0.07%	0.19%	0.42%	0.63%	0.95%	1.14%	1.41%	1.75%	2.19%	2.62%
Baa1	0.15%	0.39%	0.64%	0.91%	1.10%	1.31%	1.50%	1.69%	1.87%	2.17%
Baa2	0.19%	0.43%	0.69%	0.97%	1.20%	1.48%	1.71%	1.90%	2.23%	2.57%
Baa3	0.25%	0.60%	0.96%	1.35%	1.81%	2.19%	2.59%	3.18%	3.70%	4.33%
Ba1	0.31%	1.20%	2.15%	3.01%	4.15%	5.15%	6.04%	6.78%	7.67%	8.62%
Ba2	0.68%	1.60%	2.84%	4.12%	5.24%	6.10%	6.83%	8.02%	9.39%	10.96%
Ba3	0.96%	2.67%	4.65%	6.85%	8.42%	9.97%	11.62%	13.52%	15.27%	16.72%
B1	1.33%	4.06%	7.10%	10.13%	12.86%	15.34%	17.89%	20.27%	22.59%	24.72%
B2	2.79%	7.28%	11.95%	16.47%	19.93%	23.02%	25.74%	28.09%	30.42%	32.40%
B3	3.84%	9.31%	15.25%	20.17%	24.60%	28.57%	31.72%	34.37%	36.85%	38.80%
Caa1	4.78%	11.14%	17.18%	22.42%	26.88%	30.42%	33.32%	36.02%	39.11%	42.13%
Caa2	9.46%	17.86%	25.19%	31.72%	36.83%	40.94%	44.63%	48.38%	51.99%	52.76%
Caa3	19.70%	31.91%	40.07%	45.14%	49.15%	51.73%	55.22%	58.36%	59.16%	59.16%
Ca-C	32.87%	43.91%	51.64%	56.52%	59.58%	61.00%	62.94%	64.12%	64.52%	64.52%
IG	0.12%	0.28%	0.49%	0.70%	0.94%	1.18%	1.43%	1.71%	2.01%	2.35%
SG	4.16%	8.42%	12.46%	15.93%	18.76%	21.12%	23.20%	25.11%	26.97%	28.58%
All	1.76%	3.49%	5.07%	6.38%	7.42%	8.28%	9.03%	9.72%	10.40%	11.03%

Exhibit 37

## Average Cumulative Issuer-Weighted Global Default Rates By Broad Industry Group, 1970-2017

Industry Group	1	2	3	4	5	6	7	8	9	10
Aerospace & Defense	0.85%	1.77%	2.59%	3.20%	3.74%	4.09%	4.33%	4.53%	4.63%	4.64%
Automotive	2.33%	4.73%	7.05%	9.21%	11.28%	13.17%	14.95%	16.68%	18.27%	19.42%
Banking	0.51%	1.01%	1.49%	1.96%	2.39%	2.79%	3.14%	3.47%	3.82%	4.17%
Beverage, Food, & Tobacco	1.17%	2.32%	3.45%	4.39%	5.13%	5.80%	6.34%	6.77%	7.22%	7.54%
Capital Equipment	1.61%	3.34%	5.02%	6.51%	7.78%	8.76%	9.62%	10.40%	11.14%	11.84%
Chemicals, Plastics, & Rubber	1.09%	2.28%	3.40%	4.46%	5.42%	6.17%	6.72%	7.15%	7.60%	8.10%
Construction & Building	2.59%	5.36%	8.00%	10.51%	12.75%	14.84%	16.66%	18.45%	20.10%	21.50%
Consumer goods: Durable	2.37%	5.20%	8.19%	10.97%	13.84%	16.22%	17.98%	19.66%	21.56%	23.29%
Consumer goods: Non-durable	3.77%	7.88%	11.72%	14.79%	17.24%	19.36%	21.33%	22.99%	24.24%	25.18%
Containers, Packaging, & Glass	2.30%	4.87%	7.15%	9.26%	11.14%	12.78%	14.16%	15.57%	16.78%	17.88%
Energy: Electricity	2.60%	5.32%	7.78%	9.70%	11.55%	13.29%	15.00%	16.53%	18.09%	19.82%
Energy: Oil & Gas	2.38%	4.51%	6.37%	7.91%	9.19%	10.22%	11.11%	11.88%	12.61%	13.26%
Environmental Industries	3.66%	6.98%	9.57%	11.70%	13.27%	14.58%	15.72%	16.99%	18.42%	20.00%
FIRE: Finance	0.86%	1.73%	2.54%	3.11%	3.64%	4.14%	4.64%	5.14%	5.68%	6.27%
FIRE: Insurance	0.36%	0.76%	1.17%	1.61%	2.07%	2.52%	2.96%	3.39%	3.85%	4.31%
FIRE: Real Estate	0.94%	1.94%	2.86%	3.73%	4.34%	4.84%	5.25%	5.55%	5.84%	6.18%
Forest Products & Paper	2.94%	5.71%	8.37%	10.75%	12.74%	14.53%	16.12%	17.47%	18.41%	19.20%
Healthcare & Pharmaceuticals	1.34%	2.74%	4.00%	5.17%	6.17%	7.14%	8.05%	8.74%	9.45%	9.94%
High Tech Industries	1.77%	3.67%	5.39%	6.96%	8.23%	9.38%	10.58%	11.85%	13.10%	14.32%
Hotel, Gaming, & Leisure	4.20%	8.36%	11.99%	15.25%	18.02%	20.31%	22.24%	24.10%	25.97%	27.92%
Media: Advertising, Printing & Publishing	5.96%	11.83%	17.11%	21.65%	25.99%	29.73%	32.51%	34.46%	36.27%	38.28%
Media: Broadcasting & Subscription	3.54%	7.32%	11.22%	14.59%	17.75%	20.59%	22.95%	25.02%	26.84%	28.54%
Media: Diversified & Production	2.41%	4.80%	6.86%	8.21%	9.17%	10.02%	10.40%	10.66%	10.95%	11.27%
Metals & Mining	3.10%	6.21%	9.08%	11.59%	13.59%	15.40%	17.09%	18.56%	19.99%	21.44%
Retail	2.82%	5.69%	8.57%	11.16%	13.39%	15.32%	16.96%	18.45%	19.93%	21.30%
Services: Business	2.08%	4.20%	6.16%	7.82%	9.38%	10.89%	12.26%	13.41%	14.47%	15.43%
Services: Consumer	2.15%	4.24%	5.89%	7.46%	8.91%	10.37%	11.91%	13.50%	14.97%	16.37%
Sovereign & Public Finance	0.51%	1.02%	1.45%	1.78%	1.98%	2.10%	2.14%	2.14%	2.14%	2.14%
Telecommunications	2.23%	4.37%	6.27%	7.75%	8.84%	9.59%	10.16%	10.52%	10.76%	10.92%
Transportation: Cargo	1.99%	3.63%	4.99%	6.07%	6.90%	7.62%	8.21%	8.73%	9.20%	9.71%
Transportation: Consumer	2.91%	5.63%	8.35%	11.00%	13.31%	15.20%	17.03%	18.93%	20.90%	22.81%
Utilities: Electric	0.13%	0.25%	0.36%	0.47%	0.57%	0.67%	0.76%	0.85%	0.95%	1.05%
Utilities: Oil & Gas	0.15%	0.27%	0.40%	0.54%	0.66%	0.78%	0.88%	0.93%	0.98%	1.03%
Utilities: Water	0.12%	0.26%	0.32%	0.32%	0.32%	0.32%	0.32%	0.32%	0.32%	0.32%
Wholesale	3.44%	7.36%	10.87%	13.43%	15.33%	17.02%	17.95%	18.71%	19.47%	20.33%

Exhibit 38

## Annual Default Rates By Broad Industry Group, 1970-2017\*

first half 1/2

Year	Aerospace & Defense	Automotive	Banking	Beverage, Food, & Tobacco	Capital Equipment	Chemicals, Plastics, & Rubber	Construc- tion & Building	Consumer goods: Durable	Consumer goods: Non- durable	Containers, Energy: Packaging, Electricity & Glass	Energy: Oil & Gas	Environ- mental Industries	FIRE: Finance	FIRE: Insurance	FIRE: Real Estate	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	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
1972	0.00	0.00	0.00	0.00	1.10	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
1974	0.00	0.00	0.00	0.00	1.12	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
1976	0.00	0.00	0.00	0.00	1.04	0.00	0.00	0.00	2.63	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
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
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
1980	0.00	0.00	0.00	0.00	0.00	0.00	3.23	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
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
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
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
1985	0.00	0.00	0.00	0.00	1.84	2.04	0.00	0.00	1.82	0.00	0.00	3.43	0.00	3.45	0.00	0.00
1986	2.86	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
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
1988	2.33	0.00	1.45	0.00	0.00	1.64	2.82	4.35	3.73	0.00	4.55	2.13	0.00	1.52	0.00	0.00
1989	0.00	7.55	1.49	2.25	0.00	0.00	8.85	0.00	3.85	5.56	0.00	0.00	3.59	1.35	8.33	0.00
1990	0.00	3.89	1.84	5.61	2.61	0.00	16.93	4.76	10.03	0.00	8.00	1.47	0.00	0.00	0.00	0.00
1991	2.17	4.19	1.40	0.00	4.54	0.00	7.55	5.88	6.09	5.56	4.17	3.08	0.00	1.23	0.00	3.33

\*In percent.

## first half 2/2

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	FIRE: Finance	FIRE: Insurance	FIRE: Real Estate	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	0.80	0.00	0.00	0.00	4.76	0.00
1993	2.22	0.00	0.30	1.14	4.88	0.00	1.69	0.00	2.00	0.00	0.00	2.27	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	0.82	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	1.33	0.00	0.78	0.00	0.00	1.12	0.00	6.43	2.56	0.00	0.00	0.00	0.00	0.63	0.00	0.00
1998	0.00	1.06	0.30	0.70	0.00	2.44	0.00	0.00	4.42	0.00	0.00	1.29	5.88	0.69	0.00	2.66	1.33
1999	0.00	0.89	0.14	1.86	1.40	1.52	6.44	10.60	4.33	0.00	0.00	6.20	4.55	1.89	0.00	0.71	2.44
2000	1.59	4.83	0.00	2.88	4.21	1.48	1.98	3.45	14.34	8.28	0.00	0.40	16.67	0.62	1.48	0.00	4.46
2001	4.67	5.04	0.07	2.27	5.18	5.85	3.84	3.45	15.50	8.42	1.69	1.18	11.76	1.82	0.00	2.26	16.84
2002	0.00	1.63	0.39	1.63	2.05	0.00	5.04	3.13	6.01	5.26	10.20	2.33	14.29	0.00	0.45	0.83	2.76
2003	0.00	2.43	0.08	1.67	2.53	4.55	2.41	0.00	2.74	0.00	11.85	0.00	0.00	0.62	0.81	0.00	1.33
2004	0.00	2.35	0.00	1.66	0.97	0.00	2.27	2.70	4.49	1.56	0.00	0.35	0.00	0.00	0.39	0.00	1.43
2005	0.00	4.89	0.07	0.00	0.96	0.00	0.00	4.08	1.59	3.23	3.85	0.36	0.00	0.65	0.00	0.00	1.61
2006	0.00	4.49	0.00	1.12	1.52	0.00	2.05	1.89	3.04	1.67	0.00	0.00	0.00	0.00	0.71	0.00	0.00
2007	0.00	1.54	0.00	1.05	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	1.54	4.06	3.03	1.57	2.77	2.02	5.27	2.00	6.28	8.71	0.00	1.63	5.56	4.14	0.00	2.29	7.12
2009	4.52	17.83	0.93	4.28	10.15	7.89	14.72	23.45	6.73	9.33	1.96	1.98	0.00	4.98	0.33	6.31	17.37
2010	0.00	1.04	0.41	0.56	3.63	0.00	1.76	0.00	3.81	1.64	6.12	0.98	10.53	1.95	0.39	0.85	2.04
2011	0.00	0.92	0.54	0.00	1.95	0.00	2.27	0.00	0.00	3.51	2.00	0.98	0.00	0.58	0.38	0.78	1.85
2012	1.28	0.00	0.49	1.60	2.33	1.46	0.00	0.00	0.00	1.56	5.45	1.19	4.55	1.72	0.38	0.00	4.01
2013	1.25	0.85	1.21	1.59	0.60	0.68	2.45	0.00	2.08	1.56	1.82	1.61	4.76	0.00	0.39	0.66	0.00
2014	1.27	0.00	0.59	0.00	0.00	0.60	0.52	2.17	0.00	0.00	7.14	0.49	0.00	0.52	0.00	0.00	2.00
2015	2.57	0.00	1.55	1.93	0.00	0.00	2.23	2.00	4.64	0.00	0.00	7.06	4.35	0.51	0.75	0.53	4.17
2016	1.25	0.77	0.15	0.50	0.86	1.69	1.33	2.33	1.45	0.00	1.89	14.24	8.17	1.85	0.00	1.01	4.17
2017	2.63	0.00	0.38	0.00	0.43	1.02	0.44	0.00	0.00	0.00	5.36	6.09	5.56	0.50	0.00	0.49	8.99

\*In percent.



## second half 1/2

Year	Healthcare & Pharmaceuticals	High Tech Industries	Hotel, Gaming, & Leisure	Media: Advertising & Printing & Publishing	Media: Broad- casting & Sub- scription	Media: Diversified & Production	Metals & Mining	Retail	Services: Business	Services: Consumer	Sovereign & Public Finance	Telecomm- unications	Transport- ation: Cargo	Transport- ation: 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	5.85	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	1.12	6.49	5.88	0.00	0.00	0.00	1.05	9.52	12.50	0.00	0.00	1.09	0.00	0.00	1.59	0.00	4.35
1988	4.73	1.69	2.04	0.00	4.26	3.70	0.00	1.90	4.17	0.00	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.00
1989	2.53	1.78	13.81	0.00	4.35	11.71	0.00	2.52	4.17	0.00	10.53	0.98	1.14	3.57	0.00	0.00	0.00	0.00
1990	1.14	5.74	26.10	12.50	6.43	5.00	3.96	6.34	16.00	11.11	0.00	0.00	0.00	24.14	0.00	0.00	0.00	0.00
1991	4.82	2.25	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

\*In percent.

## second half 2/2

Year	Healthcare & Pharmaceuticals	High Tech Industries	Hotel, Gaming, & Leisure	Media: Advertising Printing & Publishing	Media: Broad- casting & Subscription	Media: Diversified & Production	Metals & Mining	Retail	Services: Business	Services: Consumer	Sovereign & Public Finance	Telecomm- unications	Transport- ation: Cargo	Transport- ation: Consumer	Utilities: Electric	Utilities: Oil & Gas	Utilities: Water	Wholesale
1992	1.43	3.38	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	4.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1994	1.03	3.03	5.36	0.00	2.44	0.00	0.00	2.49	3.57	0.00	0.00	0.00	1.25	2.94	0.00	0.00	0.00	3.70
1995	1.00	1.87	2.65	0.00	0.00	0.00	0.00	1.45	3.85	0.00	0.00	0.00	0.00	5.64	0.00	0.00	0.00	3.57
1996	0.00	1.03	2.29	0.00	0.00	18.75	0.00	0.74	2.94	0.00	0.00	0.68	0.00	0.00	0.00	0.00	0.00	0.00
1997	0.86	1.79	2.06	0.00	2.30	0.00	0.00	3.56	0.00	0.00	0.00	0.54	1.20	0.00	0.00	0.00	0.00	2.70
1998	3.05	0.73	2.90	2.44	2.55	5.56	2.91	5.41	0.00	0.00	0.00	0.95	1.06	0.00	0.00	0.00	0.00	7.14
1999	5.33	2.67	6.54	3.92	3.68	0.00	4.18	1.92	4.07	7.14	4.76	2.00	7.61	0.00	0.00	1.47	0.00	5.60
2000	4.75	3.15	6.15	1.56	1.55	3.45	6.87	4.83	2.53	8.82	4.65	2.70	4.04	5.45	0.00	0.00	0.00	10.06
2001	1.51	4.48	8.76	3.28	3.82	3.57	13.75	6.53	5.36	3.13	2.44	10.27	4.92	1.79	0.75	0.00	0.00	12.54
2002	0.72	2.70	1.85	3.55	13.83	8.52	7.24	2.80	2.73	3.03	0.00	14.47	4.64	8.96	0.00	1.20	3.70	8.62
2003	2.93	3.44	2.97	1.72	5.33	0.00	4.33	2.89	1.37	0.00	0.00	8.33	3.82	3.60	0.34	1.23	0.00	9.33
2004	0.75	0.00	4.14	0.00	4.68	0.00	1.90	0.71	2.64	0.00	0.00	1.54	0.00	5.17	0.31	0.00	0.00	2.78
2005	0.00	0.00	0.97	0.00	1.01	0.00	0.86	1.60	0.00	0.00	0.00	0.43	0.00	8.20	0.31	0.00	0.00	2.86
2006	0.00	2.58	0.84	0.00	3.03	0.00	0.00	0.74	0.00	0.00	0.00	0.00	3.60	0.00	0.00	0.00	0.00	2.50
2007	0.76	0.00	0.00	3.26	0.00	0.00	0.00	2.23	0.83	2.33	0.00	0.93	1.15	0.00	0.00	0.00	0.00	0.00
2008	0.79	0.00	10.07	7.60	1.93	7.41	0.77	2.85	0.68	0.00	0.00	2.44	4.91	0.00	0.00	0.00	0.00	0.00
2009	0.74	6.90	17.93	36.35	22.30	0.00	9.81	3.71	4.01	6.21	0.00	5.97	7.07	3.20	0.30	0.00	0.00	11.11
2010	1.43	1.54	4.50	15.35	2.05	0.00	0.00	4.06	1.95	0.00	0.00	1.56	1.39	0.00	0.00	0.99	0.00	2.78
2011	0.00	0.00	3.52	8.94	0.00	0.00	0.00	3.23	1.37	1.61	0.00	0.00	5.73	5.66	0.00	0.00	0.00	0.00
2012	0.69	1.15	3.92	16.29	1.00	0.00	2.12	2.13	1.73	6.10	0.00	1.71	1.12	1.96	0.55	0.00	0.00	0.00
2013	1.82	0.59	2.40	20.25	0.88	0.00	1.88	1.34	2.00	0.00	0.00	1.66	2.16	0.00	0.00	0.00	0.00	0.00
2014	0.00	2.71	1.56	8.70	0.00	0.00	5.10	2.33	2.57	3.00	1.10	1.64	0.97	0.00	0.00	0.00	0.00	0.00
2015	0.00	0.47	2.32	2.33	0.96	4.17	6.57	2.09	2.23	4.14	0.00	0.56	0.00	0.00	0.26	0.00	0.00	1.59
2016	0.62	0.81	0.73	16.19	0.00	0.00	8.89	3.65	1.13	0.00	0.00	1.60	2.01	1.59	0.25	0.00	0.00	5.85
2017	0.62	1.28	0.00	0.00	3.74	3.57	1.91	7.01	3.09	1.18	0.00	1.61	2.93	0.00	0.00	0.00	0.00	3.01

\*In percent.

Exhibit 39

## Annual Volume-Weighted Corporate Bond Default Rates By Letter Rating, 1994-2017\*

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	21.441	0.031	5.904	1.136
2000	0.000	0.000	0.000	0.623	1.696	5.484	19.959	0.137	5.655	1.307
2001	0.000	0.000	0.720	0.957	1.276	14.441	54.337	0.545	15.843	3.049
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	1.813	9.556	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	6.890	0.149	1.411	0.387
2012	0.000	0.000	0.000	0.018	0.000	0.142	11.103	0.007	2.006	0.390
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	19.320	0.000	3.490	0.738
2017	0.000	0.000	0.000	0.000	0.158	0.058	9.043	0.000	1.537	0.302
Mean	0.000	0.039	0.252	0.259	1.118	3.147	17.717	0.188	4.723	1.023
Median	0.000	0.000	0.000	0.000	0.080	1.595	11.205	0.003	2.606	0.691
StDev	0.000	0.167	0.723	0.494	2.076	4.224	17.151	0.457	5.410	1.119
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

\*In percent.

Exhibit 40

## Average Volume-Weighted Corporate Bond Default Rates By Letter Rating, 1994-2017\*

Rating / Year	1	2	3	4	5
Aaa	0.0000	0.0445	0.0445	0.0445	0.0445
Aa	0.0305	0.0805	0.1116	0.1510	0.2099
A	0.2358	0.4532	0.6386	0.7773	0.9451
Baa	0.1392	0.3056	0.4365	0.6696	0.9955
Ba	0.6803	1.7721	2.7759	3.7899	4.5070
B	2.6193	6.1347	9.4670	12.3915	14.3344
Caa-C	14.4109	23.8051	30.5097	33.7594	35.8235
Inv-Grade	0.1596	0.3249	0.4581	0.6039	0.7939
Spec-Grade	3.7999	7.3017	10.2514	12.4539	13.9262
All Rated	0.8731	1.6904	2.3678	2.9028	3.3295

\*In percent.

Exhibit 41

## Cumulative Issuer-Weighted Default Rates By Annual Cohort, 1970-2017

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
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
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
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
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
<b>1/1/74</b>																				
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
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
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
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
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
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
B	29	0.072	0.072	0.072	0.072	0.072	0.072	0.072	0.118	0.222	0.222	0.222	0.222	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
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	0.046	0.055	0.065	0.067
SG	229	0.013	0.023	0.028	0.038	0.049	0.049	0.049	0.062	0.110	0.118	0.118	0.134	0.197	0.226	0.226	0.238	0.263	0.330	0.344
All	1100	0.003	0.007	0.008	0.012	0.017	0.017	0.019	0.021	0.034	0.039	0.041	0.047	0.059	0.067	0.073	0.078	0.089	0.105	0.109
<b>1/1/75</b>																				
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
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
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
A	321	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004	0.004	0.007	0.007	0.015	0.015	0.019	0.028	0.032	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
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
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
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	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
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
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
<b>1/1/76</b>																				
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
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
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
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	0.052
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
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
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
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	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	0.066
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
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	0.106
<b>1/1/77</b>																				
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
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
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

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	0.004	0.005	0.016	0.023	0.030	0.037	0.052	0.060	0.068	0.072	0.089	0.105	0.108	0.112	0.112	0.114	0.114	0.114	0.114

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	0.039	0.061	0.069	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	234	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	1132	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	1465	0.009	0.018	0.028	0.047	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	0.145	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	250	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	1162	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	0.324	0.377	0.390	0.411	0.411	0.411	0.411	0.411	0.422	0.446	0.459	0.472	0.498	0.498
All	1522	0.009	0.019	0.039	0.049	0.062	0.072	0.093	0.109	0.113	0.118	0.118	0.119	0.119	0.120	0.122	0.126	0.132	0.144	0.156	0.157
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	303	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	1287	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	1720	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	352	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	1477	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	2033	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	0.087	0.099	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	0.750	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	0.093	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	0.136	0.139	0.145	0.157	0.169	0.172	0.172	0.174	0.177	0.179
<b>1/1/89</b>																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	171	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	1623	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	909	0.059	0.164	0.245	0.280	0.308	0.320	0.337	0.346	0.363	0.387	0.400	0.424	0.453	0.502	0.502	0.502	0.509	0.516	0.532	0.559
All	2532	0.022	0.060	0.088	0.101	0.109	0.112	0.117	0.119	0.124	0.128	0.132	0.138	0.151	0.164	0.166	0.166	0.168	0.171	0.173	0.185
<b>1/1/90</b>																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	192	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	0.020	0.025	0.053	0.081	0.087	0.087	0.087	0.087	0.094	0.094	0.102	0.128
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	1712	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	2637	0.036	0.064	0.079	0.087	0.090	0.095	0.097	0.101	0.106	0.109	0.116	0.129	0.141	0.143	0.143	0.145	0.147	0.149	0.161	0.176
<b>1/1/91</b>																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	179	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	493	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	1742	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.004	0.011	0.019	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	2534	0.028	0.042	0.051	0.054	0.060	0.061	0.065	0.070	0.073	0.079	0.092	0.104	0.105	0.106	0.108	0.111	0.113	0.124	0.140	0.141
<b>1/1/92</b>																					
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aaa	165	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	499	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	1845	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.002	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	2557	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	134	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	502	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	0.046	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	1938	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	2655	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	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	474	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	1003	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	0.106	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	2152	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	0.049	0.051	0.051
SG	862	0.023	0.054	0.073	0.086	0.109	0.149	0.187	0.230	0.271	0.288	0.300	0.304	0.319	0.324	0.356	0.403	0.403	0.403	0.412	0.412
All	3014	0.007	0.015	0.020	0.023	0.029	0.040	0.049	0.060	0.071	0.076	0.078	0.080	0.083	0.084	0.095	0.111	0.113	0.118	0.121	0.121

## 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	560	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	1079	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	0.105	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	502	0.040	0.065	0.090	0.123	0.166	0.220	0.311	0.385	0.428	0.451	0.458	0.465	0.474	0.492	0.522	0.522	0.522	0.522	0.522	0.522
Caa-C	94	0.105	0.165	0.165	0.207	0.313	0.419	0.557	0.631	0.631	0.631	0.631	0.631	0.631	0.631	0.631	0.631	0.631	0.631	0.631	0.631
IG	2331	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	3336	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	602	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	1156	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	0.038	0.038	0.041	0.041
Baa	650	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	0.096	0.100	0.100	0.100	0.112
Ba	468	0.000	0.007	0.021	0.056	0.076	0.110	0.137	0.153	0.153	0.165	0.177	0.184	0.207	0.257	0.257	0.257	0.267	0.267	0.267	0.267
B	571	0.015	0.040	0.088	0.121	0.177	0.253	0.328	0.364	0.389	0.395	0.401	0.408	0.434	0.486	0.486	0.486	0.486	0.486	0.486	0.512
Caa-C	106	0.103	0.152	0.198	0.345	0.444	0.567	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615
IG	2550	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	1145	0.017	0.036	0.069	0.110	0.151	0.208	0.258	0.283	0.295	0.303	0.312	0.319	0.342	0.390	0.390	0.390	0.396	0.396	0.396	0.408
All	3695	0.005	0.011	0.020	0.032	0.044	0.061	0.075	0.083	0.086	0.088	0.091	0.092	0.101	0.118	0.120	0.124	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	681	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	1178	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	0.043	0.052	0.054	0.054	0.054
Baa	821	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	590	0.002	0.014	0.051	0.082	0.107	0.140	0.155	0.155	0.164	0.173	0.178	0.194	0.229	0.229	0.229	0.236	0.236	0.236	0.259	0.259
B	689	0.020	0.063	0.103	0.156	0.250	0.313	0.348	0.373	0.381	0.396	0.407	0.438	0.503	0.503	0.503	0.503	0.512	0.512	0.512	0.521
Caa-C	127	0.098	0.174	0.308	0.474	0.589	0.626	0.626	0.626	0.626	0.626	0.626	0.626	0.626	0.626	0.626	0.626	0.626	0.626	0.626	0.626
IG	2818	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	1406	0.019	0.051	0.096	0.144	0.207	0.254	0.278	0.290	0.298	0.309	0.316	0.338	0.385	0.385	0.385	0.388	0.392	0.392	0.404	0.408
All	4224	0.006	0.017	0.031	0.045	0.066	0.080	0.088	0.092	0.094	0.097	0.099	0.109	0.126	0.127	0.132	0.135	0.138	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	735	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	1177	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	0.042	0.052	0.054	0.054	0.054	0.054
Baa	961	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	0.085	0.085	0.099	0.099	0.099
Ba	711	0.009	0.036	0.066	0.102	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	0.261	0.261
B	937	0.039	0.096	0.166	0.260	0.320	0.367	0.402	0.412	0.433	0.450	0.469	0.505	0.505	0.505	0.505	0.510	0.510	0.516	0.516	0.522
Caa-C	139	0.083	0.275	0.391	0.581	0.633	0.689	0.733	0.733	0.733	0.733	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
IG	2998	0.000	0.001	0.003	0.007	0.011	0.014	0.015	0.016	0.018	0.018	0.024	0.035	0.037	0.043	0.046	0.050	0.051	0.055	0.055	0.056
SG	1787	0.030	0.085	0.141	0.215	0.262	0.296	0.316	0.324	0.336	0.346	0.365	0.400	0.400	0.400	0.405	0.408	0.408	0.418	0.424	0.426
All	4785	0.011	0.031	0.052	0.079	0.098	0.110	0.117	0.120	0.124	0.126	0.135	0.152	0.154	0.158	0.161	0.165	0.166	0.171	0.172	0.174

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
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
Aa	731	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
A	1218	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	0.051
Baa	1102	0.001	0.005	0.013	0.025	0.030	0.033	0.035	0.038	0.038	0.047	0.068	0.072	0.079	0.083	0.086	0.086	0.098	0.098	0.098
Ba	701	0.015	0.035	0.061	0.087	0.107	0.109	0.115	0.121	0.124	0.150	0.186	0.190	0.190	0.199	0.199	0.199	0.205	0.221	0.221
B	1089	0.049	0.136	0.233	0.318	0.365	0.403	0.420	0.439	0.460	0.480	0.527	0.527	0.532	0.532	0.536	0.536	0.558	0.564	0.581
Caa-C	299	0.162	0.243	0.404	0.436	0.478	0.495	0.495	0.495	0.509	0.509	0.509	0.526	0.526	0.526	0.526	0.526	0.526	0.526	0.526
IG	3163	0.000	0.002	0.005	0.010	0.013	0.015	0.016	0.017	0.017	0.023	0.035	0.038	0.043	0.047	0.051	0.052	0.056	0.056	0.057

SG	2089	0.054	0.117	0.197	0.255	0.291	0.313	0.324	0.336	0.346	0.368	0.403	0.405	0.408	0.412	0.414	0.414	0.426	0.435	0.442
All	5252	0.021	0.046	0.079	0.103	0.117	0.125	0.129	0.133	0.136	0.147	0.164	0.167	0.171	0.175	0.178	0.179	0.184	0.187	0.189
<b>1/1/00</b>																				
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	0.000
Aa	726	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	0.008	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	0.058	0.058
Baa	1184	0.003	0.008	0.019	0.025	0.028	0.031	0.034	0.034	0.038	0.060	0.064	0.069	0.075	0.077	0.077	0.083	0.083	0.083	0.083
Ba	662	0.013	0.031	0.052	0.068	0.068	0.076	0.079	0.082	0.115	0.164	0.168	0.168	0.177	0.177	0.177	0.187	0.203	0.203	0.203
B	1167	0.057	0.157	0.244	0.295	0.334	0.354	0.382	0.400	0.424	0.483	0.486	0.490	0.490	0.494	0.499	0.520	0.530	0.547	0.547
Caa-C	313	0.179	0.400	0.494	0.562	0.601	0.601	0.601	0.601	0.601	0.620	0.620	0.640	0.640	0.640	0.640	0.640	0.640	0.640	0.640
IG	3278	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	0.054	0.054
SG	2142	0.061	0.150	0.216	0.256	0.281	0.294	0.309	0.319	0.344	0.392	0.396	0.399	0.403	0.405	0.407	0.420	0.431	0.438	0.438
All	5420	0.025	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	0.182	0.184	0.184
<b>1/1/01</b>																				
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		
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	754	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	0.010	0.013	0.013
A	1298	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	0.052	0.057	0.057	0.057	0.057	0.057
Baa	1157	0.002	0.014	0.020	0.025	0.028	0.031	0.031	0.034	0.054	0.056	0.061	0.070	0.072	0.072	0.076	0.078	0.078	0.078	0.078
Ba	622	0.012	0.028	0.046	0.046	0.057	0.060	0.063	0.096	0.151	0.155	0.155	0.165	0.165	0.165	0.175	0.186	0.192	0.192	0.192
B	1110	0.092	0.189	0.245	0.284	0.304	0.334	0.352	0.381	0.458	0.462	0.466	0.466	0.471	0.476	0.499	0.517	0.537	0.537	0.537
Caa-C	309	0.300	0.417	0.547	0.602	0.613	0.613	0.613	0.613	0.630	0.630	0.650	0.650	0.650	0.650	0.650	0.650	0.650	0.650	0.650
IG	3326	0.001	0.007	0.010	0.011	0.012	0.013	0.013	0.020	0.031	0.033	0.038	0.042	0.047	0.048	0.051	0.052	0.053	0.053	0.053
SG	2041	0.096	0.169	0.219	0.245	0.260	0.277	0.287	0.314	0.373	0.377	0.381	0.385	0.387	0.389	0.403	0.414	0.424	0.424	0.424
All	5367	0.037	0.067	0.086	0.095	0.100	0.105	0.108	0.119	0.142	0.144	0.148	0.152	0.156	0.158	0.163	0.166	0.169	0.169	0.169
<b>1/1/02</b>																				
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
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
Aa	757	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	0.010	0.013	0.013	0.013
A	1302	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	0.052	0.052	0.052	0.052
Baa	1249	0.010	0.015	0.015	0.018	0.019	0.019	0.022	0.041	0.041	0.042	0.050	0.052	0.052	0.056	0.058	0.058	0.058	0.058	0.058
Ba	601	0.014	0.037	0.046	0.055	0.063	0.067	0.095	0.147	0.151	0.151	0.164	0.164	0.164	0.179	0.184	0.190	0.190	0.190	0.190
B	893	0.047	0.098	0.130	0.153	0.184	0.200	0.243	0.340	0.356	0.369	0.369	0.374	0.379	0.398	0.424	0.444	0.444	0.444	0.444
Caa-C	359	0.268	0.410	0.485	0.498	0.527	0.538	0.554	0.601	0.601	0.619	0.619	0.619	0.619	0.619	0.619	0.619	0.619	0.619	0.619
IG	3433	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	0.044	0.044	0.044	0.044
SG	1853	0.077	0.132	0.160	0.177	0.198	0.208	0.240	0.309	0.318	0.326	0.332	0.334	0.336	0.350	0.362	0.372	0.372	0.372	0.372
All	5286	0.029	0.049	0.058	0.063	0.069	0.071	0.083	0.107	0.110	0.114	0.119	0.122	0.124	0.129	0.132	0.134	0.134	0.134	0.134
<b>1/1/03</b>																				
Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15				
Aaa	123	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	687	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	0.013	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	0.046	0.046	0.046	0.046	0.046
Baa	1209	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	0.031	0.031	0.031	0.031
Ba	591	0.009	0.013	0.019	0.024	0.027	0.055	0.106	0.114	0.114	0.127	0.127	0.127	0.136	0.146	0.151	0.151	0.151	0.151	0.151

B	873	0.027	0.047	0.068	0.094	0.108	0.153	0.253	0.269	0.280	0.296	0.304	0.308	0.327	0.348	0.364
Caa-C	359	0.206	0.316	0.344	0.382	0.391	0.403	0.473	0.473	0.506	0.506	0.506	0.506	0.506	0.506	0.506
IG	3309	0.000	0.000	0.001	0.001	0.001	0.007	0.014	0.016	0.019	0.023	0.027	0.028	0.031	0.031	0.032
SG	1823	0.053	0.082	0.098	0.117	0.126	0.159	0.234	0.245	0.253	0.266	0.269	0.271	0.284	0.297	0.306
All	5132	0.018	0.028	0.033	0.039	0.041	0.054	0.078	0.082	0.086	0.091	0.095	0.097	0.102	0.105	0.107

1/1/04

Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
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
Aa	654	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
A	1276	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	0.040
Baa	1269	0.000	0.002	0.002	0.002	0.003	0.019	0.019	0.019	0.027	0.028	0.028	0.033	0.035	0.035
Ba	569	0.004	0.006	0.013	0.018	0.045	0.099	0.102	0.102	0.111	0.111	0.111	0.125	0.135	0.140
B	966	0.008	0.021	0.040	0.049	0.091	0.201	0.214	0.222	0.241	0.248	0.251	0.263	0.276	0.295
Caa-C	314	0.118	0.185	0.229	0.259	0.287	0.405	0.416	0.475	0.491	0.491	0.491	0.491	0.514	0.514
IG	3342	0.000	0.001	0.001	0.001	0.006	0.014	0.015	0.018	0.022	0.026	0.027	0.030	0.031	0.031
SG	1849	0.024	0.041	0.060	0.070	0.105	0.195	0.204	0.214	0.228	0.231	0.233	0.245	0.257	0.268
All	5191	0.008	0.014	0.020	0.023	0.036	0.065	0.068	0.073	0.079	0.083	0.084	0.089	0.092	0.095

1/1/05

Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12	13
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
Aa	672	0.000	0.000	0.000	0.002	0.002	0.008	0.010	0.010	0.013	0.013	0.013	0.013	0.016
A	1326	0.000	0.000	0.000	0.008	0.013	0.015	0.020	0.021	0.028	0.030	0.034	0.034	0.034
Baa	1291	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
Ba	560	0.000	0.006	0.009	0.036	0.089	0.095	0.095	0.106	0.106	0.106	0.123	0.127	0.132
B	1050	0.008	0.026	0.037	0.085	0.203	0.216	0.225	0.244	0.255	0.258	0.272	0.291	0.307
Caa-C	346	0.073	0.113	0.145	0.218	0.377	0.409	0.489	0.502	0.515	0.532	0.551	0.571	0.571
IG	3421	0.001	0.001	0.001	0.006	0.013	0.015	0.018	0.021	0.025	0.026	0.029	0.029	0.030
SG	1956	0.017	0.036	0.047	0.092	0.194	0.207	0.220	0.235	0.242	0.245	0.261	0.273	0.282
All	5377	0.006	0.012	0.016	0.033	0.067	0.072	0.078	0.084	0.089	0.090	0.096	0.099	0.102

1/1/06

Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11	12
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
Aa	691	0.000	0.000	0.002	0.002	0.008	0.010	0.010	0.012	0.012	0.012	0.012	0.015
A	1385	0.000	0.000	0.007	0.010	0.012	0.018	0.019	0.027	0.029	0.033	0.033	0.033
Baa	1280	0.000	0.000	0.006	0.016	0.016	0.016	0.022	0.024	0.024	0.027	0.028	0.028
Ba	567	0.002	0.002	0.031	0.094	0.094	0.094	0.104	0.107	0.110	0.132	0.136	0.140
B	1117	0.011	0.020	0.082	0.190	0.213	0.229	0.253	0.263	0.269	0.293	0.320	0.350
Caa-C	375	0.059	0.100	0.199	0.386	0.440	0.497	0.505	0.526	0.538	0.551	0.598	0.598
IG	3483	0.000	0.000	0.005	0.010	0.012	0.015	0.017	0.022	0.023	0.025	0.026	0.026
SG	2059	0.017	0.029	0.086	0.192	0.212	0.228	0.245	0.253	0.258	0.280	0.298	0.313
All	5542	0.006	0.010	0.032	0.069	0.076	0.082	0.089	0.094	0.096	0.103	0.108	0.112

1/1/07

Rating	n(0)	1	2	3	4	5	6	7	8	9	10	11
Aaa	136	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	738	0.000	0.002	0.002	0.007	0.009	0.009	0.011	0.011	0.011	0.011	0.013

A	1379	0.000	0.007	0.011	0.012	0.017	0.019	0.029	0.031	0.034	0.034	0.034
Baa	1281	0.000	0.007	0.017	0.017	0.017	0.023	0.025	0.025	0.028	0.029	0.031
Ba	623	0.000	0.018	0.078	0.085	0.085	0.099	0.107	0.110	0.132	0.145	0.148
B	1145	0.000	0.065	0.178	0.209	0.227	0.255	0.268	0.279	0.306	0.334	0.355
Caa-C	423	0.050	0.162	0.345	0.389	0.429	0.454	0.483	0.492	0.502	0.581	0.609
IG	3534	0.000	0.006	0.011	0.013	0.015	0.018	0.023	0.024	0.026	0.026	0.027
SG	2191	0.009	0.069	0.179	0.205	0.220	0.242	0.255	0.262	0.285	0.310	0.323
All	5725	0.003	0.028	0.070	0.080	0.086	0.095	0.102	0.104	0.112	0.119	0.123

1/1/08

Rating	n(0)	1	2	3	4	5	6	7	8	9	10
Aaa	169	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	824	0.005	0.005	0.009	0.014	0.014	0.017	0.019	0.023	0.023	0.025
A	1301	0.004	0.009	0.011	0.014	0.018	0.028	0.029	0.031	0.031	0.031
Baa	1244	0.010	0.018	0.018	0.018	0.022	0.023	0.023	0.023	0.025	0.026
Ba	629	0.023	0.072	0.074	0.074	0.085	0.092	0.097	0.119	0.130	0.136
B	1020	0.040	0.149	0.178	0.196	0.220	0.231	0.241	0.274	0.296	0.320
Caa-C	655	0.107	0.286	0.342	0.376	0.409	0.438	0.464	0.485	0.549	0.563
IG	3538	0.006	0.011	0.013	0.015	0.017	0.022	0.023	0.025	0.026	0.027
SG	2304	0.054	0.166	0.195	0.211	0.233	0.246	0.257	0.283	0.306	0.320
All	5842	0.025	0.072	0.083	0.090	0.099	0.107	0.111	0.119	0.126	0.130

1/1/09

Rating	n(0)	1	2	3	4	5	6	7	8	9
Aaa	148	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	737	0.000	0.002	0.005	0.005	0.008	0.010	0.016	0.016	0.018
A	1291	0.002	0.004	0.007	0.010	0.019	0.020	0.022	0.022	0.022
Baa	1233	0.009	0.009	0.012	0.014	0.015	0.016	0.016	0.019	0.020
Ba	602	0.018	0.022	0.022	0.035	0.042	0.050	0.066	0.075	0.081
B	861	0.072	0.084	0.098	0.117	0.126	0.139	0.185	0.207	0.232
Caa-C	757	0.261	0.334	0.367	0.407	0.436	0.459	0.476	0.535	0.550
IG	3409	0.004	0.005	0.008	0.010	0.014	0.016	0.018	0.019	0.019
SG	2220	0.121	0.151	0.166	0.190	0.204	0.217	0.243	0.267	0.282
All	5629	0.050	0.062	0.069	0.078	0.086	0.091	0.100	0.107	0.111

1/1/10

Rating	n(0)	1	2	3	4	5	6	7	8
Aaa	99	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	573	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
A	1232	0.002	0.005	0.008	0.016	0.019	0.024	0.024	0.024
Baa	1354	0.001	0.003	0.005	0.008	0.009	0.010	0.013	0.014
Ba	586	0.000	0.000	0.006	0.015	0.020	0.038	0.046	0.052
B	834	0.004	0.018	0.039	0.047	0.066	0.110	0.133	0.153
Caa-C	723	0.085	0.128	0.186	0.229	0.261	0.288	0.346	0.372
IG	3258	0.001	0.003	0.005	0.009	0.011	0.013	0.014	0.015
SG	2143	0.030	0.049	0.077	0.096	0.113	0.143	0.169	0.185
All	5401	0.012	0.021	0.032	0.041	0.047	0.058	0.066	0.071

1/1/11

Rating	n(0)	1	2	3	4	5	6	7
Aaa	86	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aa	542	0.002	0.002	0.002	0.002	0.002	0.002	0.004
A	1222	0.000	0.001	0.008	0.009	0.010	0.010	0.010
Baa	1447	0.004	0.004	0.008	0.011	0.012	0.015	0.016
Ba	640	0.002	0.012	0.020	0.028	0.050	0.059	0.064
B	968	0.003	0.021	0.034	0.053	0.097	0.133	0.153
Caa-C	744	0.059	0.128	0.176	0.214	0.252	0.310	0.336
IG	3297	0.002	0.003	0.007	0.008	0.009	0.011	0.011
SG	2352	0.020	0.051	0.071	0.092	0.126	0.157	0.172
All	5649	0.009	0.021	0.032	0.040	0.052	0.063	0.068

## 1/1/12

Rating	n(0)	1	2	3	4	5	6
Aaa	84	0.000	0.000	0.000	0.000	0.000	0.000
Aa	437	0.000	0.000	0.002	0.002	0.002	0.002
A	1191	0.000	0.001	0.001	0.001	0.001	0.002
Baa	1480	0.001	0.004	0.005	0.005	0.008	0.008
Ba	721	0.001	0.015	0.020	0.034	0.050	0.058
B	1000	0.005	0.017	0.037	0.077	0.111	0.139
Caa-C	839	0.078	0.130	0.173	0.226	0.284	0.310
IG	3192	0.000	0.002	0.003	0.003	0.004	0.005
SG	2560	0.028	0.052	0.074	0.109	0.142	0.162
All	5752	0.012	0.024	0.033	0.046	0.058	0.065

## 1/1/13

Rating	n(0)	1	2	3	4	5
Aaa	60	0.000	0.000	0.000	0.000	0.000
Aa	298	0.000	0.000	0.000	0.000	0.000
A	1166	0.001	0.002	0.002	0.002	0.002
Baa	1663	0.001	0.002	0.002	0.003	0.003
Ba	708	0.006	0.011	0.020	0.033	0.045
B	1055	0.009	0.023	0.066	0.107	0.128
Caa-C	946	0.062	0.103	0.171	0.232	0.270
IG	3187	0.001	0.002	0.002	0.002	0.002
SG	2709	0.026	0.046	0.087	0.125	0.147
All	5896	0.012	0.021	0.038	0.053	0.061

## 1/1/14

Rating	n(0)	1	2	3	4
Aaa	55	0.000	0.000	0.000	0.000
Aa	292	0.000	0.000	0.000	0.000
A	1162	0.001	0.001	0.001	0.001
Baa	1725	0.001	0.001	0.002	0.002
Ba	739	0.001	0.006	0.016	0.025
B	1107	0.005	0.036	0.073	0.097
Caa-C	1140	0.046	0.117	0.185	0.240
IG	3234	0.001	0.001	0.001	0.001

SG	2986	0.019	0.058	0.098	0.127
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All	6220	0.009	0.027	0.044	0.055
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1/1/15

Rating	n(0)	1	2	3
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Aaa	55	0.000	0.000	0.000
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Aa	302	0.000	0.000	0.000
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A	1237	0.000	0.000	0.000
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Baa	1724	0.000	0.000	0.000
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Ba	747	0.003	0.015	0.021
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B	1101	0.023	0.057	0.076
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Caa-C	1348	0.068	0.131	0.182
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IG	3318	0.000	0.000	0.000
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SG	3196	0.037	0.077	0.105
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All	6514	0.018	0.036	0.048
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1/1/16

Rating	n(0)	1	2
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Aaa	53	0.000	0.000
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Aa	304	0.000	0.000
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A	1290	0.000	0.000
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Baa	1713	0.000	0.000
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Ba	763	0.001	0.004
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B	1043	0.015	0.026
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Caa-C	1414	0.090	0.149
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IG	3360	0.000	0.000
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SG	3220	0.045	0.073
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All	6580	0.021	0.034
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1/1/17

Rating	n(0)	1
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Aaa	54	0.000
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Aa	297	0.000
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A	1260	0.000
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Baa	1702	0.000
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Ba	831	0.002
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B	1009	0.003
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Caa-C	1426	0.064
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IG	3313	0.000
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SG	3266	0.029
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All	6579	0.014
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**Moody's related publications**

[Annual Default Study: Corporate Default and Recovery Rates, 1920-2016](#)

[Impairment and Loss Rates of Structured Finance Securities: 1993-2016](#)

[Glossary of Moody's Ratings Performance Metrics](#)

[Introducing Moody's Credit Transition Model](#)

## Endnotes

- [1](#) 2014 marks the beginning of the latest commodity crisis when commodity prices began to fall substantially.
- [2](#) Combines Oil & Gas and Metals & Mining.
- [3](#) Only 88 were included in the January 1st cohort. See details in Exhibit 15.
- [4](#) 2017 also recorded defaults by the governments of Venezuela, Congo, Belize, and Mozambique, which are outside the scope of this report.
- [5](#) The dollar-weighted bond default rates only include bonds issued by US and European issuers.
- [6](#) Together with Toys 'R' US, Inc., the corporate family's total default amount was \$3.3 billion.
- [7](#) The 9.0% default rate is based on 49 issuers.
- [8](#) The industry default rates in this report refer to Moody's entire rated universe combining investment-grade and speculative-grade companies.
- [9](#) In Exhibit 7, we use market prices (bids) to proxy recoveries.
- [10](#) 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. Please see Exhibit 19 for more details.
- [11](#) Moody's research shows that distressed exchanges generally have higher recovery rates than non-distressed exchange defaults. For details, please see Moody's Special Comment, [A closer look at distressed exchanges, December 2017](#).
- [12](#) For distressed exchanges, we take trading prices at default. For other types of defaults, we take trading prices approximately one month after default.
- [13](#) For details, see Moody's Special Comment [Moody's Ultimate Recovery Database, April 2007](#).
- [14](#) 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 over 5500 loans and bonds from more than 1,100 North American corporate defaulters since 1987.
- [15](#) 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 debts.
- [16](#) The high yield spreads are option-adjusted. The unemployment rate forecast is sourced from Moody's Economy.com.
- [17](#) See Oil and Gas –Global 2018 Outlook, Moody's Outlook Research, December 2017.
- [18](#) The industry default rate forecasts include both investment-grade and speculative-grade issuers.
- [19](#) For details, see Moody's outlook research: Retail, Apparel, Restaurants – US, December 2017.
- [20](#) Note that the EDF-implied default rate forecast includes rated and unrated issuers.
- [21](#) 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, please refer to [Public Firm Expected Default Frequency \(EDF\) Credit Measures: Methodology, Performance, and Model Extensions, Moody's Capital Markets Research, June, 2012](#).
- [22](#) We apply S4 - Protracted Slump scenario in our pessimistic forecast. For more details about the description and assumption under this economic scenario, please refer to the [Standard Stress Scenarios webpage from Moody's Analytics - Economy.com](#).
- [23](#) For a detailed discussion of average default position and the mathematical derivation of accuracy ratio from the average default position, please refer to Moody's Special Comment, [Measuring Ratings Accuracy Using Average Default Position](#), Feb 2011.

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