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INVESTORS SERVICE

Moody's Infrastructure-relevant Data Sets

Andrew Davison, Senior Vice President

2 November, 2017

Moody's Infrastructure-relevant Data Sets

» Unique insight on the credit performance of two infrastructure-relevant data sets:
  - $2.0 trillion of unrated project finance bank loans
  - $2.8 trillion of Moody’s-rated infrastructure debt securities

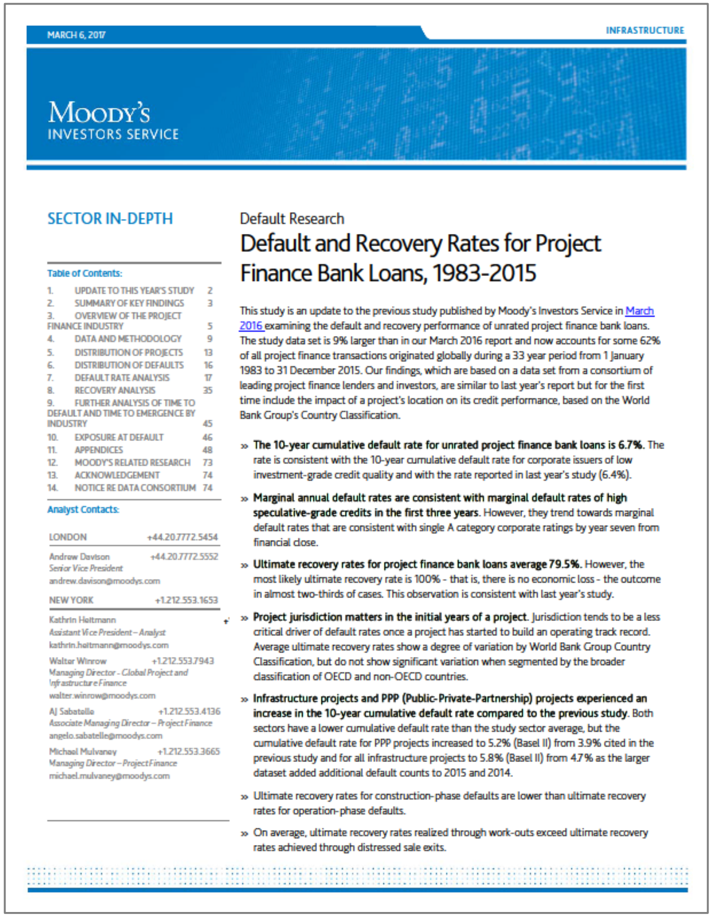
» Recent default study research on unrated project finance bank loans
  - Jan 2017: Project type and jurisdiction matter
  - Mar 2017: Annual default study (1983-2015)
  - Oct 2017: Infrastructure sector hurt by demand risk

» Recent default study research on Moody’s-rated infrastructure debt
  - Apr 2017: Addendum to default study (1983-2015) focusing on corporate infrastructure
  - Jul 2017: Annual default study (1983-2016)

Moody’s analysis shows credit characteristics that are likely to be attractive to long-term investors

Moody’s PF Bank Loan Data Set

Mar 2017: Annual default study (1983-2015)



MARCH 6, 2017 INFRASTRUCTURE

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SECTOR IN-DEPTH

Default Research

Default and Recovery Rates for Project Finance Bank Loans, 1983-2015

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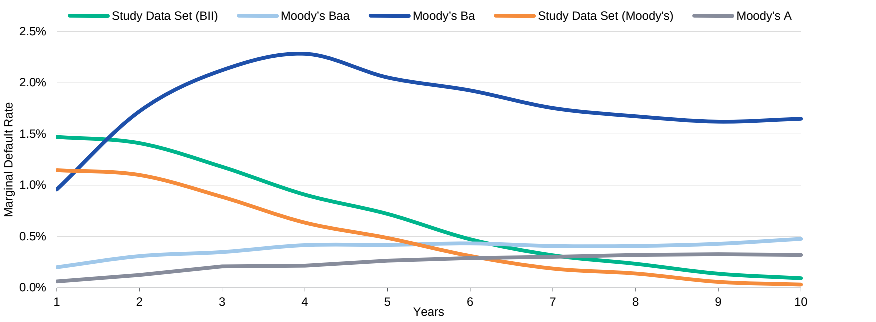
This study is an update to the previous study published by Moody's Investors Service in March 2016 examining the default and recovery performance of unrated project finance bank loans. The study data set is 9% larger than in our March 2016 report and now accounts for some 62% of all project finance transactions originated globally during a 33 year period from 1 January 1983 to 31 December 2015. Our findings, which are based on a data set from a consortium of leading project finance lenders and investors, are similar to last year's report but for the first time include the impact of a project's location on its credit performance, based on the World Bank Group's Country Classification.

- **The 10-year cumulative default rate for unrated project finance bank loans is 6.7%.** The rate is consistent with the 10-year cumulative default rate for corporate issuers of low investment-grade credit quality and with the rate reported in last year's study (6.4%).
- **Marginal annual default rates are consistent with marginal default rates of high speculative-grade credits in the first three years.** However, they trend towards marginal default rates that are consistent with single A category corporate ratings by year seven from financial close.
- **Ultimate recovery rates for project finance bank loans average 79.5%.** However, the most likely ultimate recovery rate is 100% - that is, there is no economic loss - the outcome in almost two-thirds of cases. This observation is consistent with last year's study.
- **Project jurisdiction matters in the initial years of a project.** Jurisdiction tends to be a less critical driver of default rates once a project has started to build an operating track record. Average ultimate recovery rates show a degree of variation by World Bank Group Country Classification, but do not show significant variation when segmented by the broader classification of OECD and non-OECD countries.
- **Infrastructure projects and PPP (Public-Private-Partnership) projects experienced an increase in the 10-year cumulative default rate compared to the previous study.** Both sectors have a lower cumulative default rate than the study sector average, but the cumulative default rate for PPP projects increased to 5.2% (Basel II) from 3.9% cited in the previous study and for all infrastructure projects to 5.8% (Basel II) from 4.7% as the larger dataset added additional default counts to 2015 and 2014.
- Ultimate recovery rates for construction-phase defaults are lower than ultimate recovery rates for operation-phase defaults.
- On average, ultimate recovery rates realized through work-outs exceed ultimate recovery rates achieved through distressed sale exits.

» Latest annual default study published in March 2017:
  - Updated data set 9% larger
  - 6,389 projects representing 62% of all project finance transactions 1983-2015
  - New insight 2008-15 and from segmentation by World Bank Group country classification

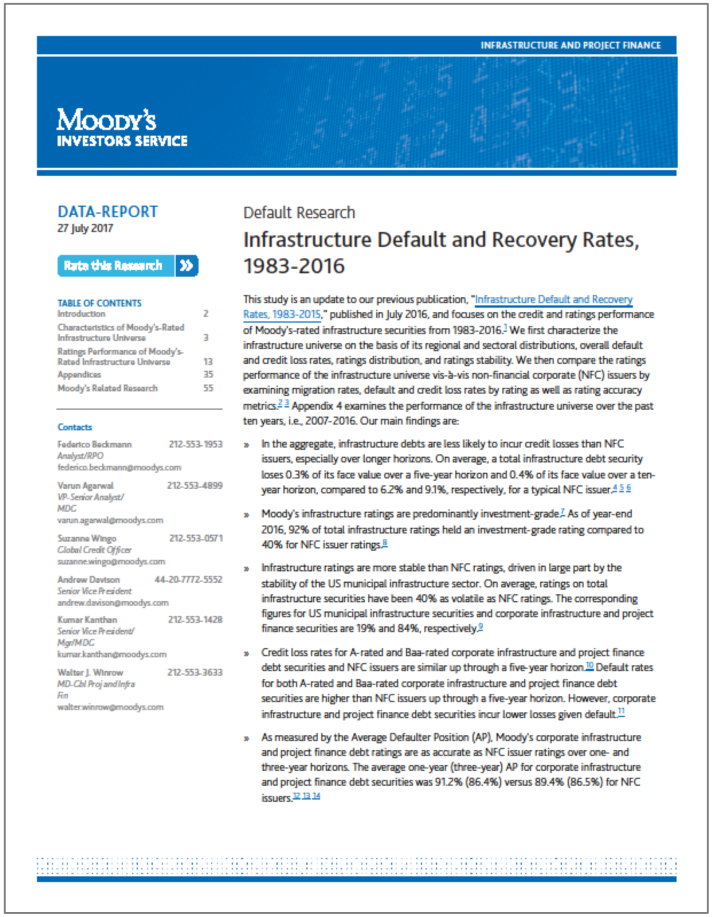
» Key findings include:
  - Marginal default rates trend towards levels consistent with single-A:



  - Incremental risk during the construction phase and/or ramp-up
  - Ultimate recovery rates are high, averaging 80%
  - Adverse impact of demand risk in the Infrastructure sector
  - Project jurisdiction matters
  - PPP projects are a discrete sub-sector

Moody’s-rated Infrastructure Data Set

Jul 2017: Annual default study (1983-2016)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27 July 2017

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Default Research

Infrastructure Default and Recovery Rates, 1983-2016

This study is an update to our previous publication, "Infrastructure Default and Recovery Rates, 1983-2015," published in July 2016, and focuses on the credit and ratings performance of Moody's-rated infrastructure securities from 1983-2016.[1] We first characterize the infrastructure universe on the basis of its regional and sectoral distributions, overall default and credit loss rates, ratings distribution, and ratings stability. We then compare the ratings performance of the infrastructure universe vis-à-vis non-financial corporate (NFC) issuers by examining migration rates, default and credit loss rates by rating as well as rating accuracy metrics.[2] [3] Appendix 4 examines the performance of the infrastructure universe over the past ten years, i.e., 2007-2016. Our main findings are:

» In the aggregate, infrastructure debts are less likely to incur credit losses than NFC issuers, especially over longer horizons. On average, a total infrastructure debt security loses 0.3% of its face value over a five-year horizon and 0.4% of its face value over a ten-year horizon, compared to 6.2% and 9.1%, respectively, for a typical NFC issuer.[4] [5] [6]

» Moody's infrastructure ratings are predominantly investment-grade.[7] As of year-end 2016, 92% of total infrastructure ratings held an investment-grade rating compared to 40% for NFC issuer ratings.[8]

» Infrastructure ratings are more stable than NFC ratings, driven in large part by the stability of the US municipal infrastructure sector. On average, ratings on total infrastructure securities have been 40% as volatile as NFC ratings. The corresponding figures for US municipal infrastructure securities and corporate infrastructure and project finance securities are 19% and 84%, respectively.[9]

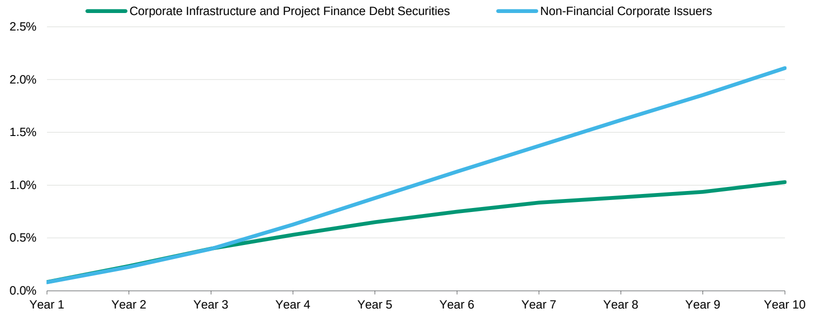
» Credit loss rates for A-rated and Baa-rated corporate infrastructure and project finance debt securities and NFC issuers are similar up through a five-year horizon.[10] Default rates for both A-rated and Baa-rated corporate infrastructure and project finance debt securities are higher than NFC issuers up through a five-year horizon. However, corporate infrastructure and project finance debt securities incur lower losses given default.[11]

» As measured by the Average Defaulter Position (AP), Moody's corporate infrastructure and project finance debt ratings are as accurate as NFC issuer ratings over one- and three-year horizons. The average one-year (three-year) AP for corporate infrastructure and project finance debt securities was 91.2% (86.4%) versus 89.4% (86.5%) for NFC issuers.[12] [13] [14]

» Latest annual default study published in Jul 2017:
  – We report on the credit and ratings performance of Moody's-rated infrastructure debts from 1983-2016

» Key findings include:
  – Infrastructure ratings are more stable than than those of non-financial corporates
  – Credit loss rates for A-rated and Baa-rated infrastructure debts are lower over the medium/long term compared with like-rated non-financial corporates

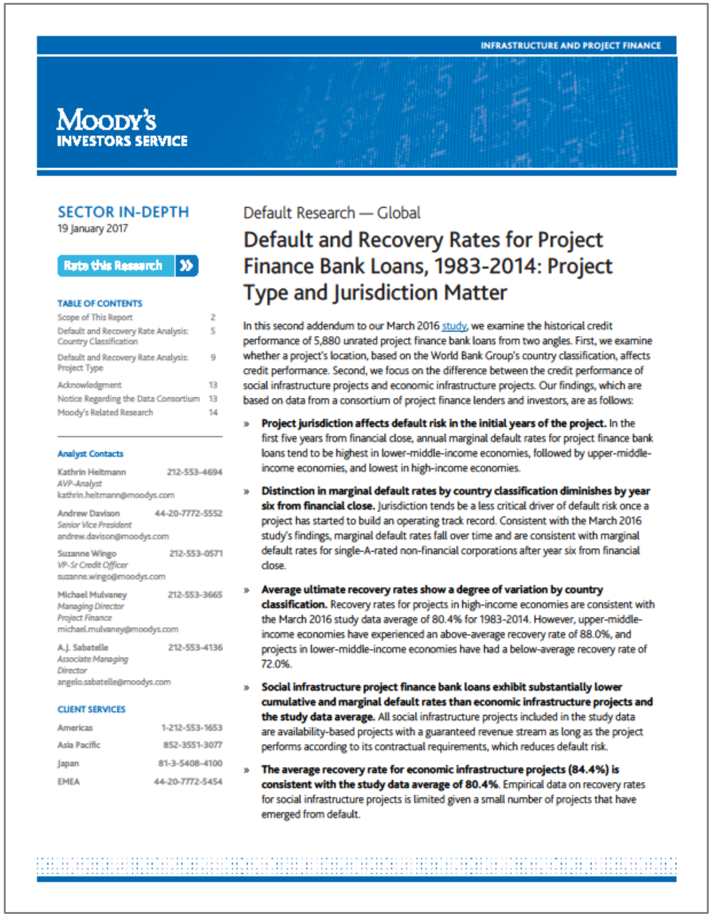
Baa Credit Loss Rates:



Appendix

Moody’s PF Bank Loan Data set

Jan 2017: Project type and jurisdiction matter



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Default Research — Global

Default and Recovery Rates for Project Finance Bank Loans, 1983-2014: Project Type and Jurisdiction Matter

In this second addendum to our March 2016 study, we examine the historical credit performance of 5,880 unrated project finance bank loans from two angles. First, we examine whether a project's location, based on the World Bank Group's country classification, affects credit performance. Second, we focus on the difference between the credit performance of social infrastructure projects and economic infrastructure projects. Our findings, which are based on data from a consortium of project finance lenders and investors, are as follows:

» **Project jurisdiction affects default risk in the initial years of the project.** In the first five years from financial close, annual marginal default rates for project finance bank loans tend to be highest in lower-middle-income economies, followed by upper-middle-income economies, and lowest in high-income economies.

» **Distinction in marginal default rates by country classification diminishes by year six from financial close.** Jurisdiction tends be a less critical driver of default risk once a project has started to build an operating track record. Consistent with the March 2016 study's findings, marginal default rates fall over time and are consistent with marginal default rates for single-A-rated non-financial corporations after year six from financial close.

» **Average ultimate recovery rates show a degree of variation by country classification.** Recovery rates for projects in high-income economies are consistent with the March 2016 study data average of 80.4% for 1983-2014. However, upper-middle-income economies have experienced an above-average recovery rate of 88.0%, and projects in lower-middle-income economies have had a below-average recovery rate of 72.0%.

» **Social infrastructure project finance bank loans exhibit substantially lower cumulative and marginal default rates than economic infrastructure projects and the study data average.** All social infrastructure projects included in the study data are availability-based projects with a guaranteed revenue stream as long as the project performs according to its contractual requirements, which reduces default risk.

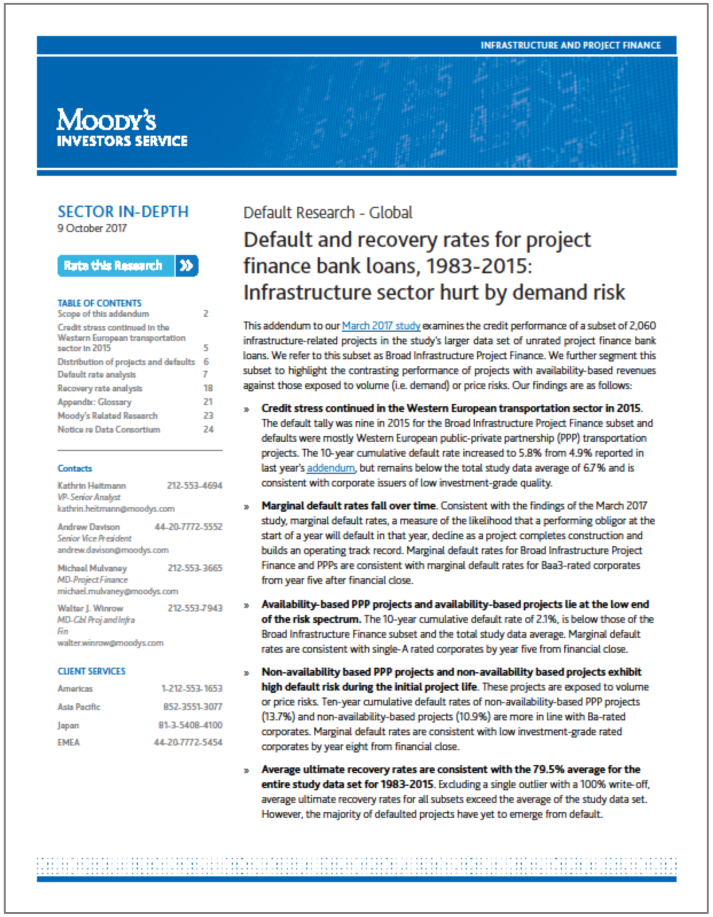
» **The average recovery rate for economic infrastructure projects (84.4%) is consistent with the study data average of 80.4%.** Empirical data on recovery rates for social infrastructure projects is limited given a small number of projects that have emerged from default.

» Incremental research published in Jan 2017 examining:
  – Whether a project's location affects credit performance
  – Differences between the credit performance of social infrastructure and economic infrastructure

» Key findings include:
  – Project jurisdiction affects default risk in the initial years of the project
  – Distinction in marginal default rates by country classification diminish as loans season
  – Average ultimate recovery rates show a degree of variation by country classification
  – Social infrastructure projects exhibit substantially lower default rates than economic infrastructure projects
  – The average recovery rate for economic infrastructure projects is consistent with the study average

Moody's PF Bank Loan Data set

Oct 2017: Infrastructure sector hurt by demand risk



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Default Research - Global

Default and recovery rates for project finance bank loans, 1983-2015: Infrastructure sector hurt by demand risk

This addendum to our March 2017 study examines the credit performance of a subset of 2,060 infrastructure-related projects in the study's larger data set of unrated project finance bank loans. We refer to this subset as Broad Infrastructure Project Finance. We further segment this subset to highlight the contrasting performance of projects with availability-based revenues against those exposed to volume (i.e. demand) or price risks. Our findings are as follows:

» **Credit stress continued in the Western European transportation sector in 2015.** The default tally was nine in 2015 for the Broad Infrastructure Project Finance subset and defaults were mostly Western European public-private partnership (PPP) transportation projects. The 10-year cumulative default rate increased to 5.8% from 4.9% reported in last year's addendum, but remains below the total study data average of 6.7% and is consistent with corporate issuers of low investment-grade quality.

» **Marginal default rates fall over time.** Consistent with the findings of the March 2017 study, marginal default rates, a measure of the likelihood that a performing obligor at the start of a year will default in that year, decline as a project completes construction and builds an operating track record. Marginal default rates for Broad Infrastructure Project Finance and PPPs are consistent with marginal default rates for Baa3-rated corporates from year five after financial close.

» **Availability-based PPP projects and availability-based projects lie at the low end of the risk spectrum.** The 10-year cumulative default rate of 2.1%, is below those of the Broad Infrastructure Finance subset and the total study data average. Marginal default rates are consistent with single-A rated corporates by year five from financial close.

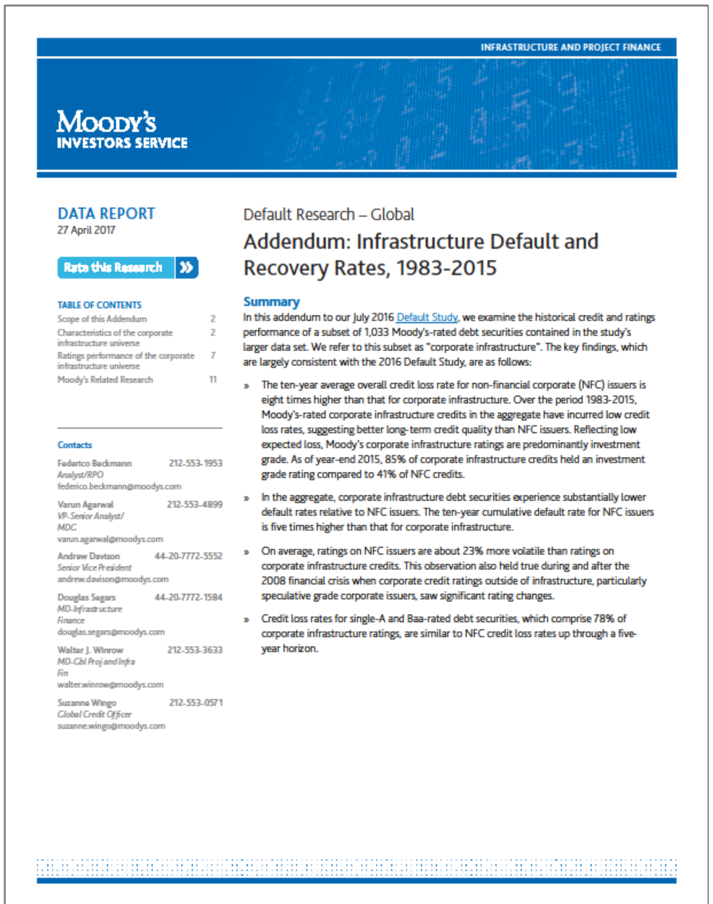
» **Non-availability based PPP projects and non-availability based projects exhibit high default risk during the initial project life.** These projects are exposed to volume or price risks. Ten-year cumulative default rates of non-availability-based PPP projects (13.7%) and non-availability-based projects (10.9%) are more in line with Ba-rated corporates. Marginal default rates are consistent with low investment-grade rated corporates by year eight from financial close.

» **Average ultimate recovery rates are consistent with the 79.5% average for the entire study data set for 1983-2015.** Excluding a single outlier with a 100% write-off, average ultimate recovery rates for all subsets exceed the average of the study data set. However, the majority of defaulted projects have yet to emerge from default.

- Incremental research published in Oct 2017 examining a subset of infrastructure-related projects
  - We also contrast the performance of projects with availability-based revenues versus those exposed to revenue risk
- Key findings include:
  - Credit stress continued in the Western European transportation sector in 2015
  - Marginal default rates fall over time
  - Availability-based PPP projects and availability-based projects lie at the low end of the risk spectrum
  - Non-availability based PPP projects and non-availability based projects exhibit high default risk during the initial project life
  - Average ultimate recovery rates are consistent with the study average

Moody's-rated Infrastructure Data Set

Apr 2017: Addendum to default study (1983-2015) focusing on corporate infrastructure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Default Research – Global

Addendum: Infrastructure Default and Recovery Rates, 1983-2015

Summary

In this addendum to our July 2016 Default Study, we examine the historical credit and ratings performance of a subset of 1,033 Moody's-rated debt securities contained in the study's larger data set. We refer to this subset as "corporate infrastructure". The key findings, which are largely consistent with the 2016 Default Study, are as follows:

» The ten-year average overall credit loss rate for non-financial corporate (NFC) issuers is eight times higher than that for corporate infrastructure. Over the period 1983-2015, Moody's-rated corporate infrastructure credits in the aggregate have incurred low credit loss rates, suggesting better long-term credit quality than NFC issuers. Reflecting low expected loss, Moody's corporate infrastructure ratings are predominantly investment grade. As of year-end 2015, 85% of corporate infrastructure credits held an investment grade rating compared to 41% of NFC credits.

» In the aggregate, corporate infrastructure debt securities experience substantially lower default rates relative to NFC issuers. The ten-year cumulative default rate for NFC issuers is five times higher than that for corporate infrastructure.

» On average, ratings on NFC issuers are about 23% more volatile than ratings on corporate infrastructure credits. This observation also held true during and after the 2008 financial crisis when corporate credit ratings outside of infrastructure, particularly speculative grade corporate issuers, saw significant rating changes.

» Credit loss rates for single-A and Baa-rated debt securities, which comprise 78% of corporate infrastructure ratings, are similar to NFC credit loss rates up through a five-year horizon.

» Incremental research published in April 2017 examining a subset of Moody's-rated corporate infrastructure debts

» Key findings include:

- The ten-year average overall credit loss rate for non-financial corporate (NFC) issuers is eight times higher than that for corporate infrastructure
- In aggregate, corporate infrastructure debt securities experience substantially lower default rates relative to NFC issuers
- On average, ratings on NFC issuers are about 23% more volatile than ratings on corporate infrastructure credits
- Credit loss rates for single-A and Baa-rated debt securities, which comprise 78% of corporate infrastructure ratings, are similar to NFC credit loss rates up through a five year horizon

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