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An Update on Proposed C1 Bond Factors
Prepared for the NAIC Life Risk-Based Capital (E) Working Group

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Moody's Investors Service (MIS) provides investors with a comprehensive view of global debt markets through credit ratings and research. Moody's Analytics provides data, analytics, and insights to equip leaders of financial, non-financial, and government organizations with effective tools to understand a range of risks.

Throughout this document, "Moody's" rating refers to an MIS rating. And while references to MIS are made, **the views and opinions in this document are solely of Moody's Analytics.**

C1 Bond Factors (C1 Factors)
Scope and performance criteria

» **Scope**: Moody's Analytics to provide default probability term structures for each Moody's corporate rating and resulting C1 Bond Factors, with articulated limitations providing transparency using data and methodologies accessible and repeatable to the NAIC and industry on an ongoing basis.

  – NAIC to use as they choose in setting the final C1 factors that are applied to a broad set of credit assets with NAIC ratings.

  – Moody's Analytics is not "certifying"/"validating" default rates for each NAIC rating.

» **Heuristic Performance Criteria:** Align default rates (and C1 factors) with economic risks, mitigating incentives for "regulatory arbitrage".

  – Arbitrage opportunities arise when expected spread-to-capital ratios diverge across ratings.

» **Challenges**

  – Expected spreads change over time at different magnitudes across ratings and asset classes.

  – C1 factors will be applied to a broad range of credit assets, based on the second lowest NRSROs ratings which can have different statistical properties than Moody's corporate ratings.

  – Moody's credit ratings are opinions of ordinal, horizon-free credit risk, rather than cardinal measures.
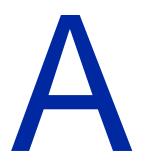
Targeted C1 Base Factors Updates

Engine & Input Updates

» **Modifications** to simulation engine that replicated Academy's factors

  › Error fix for Baa-Caa ratings, where default rates and Loss Given Default (LGD) can be drawn from separate economic states in simulation

  › Assessed impact of simulation noise by increasing the number of simulation trials

» **Updates to input parameters**

  A. Explored range of discount rates based on several time windows and updated the tax rate

  B. Updated LGD distribution to more closely align with empirical patterns

  C. Updated Risk Premium to more closely align with reserving

  D. Revisited economic state models and updated baseline default rates to utilize Moody's historic data and internal benchmarks

  E. Explored bounds on base factors to align with factors for other asset classes

  F. Updated portfolio adjustment factors

  G. Reviewed concentration factor (doubling of top-ten holdings)

A | Explored range of discount rates based on several time windows

Discount and Tax Rates

Possible candidates

Discount rate

» Used to calculate the net present value of projected cash flows.

» The Academy's model sets the Discount Rate at (5.02%), the average 10-year LIBOR swap rate from 1993−2013. The exact source is not referenced, and the time-series data is not made available to Moody's Analytics.

» Moody's Analytics recognizes the need to parameterize the discount rate with a long-term perspective of long-term interest rates, and the desire for this parameter to be relatively stable while also allowing a closer reflection of the current, low-rate, environment. Several possible candidate windows are considered with sensitivity analysis presented later in the deck:

  » 1993−2020 (4.32%)

  » 2000−2020 (3.47%)

  » 2010−2020 (2.25%)

Tax rate was updated from 35% to 21%

Source: Federal Reserve System H.15 Daily Selected Interest Rate (July 3, 2000 to July 31, 2014) and Intercontinental Exchange (data on or after August 1, 2014).

B

Updated LGD distribution to more closely align with empirical patterns

LGD Distribution

Moody's Analytics estimates using the Default & Recovery Database (DRD)

» Expand the time window to 1987−2019.
  2020 is excluded for two reasons: (1) some bonds may still be in the early stage of recovery due to the lengthy process;
  (2) 2020's economic state has not yet been officially declared at time of this writing.

» Estimate bond LGD to align ultimate recovery with Moody's analyst's recommendation for each default
  (e.g., settlement, liquidity, or trading price).

» Use issuer-level LGD to construct empirical distribution instead of bond-level LGD, to rule out undue influence
  of issuers that had many defaults.
  For example, PG&E had 49 senior unsecured bond defaults in 2001, all with zero LGD.
  The issuer-level LGD is the principal-weighted average of LGDs for all bonds of the same issuer in a default event.

» Group issuer-level LGD data into expansion years and contraction years by the year of default rather than the year of emergence

» Moody's Analytics proposed LGD is higher than the current or the LGD proposed by the Academy

C | Updated Risk Premium to align more closely with reserving

Measuring the Risk Premium

Within the context of Risk Based Capital

» C1 RBC is the minimum required capital beyond statutory reserves to buffer against a tail loss credit loss scenario

» Statutory reserves are liabilities ensuring policy claims can be paid off under a moderate downturn scenario

» Risk Premium is an offset to RBC; it is part of statutory reserves provisioned against default loss under a moderate downturn scenario

Default Loss Under Statutory Reserves

VM-20 coverage exceeds expected loss

Under VM-20 DR and SR CTE 70, default loss (Baseline Default Cost Factor) is subtracted from investment return in the asset model.

- CTE70 represents the mean between the 70th and 100th percentiles
- CTE70 can be approximated by the 88th percentile default loss

Under VM-21 (applicable to all in force), the Variable Annuity asset model also reflects default cost prescribed by VM-20. In addition, VM-22, the Payout Annuity asset model, is being updated with the same framework in mind.

If we strictly follow these rules, **the Risk Premium can be set at around the 88th percentile or mean plus one standard deviation of the default loss distribution** (shown in the next slide.)*

* Separately, C3-Phase 1 will be applicable to all in force Fixed and Indexed Annuities is being updated to include a similar default cost.
  Once finalized the Risk Premium should be reevaluated to avoid double counting of credit risk.

D

Revisited economic state models and updated baseline default rates to utilize Moody's historic data and internal benchmarks

Default Rates for the C1 Factors

More on limitations of associating Moody's ratings with default rates

» Moody's credit ratings are opinions of ordinal, horizon-free credit risk.*

- They do not target specific default rates or expected loss rates.

» Assessments of relative credit risk rather than cardinal risk measures.*

"If ratings targeted specific default and loss rates, this would likely require frequent wide-spread rating actions in anticipation of economic and market changes that might broadly push default and loss rates sharply higher or lower for a brief period of time. Due to the inherent volatility of general credit and market conditions, most such rating changes would likely soon need to be reversed. Therefore, the use of cardinal targets would result in much higher rating volatility and disruption for investors without meaningfully improving the cardinal predictive power of ratings over medium and long-term horizons."

Rating Symbols and Definitions 26 January 2021.

* Moody's Investor Service, 'Rating Symbols and Definitions' 26 January 2021

Possible Sources for Default Rates by Moody's Rating

Default studies

Moody's Investor Service Annual Default Study provides historical default rate term structures.

» Raw empirical term structures are useful, but <u>not appropriate in raw form,</u> and in this context:

> › While default rates along the ratings scale are highly monotonic, instances of non-monotonicity will flow into non-monotonicity in capital along the ratings scale. These instances are observed across horizons ranging from 1−10 years, thus requiring subjective overrides to ensure monotonicity in cumulative default rate term structures across ratings.

> › Have point estimates with limited statistical reliability at higher end of the credit rating scale.
> There have been 6 defaults within 10 years of being assigned a Aaa rating since 1983.
> Similarly, there have been 5 Aa1 defaults and 10 Aa2 defaults.

» Other default studies (similar to those developed by the Academy):

> › Rely on default data, migration data, and/or data from Moody's Investors Service Annual Default Study

> › Statistical properties of ratings, the dearth of defaults at the higher end of the credit rating scale results in parameters with statistical limitations.

Possible Sources for Default Rates by Moody's Rating

Idealized default rates from *Rating Symbols and Definitions*

» Used as benchmarks by Moody's analysts across asset classes and recognized as having a relationship with actual default rates that "has varied over time, Moody's continuing use of the Idealized Rates for modeling purposes does not depend on the strength of that relationship over any particular time horizon". In addition, it is recognized that different asset classes are driven by different risk factors, attributed to different fundamental strengths, weaknesses, and the inherent nature of each sector.

» While originally constructed in 1989, Moody's Investors Service has periodically reviewed its idealized default rate tables and has no plans to revise them at the time of this writing.

» 10-year idealized default rates based on historic defaults from 1970−1989 for all but Aaa and Aa, that were set lower than their historical default rates.

  – At upper end of the credit spectrum, dearth of defaults and possibly high recovery makes default events difficult to use in isolation given the context. Between 1970−1989:

    › Getty Oil and Texaco were the two issuers that defaulted within 10-years of Aaa rating, and they experienced extremely high recovery (~97% and ~88%).

    › There were 10 Aa defaults.

E

Explored bounds on base factors to align with factors for other asset classes

Broader Set of Pre-Tax Factors

Considerations when setting C1 bond factors

C1 bond factors should align with the broader set of C1 factors, to avoid unintended risk-shifting incentives.

» C1 RBC factors that may be worth considering on the lower bound:

- Cash, cash equivalent, short-term investment 0.40%
- Federal guaranteed low-income housing tax credits 0.14%
- Receivable for securities 0.14%
- Residential mortgages — insured or guaranteed 0.14%
- Government full-faith bonds 0%

» C1 RBC factors that may be enter into considerations on the upper bound:

- Common stock 30%
- Hedge fund, private equity 30%

F | Updated portfolio adjustment factors

Portfolio Adjustment Factors (PAF)

Overview of Moody's Analytics findings

» Moody's Analytics has been able to closely replicate the Academy's PAF when the framework is parametrized to the PD, LGD, and Risk Premium proposed by the Academy.

» The economic state model implies investment grade default correlations <u>at approximately zero</u> (within simulation noise), and much lower than those observed empirically.

» This suggests adjustment factors calibrated to the economic state model is not appropriate for use as it overstates name diversification benefits.

– Intuitively, if assets are perfectly correlated, diversification is achieved with a single asset.

– The lower the correlation, the more assets are needed to hit an asymptote, suggesting the adjustment function calibrated to the economic state model is overly punitive (lenient) to portfolios with a small (larger) number of holdings.

» Using a benchmark framework calibrated to empirical default correlations suggests an adjustment function that sits somewhere in <u>between the current adjustment factors and those proposed by the Academy.</u>

– A full update to align the entire framework with empirical default correlations is beyond Phase 1 scope.

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