BLACKROCK®

BlackRock Solutions CMBS Methodology

BlackRock Solutions CMBS Modeling Framework

BlackRock Solutions uses a bottom-up approach to analyzing CMBS, built on loan-level data and a forward-looking deterministic modeling framework

- ▶ BlackRock Solutions sources data directly from CMBS servicers and trustees, reviewing monthly loan information for data errors and qualitatively reviewing property financials quarterly to assess whether reported data reflects property risk profiles
- Forward-looking real estate assumptions, combined with a deterministic credit loss model project outcomes for each loan backing a CMBS trust under multiple scenarios
- Loan-level loss outcomes are passed through Trepp's waterfall engine to generate bond-level cashflows, which BlackRock Solutions uses to estimate CMBS intrinsic valuations, loss projections and related security-level analytics

SPEAR **Trepp® SPEAR** Loan-Level **CMBS** Deal **CMBS** Loan & Rent & **Property** Loan **Underwriting Cash Flow Cash Flow** Cash Flows & **Property Vacancy** Waterfall **Database** & Review **Projections** Model **Analytics** Model P&1 · Deal collateral and Comprehensive **Review process** Regression based Framework utilizes CMBS deal creates a starting framework that tranche level cash rent and vacancy database point for forward establishes the link projections and flows across comprised of over looking modeling by between rentsand incorporates rent scenarios 800 CMBS deals incorporating vacancies and their roll data to model AAA Deal level collateral secured by ~50k lease rolls. property-level risk macroeconomic loss loansand covering attributes drivers renewals, and dark Tranche cashflows ~75k properties periods to arrive at **Underwriting** and Discrete Market and monthly property and analytics surveillance Property Type level -> Data directly level revenue and AA including principal forecasts by sourced from process expense projections loss, interest issuers, master incorporatesboth scenario Workout period with shortfalls, weighted property specific Utilizes actual rent servicer advancing servicers, and average life, option Α trustees and loaded and market data roll data where adjusted spread. on a real-time basis available Quantitative Ioan yield, and duration BBB Data reviewed DCF / Terminal Cap review includes and loss severity monthly to checkfor designation of a based property BB inconsistencies in Property Score and valuation servicer reporting evaluation of loss estimates are Sub market level data Complex loan capital structures osses modeled correctly

CMBS Modeling Framework: Loan and Property Database

BlackRock Solutions maintains its own database of commercial mortgage and property information backing US CMBS transactions

- ▶ All loan- and bond-level analysis and projections are derived using this data
- ▶ The initial dataset is aggregated from the original offering documents
- Updates are sourced directly from CMBS servicers and trustees on a monthly basis
- ▶ The dataset includes > 800 CMBS transactions, comprised of ~50k loans and ~75k properties

The BlackRock Solutions CMBS database is organized to relate multi-note loan structures with underlying properties and reported financials

Property and loan data are reviewed period-over-period and versus issuance to assess any potential servicer reporting errors or data ambiguities

Examples of BlackRock Solutions CMBS Loan Database Structure & Process Data BlackRock Solutions Structure ▶ BlackRock Solutions manually maps the capital stacks for all multi-note loans included in CMBS trusts from original Offering Documents Loan Capital Tie-out of note/loan information to capture and attribute property cash-flows on complete loan capital structures Structure Identify cross-default provisions with associated loans / 'notes' Partial-year financials reported by servicers are compared to prior reported periods to determine whether the amounts reported are annualized, partial or errant **Financial** Reporting BlackRock Solutions identifies the controlling servicer for multi-note loans (dubbed the "Paymaster") and uses its financial reporting for all notes associated with the unique underlying property(s)

CMBS Modeling Framework: Loan-Level Review

BlackRock Solutions performs a qualitative review of large loans along with any other loans meeting certain review criteria (e.g. delinquent or specially serviced loans)

▶ All other loans undergo a quantitative vetting process

Loan review process assesses the reasonableness of servicer reported information to account for the following:

- ▶ Stale or dated income information (e.g. income reporting 9 12 months old) or partial year reporting
- ▶ Recent credit events that may materially alter property values (e.g. tenant/sponsor bankruptcy)
- ldiosyncratic credit characteristics (e.g. credit tenant or ground leases, environmental issues)

Loan reviews create a starting point for forward-looking modeling by incorporating property-level risk attributes, which are not captured by static income reporting

As a final step, loan outcomes are reviewed for consistency with underwriting inputs

Loans for Qualitative Review

- Large loans by balance or % of deal
- Loans meeting other review criteria
 - Loans moving in/out of Special Servicing
 - Delinquent or REO loans
 - Loans with deteriorating financials
 - Newly modified

CRE Professionals

- Review disclosure documents
- Assess recent financials and servicer commentary
- Research tenancy and sponsor developments
- Review market specific developments

Outputs from Loan-Level Review

- BlackRock Solutions underwritten cashflows are used as the starting point for all performance forecasting
- Property grades for location, size and property condition
- Model valuations are reviewed for reasonableness



CMBS Modeling Framework: Assumption Setting

Property-level Cap Rate and NCF projections vary by scenario and are used to estimate loan outcomes

NCF Generation Process

Property-Level Data

 Recently reported income and operating history

CRE Projections

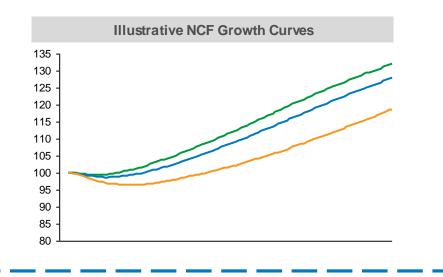
- BlackRock Solutions leverages third party data on historical rent and vacancy rates as well as market discount and cap rates
- BlackRock Solutions econometrically forecasts rent and vacancy at the market and property type level

BlackRock Solutions Commercial Real Estate Professional Review

- Analysis and review of forecast information
- Review of property level data and outcomes

NCF Curves

- BlackRock Solutions underwritten cashflows are used as the starting point in forecasts
- ▶ NCF curves project property income and value across multiple scenarios
- Capitalization rates are applied to NCF projections to determine property valuations over time



CMBS Modeling Framework: Assumption Setting

BlackRock Solutions employs a forward-looking deterministic credit model to estimate loan-level outcomes. Major assumptions and credit model parameters include the following:

Primary Deterministic Model Parameters

Income and **Property** Value **Drivers**

Rent and MSA and property-type based projections of property-level performance through time Vacancy Income growth ▶ Cap rate curves (term structure) by MSA and property type curves and cap rates Discount rates are stressed across Adjusted by property grades to account for individual property location and quality and cap rates

Property grades

Assumption

Individually assigned grades based on location, condition and size

Combined with income projections to determine property value

Used to adjust cap rates to account for individual property quality

Loan Outcome and Loss **Parameters**

Monthly test that results in a term default if DSCR and LTV cross threshold levels **DSCR** default trigger

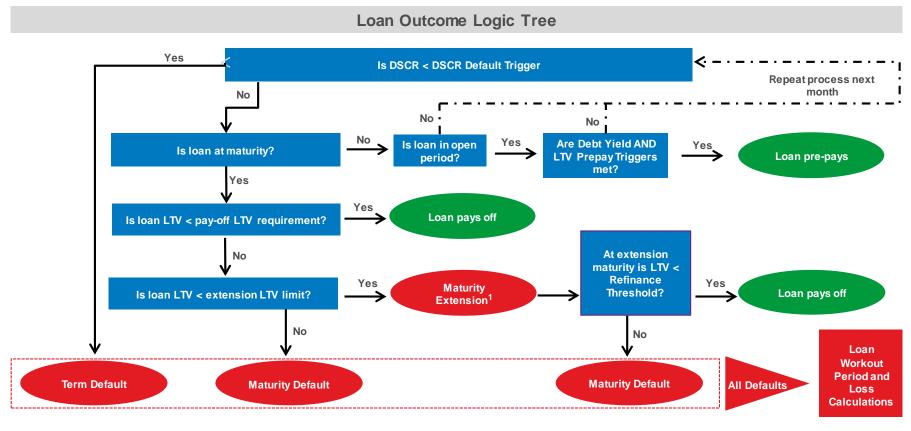
Description

- Triggers are property type based
- Loan extensions Loans are extended at maturity if LTV falls within a defined band
- Loan prepayment Loans are prepaid during their open period if LTV and Debt Yield falls within specified levels
- Workout period
- Time to resolution after a term or maturity default
- Period length based on loan size and jurisdiction (by State)
- **Liquidation costs** Percentage of property value at liquidation
- Reserves held by the servicer are used to fund debt service payment shortfalls if income drops below Servicer reserves the DSCR threshold

scenarios

CMBS Modeling Framework: Loan Outcome Projections

Loan outcomes are determined by a series of DSCR and LTV tests over time



Term default:

Pay off at original maturity

Default at original maturity

Extension at original maturity

Default at extension maturity

DSCR < Default Triggers at any point during initial term of loan extension

LTV < Pay-off LTV requirement

LTV > Extension LTV limit at original maturity

LTV between extension LTV bounds at original maturity

LTV > Refinance Threshold at extension maturity

(1) DSCR tests are run throughout the extended lifetime of the loan. If a DSCR test fails, the loan will go into default

Important Notes

This report contains modeling based on hypothetical information which has been provided for informational purposes only. No representation is being made that results similar to those shown may be achieved.

Past performance is not a guarantee or a reliable indicator of future results. This report has been created to satisfy BlackRock Solutions' contractual agreement with the NAIC and should not be construed as an offer or solicitation of investment advisory services. All investments are subject to risk and may lose value.

The information and opinions contained in this material are as of August 31, 2015. Such information and opinions are subject to change without notice, and BlackRock Solutions has no obligation to update this information. The information and opinions contained in this report are derived from proprietary and non-proprietary sources deemed by BlackRock Solutions to be reliable, are not necessarily all-inclusive and are not guaranteed as to accuracy. Charts, graphs, and securities referenced herein are not indicative of the past or future performance of any BlackRock product. BlackRock or one or more of its affiliates may or may not own the securities referenced and, if such securities are owned, no representation is being made that such securities will continue to be held. This document is not intended to make any recommendations or solicit any actions on the part of the reader, and for the avoidance of doubt nothing in this report should not be considered as investment advice or a recommendation of any particular security, strategy or investment product. Any analysis or projections contained in this work product are advisory and estimated in nature and are based on assumptions and models. Any reliance on this document is taken at the risk of the reader. BlackRock Solutions accepts no liability or responsibility to any other party or person in connection with our work product.

No part of this material may be reproduced in any form, or referred to in any other publication, without express written permission. BlackRock Financial Management, Inc., 55 East 52nd Street, New York, NY 10055, 212-810-5300.

©2015 BlackRock, Inc. All rights reserved.