

Yield Book CRT collateral performance model



Non-Agency RMBS

Overview

Yield Book applications have covered the Agency Credit Risk Transfer (CRT) market since the introduction of STACR and CAS issuances in 2013. Foundational to CRT analytics is a comprehensive suite of models projecting voluntary prepayment, delinquencies, defaults, and severities. The models are calibrated from millions of loan level records from related FNMA, FHLMC, and GNMA programs. The model has a comprehensive capture of relevant indicatives related to the borrower's ability to pay and willingness to pay, the features of the loan, the presence of mortgage insurance, latent credit worthiness, distributional measures, and economic drivers. Yield Book Mortgage Modeling actively monitors, maintains, and enhances the suite of models to address changes in policy, seasoning of loan performance, and expansion of reported indicatives.

Deal coverage

Yield Book applications have covered the CRT market since the introduction of STACR and CAS issuances in 2013.

Complete coverage since inception of CRT deals.

CRT deals are modeled in-house by the Yield Book modeling team.

- Deal documents are obtained directly from the underwriter.
- Deals are typically available in Yield Book applications pre-settlement.

CRTs are accessed broadly by both buy-side and sell-side Yield Book customers.

Our coverage is comprehensive and we onboard new deals usually prior to settlement.

Summary of CRT Deals on Yield Book. Data as of 1/31/2020

	No. of Deals (Issued)	No. of Deals (Modeled)
CAS	38	38
SCRT	13	13
STACR	57	57
US Agency Risk Sharing	108	108

Model data

The model covers collateral from FNMA Single-Family Loan Performance Data, FHLMC Single-Family Loan Performance Data, and certain GNMA pools and includes collateral from long before the creation of the CRT deals. This yields multiple benefits from examining the full history of collateral in various different economic environments and boosts stability for our understanding of the impact of indicatives on their boundary values.

The model has a comprehensive capture of relevant indicatives related to the borrower's ability to pay and willingness to pay, the features of the loan, the presence of mortgage insurance, latent credit worthiness, distributional measures, and economic drivers including those required by CCAR and DFAST.

For the FNMA single-Family Loan Performance Data, the initial population of mortgage loans represents Fannie Mae acquisitions between January 1, 2000 and March 31, 2016 with corresponding monthly performance data as of September 30, 2016. This includes a total of about 24.3 million loans.

For the FHLMC single-Family Loan Performance Data, the initial dataset covers approximately 23.1 million fixed-rate mortgages originated between January 1, 1999 and March 31, 2017. Monthly loan performance data, including credit performance information up to and including property disposition, is being disclosed through September 30, 2016.

Model trained on more than 47.4 million loans.

Voluntary prepayment model

The Yield Book benefits from a long history of model development and refinement. The collateral in scope for the model is much broader than the CAS and STACR programs. This aides in calibrating the impact for the full range of any indicative or driver.

The Yield Book incorporates extensive collateral indicatives and economic drivers including

- Loan purpose, occupancy, % in each state, PMI coverage fraction, SATO, Credit Score, LTV, DTI, loan size, etc.
- Primary mortgage rates, secondary mortgage rates, home price appreciation, unemployment rates, etc.

The framework assumes four different prepayment situations and adds them together for a final projection of speeds.

Voluntary Prepayment is modeled as the sum of Housing Turnover, Refinancing, Curtailments/Payoffs, and Defaults/Buyouts.

$$\text{Total Speed} = \text{Housing Turnover} + \text{Refinancing} + \text{Curtailments/Payoffs} + \text{Defaults/Buyouts}$$

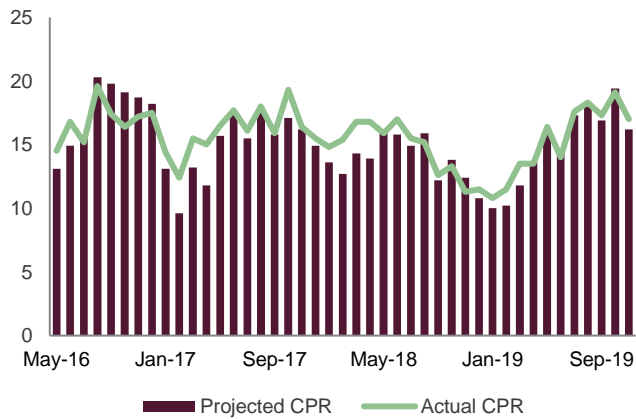
The Defaults/Buyouts portion is addressed by a separate Credit Roll Rate model, which is discussed in detail below.

The model captures a rich collection of many effects incorporating rate incentive-based S-curves, seasonality, media effect, burnout, and impact of servicers.

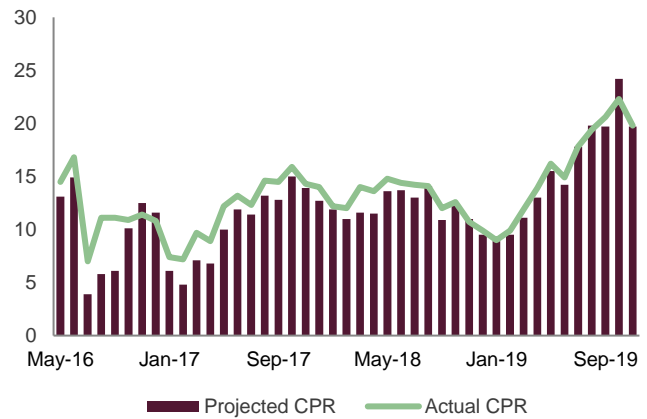
The back-test of actual versus projected speeds shows a high-quality fit for representative agency cohorts.

Projected track Actuals for representative FNMA and FHLMC cohorts for 2015 and 2016 origination

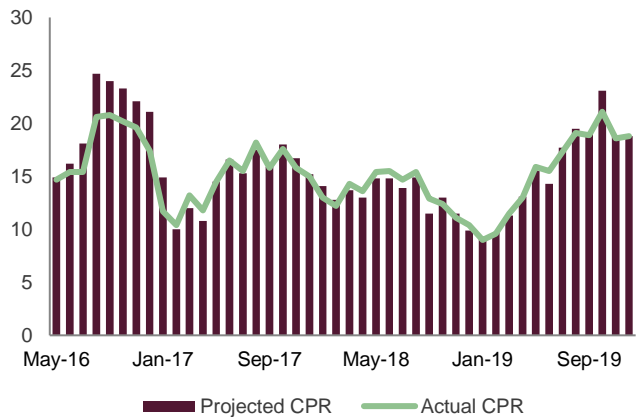
FNMA 30yr 4.5% pools from 2015



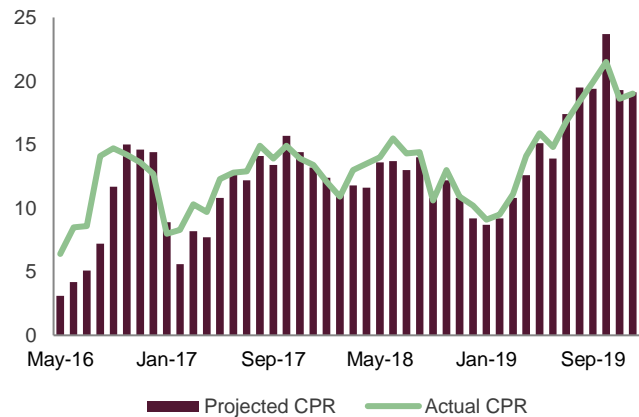
FNMA 30yr 4.0% pools from 2016



FHLMC 30yr 4.0% pools from 2015



FHLMC 30yr 4.0% pools from 2016



Source: FTSE Russell. Prepay Model version 21.5 As of 11/20/2019. Past performance is no guarantee of future results. Please see the end for important legal disclosures.

Credit roll rate model

Roll Rate models have been popular as a way to mathematically describe state transitions for borrower payment behavior since the mid 2000's for credit sensitive mortgage backed securities. We've taken the insights learned through modeling legacy subprime, alt-a, and jumbo mortgages and fashioned a calibration to CRT eligible collateral.

FNMA and FHLMC have provided indicative and payment performance data for approx. 47m loans that are CRT eligible – Single Family, 30 Year, Fully Amortizing, full documentation for income, below the conventional limit loan

Our roll rate model produces projections for the possible states of mortgage payment:

E.g.

Current → Voluntary Prepayment

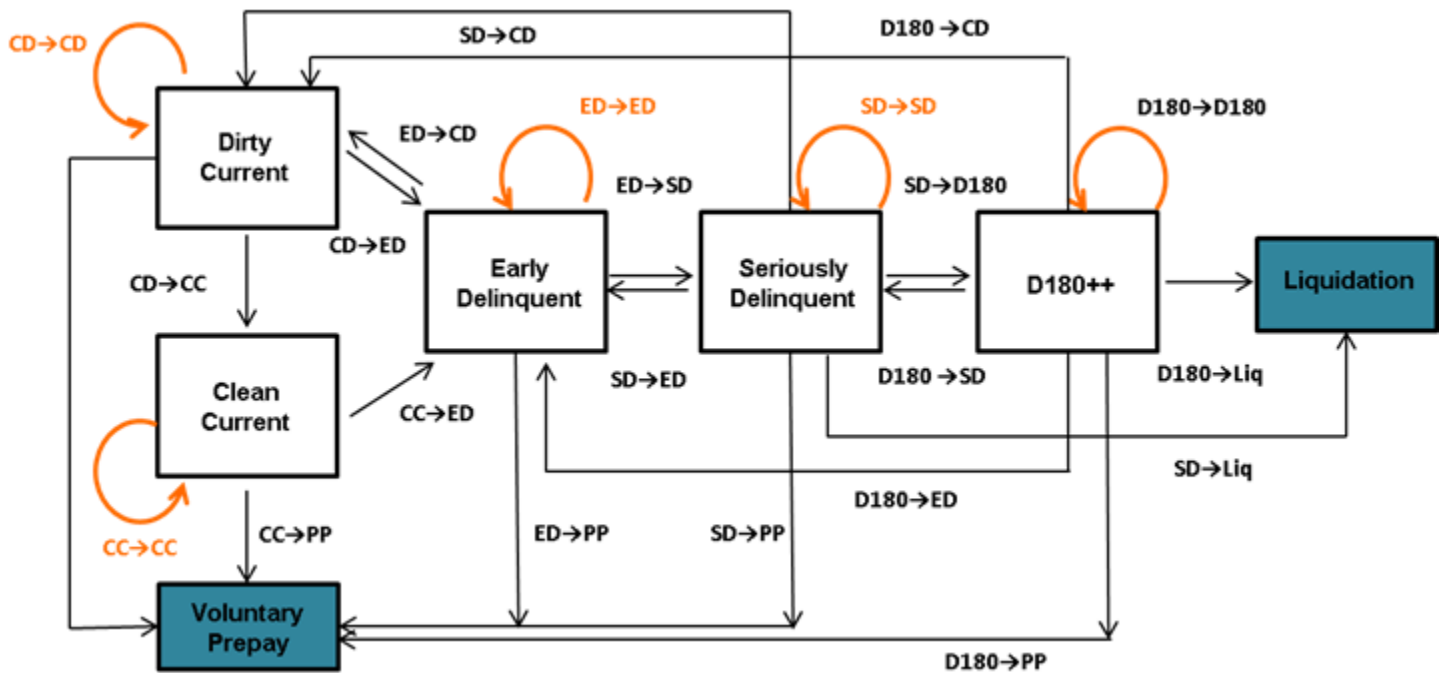
Current → Early Delinquent → Seriously Delinquent → Defaulted → Liquidated.

balance, and fixed rate. We've used these loans for our CRT Credit Roll Rate calibration.

Although the model is calibrated at the repline level, the basic roll rate dynamics are easier to describe as a loan level process. This is a simplification that does not dilute the core concepts.

At each monthly remittance report, a loan can only be in one state: e.g., Clean Current, Voluntary Prepay, Early Delinquent, and others. Some states are absorbing and loans can never leave once there, for example, voluntary prepayment. Once a loan prepays, it remains prepaid for all future periods. For the next monthly remittance, each loan will transition into another state and in some cases may remain in the existing state.

State Transition diagram



In the diagram, let's focus on a loan in Clean Current. Next period, that loan can transition to Voluntary Prepayment, remain in Clean Current, or transition to Early Delinquent.

Each period, the model rolls loans forward into eligible states.

The model rolls loans forward based on indicatives and economic drivers. The model uses these to project the transition from each existing state to eligible future states. These indicatives and drivers include loan age, updated current LTV, DTI, FICO, SATO, seasonality, and unemployment.

The framework provides projections for each modeled stage for each period including delinquency and default as needed to determine securitization cash flows. The resolution around delinquency is further utilized in other Yield Book services such as our MSR analytics.

Loss severity model

In the event of borrower default, in all likelihood the mortgage will be paid back less than the amount of the outstanding principal balance resulting in a loss.

We model this loss given the event of default. We use FNMA and FHLMC provided 30 YR FRM loss data for our calibration.

Formally, we define loss as

Loss is modeled directly, and Loss timelines are informed by the Roll Rate Model.

$$\text{Loss} = \text{Outstanding Balance} - \text{Sales Price at Liquidation} + \text{Costs} + \text{Taxes} + \text{Interest Advanced} + \text{PMI Premiums} - \text{PMI Proceeds}$$

We consider three liquidation statuses:

- Short Sale – a sale that is typically through co-operation between the servicer and defaulted borrower. This often happens when there is the potential for extra equity above the unpaid principal in the property.
- Foreclosure Sale – where the property is sold by way of a foreclosure process.
- REO – Real Estate Owned – where the property is purchased by the servicer.

For each, we project a likelihood of their occurrence and the projected loss as it relates to indicatives and economic drivers. For a final loss projection, we blend the likelihood and the projected loss across all three liquidation statuses.

The Foreclosure process is nuanced and the model accounts for the many state specific considerations around Judicial versus Power-of-Sale, authorization of Strict Foreclosure or Entry and Possession, and mortgagor Redemption Rights. The main indicatives and economic drivers for the model include state of property, loan age at time of default, loan size, occupancy, PMI coverage, and state level HPA discounted by time in delinquency. There are many costs associated with liquidation. We have historical measures that allow the model to account for realtor fees, state specific property taxes, estimated maintenance costs, interest advanced by the servicer, state specific estimated attorney fees, hazard insurance, and other miscellaneous costs associated with selling property.

The liquidation timeline is computed in coordination with the roll rate process. An accounting of months spent in each state e.g. current, early delinquency, and serious delinquency. For each period, as we roll the model forward, we capture the proportionate time a repline spends in each state all the way through to liquidation.

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